The Representation of Urban Environment. From the Survey of the Built City to the Representation of the Intangible Assets

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Abstract

The representation of the image characterizing an urban environment has always been a complex challenge for those involved in documentation and Drawing, because it contains a multiplicity of aspects that it is not always possible to measure and graphically return. The immaterial aspects are the ones that most characterize the image of a city, together with all those characteristics that derive from the evolutionary history of the city itself, which are decisive for its current configuration, but which it is not always easy to grasp. A set of relationships, colours, materials and lights that go beyond the quantitative aspects expressed by forms and dimensions, which sometimes even the most advanced digital representation seems not to fully render.

In fact, the system of representation used for the communication of the physical consistency of an urban environment must try to explain all the elements that contribute to the definition of the image, elaborating a representation that not only manifests geometric/dimensional instances, but it also shows the formal/qualitative ones, the one that are useful for the understanding of the elements that characterize in a unique way the image of each specific urban reality.

This text collects a series of reflections on the various meanings of the representation of the urban environment, briefly referring to two case studies of different nature, which, as examples, can help to frame the complexity of the issues involved.

Keywords: city, complexity, interdisciplinarity, representation of the immaterial, HGIS.

Introduction

The time is long gone when the representation of the city was considered as a simple topographical support, source of timely information for more general investigations on the built environment. By now definitively redeemed from this subordinate role, the urban iconography is the subject of an increasingly wide and heterogeneous production, as a figurative document through which information on the built space is communicated. In its material and immaterial aspects, this built space meets the definition of the city. The approach to the theme attempts to focus on the graphic/visual structure through which the information is presented, using the conventions of representation, analyzing the different languages, understanding each of them as the result of choices. In these choices converge cultural models, urban ima-

gery, mechanisms of visual perception, figurative codes, technical skills, scientific knowledge and practical purposes, addressed to the recipients of the urban representation is directed. In this process, the view of the surveyor/draftsmanis always oriented towards the selection of information that allows the representation of the true, even if sometimes the very concept of "true" escapes the boundaries of objectivity, slipping towards subjectivity.

The city and its history

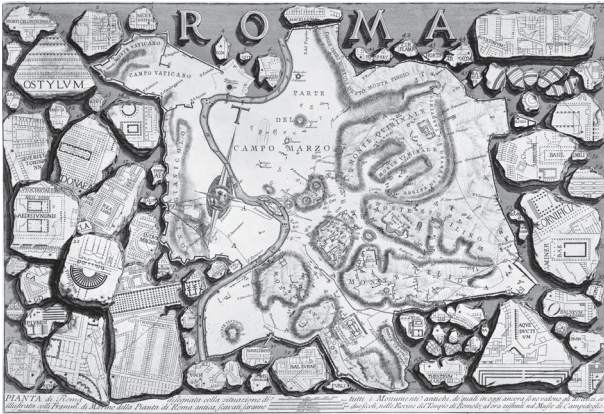The city is an extremely complex and varied reality. Inevitably, in every age the need to live in community, that

Fig. 1. G.B. Piranesi, 1756. "Pianta di Roma disegnata colla situazione di tutti i Monumenti antichi…" (Le antichità Romane, Tomo I, tav. II).

Fig. 2. A. Guesdon, 1850 ca. Lithograph of the city of Parma seen from the bastion of San Francesco (Parma, Collection of the Cassa di Risparmio Foundation).

always accompanied man, has determined a wide range of problems to which we have tried to provide solutions in order to constitute socially cohesive communities. Therefore, the city is configured as an organism in continuous evolution and transformation, despite the strong resistance to the changes that the physical form of the city, especially the strongly historicized European one, has always manifested with its rigid urban structure made of streets, green spaces, squares, volumes. In this sense, the transformations undergone by urban centers over the last two centuries have generally only partially affected the physical scenarios that have been consolidated a long time ago. Instead, social functions have changed: today's public administration, education and health are no longer those of the 19th century; economic structures have changed and, above all, with the development of new means of communication, the way in which social life is carried out has undergone a revolution. But, if we exclude the expansions and transformations of the peripheries, the physical form of the historical city has resisted and has changed only partially.

The motivations behind this phenomenon are easy to understand. The preservation of the material heritage of our cities represents the natural inclination of man not to want to lose the identity of the places where he lives, has lived and developed a sense of belonging to a specific community. It is the entirely human need for stability, for identification with one's place of origin. The physical scenario of

the city is also an uninterrupted thread that connects the past of roots to the present. Precisely the urban settlement, or material city, makes the mark durable, once left on the territory by a given society in a given historical period. that the city itself passes it on to subsequent eras, conditioning the immaterial way of life of the generations that will follow. To investigate these dynamics, the drawing is an extraordinary tool. In fact, it is one of the lenses through which to observe not only the physical scenario of the city, but also the history of an organism in continuous evolution.

The theme of the representation of the urban environment and its image can be developed from many points of view, from the purely urbanistic analysis of both a quantitative and qualitative nature to the study of perceptual and communicative aspects. This last aspect identifies a disciplinary specificity that constitutes a field of study of high interest, also for its interdisciplinary character, focusing on the old and new iconographies of the urban environment and their contents [De Carlo 2015a].

It is certain that it is impossible to think of describing an urban environment without knowing the history of its constitution, its evolution and the historical, political, social and cultural events that have guided its transformations.

Historical urban iconography has always allowed us to read these passages (fig. 1), itself being the object of study, in the methods of representation used and in the thematic categories that can include the various iconogra-

phies, which alternate quantitative information of a more and more precise nature, with qualitative and sometimes symbolic information that well express the essence of the urban image that, at a given time, was to be transmitted in a widespread way.

The symbolic representations, the perspective or pseudo-axonometric iconographies, the perspective views from the ground or by bird's eye view, but also the zenithal planimetric representations, together tell us the evolution of the city and its representation, focusing on the communication of precise messages focused on different aspects such as the technical one, linked to the structure of an urban fabric, or the symbolic/celebrative aspect wanted by this or that governor (fig. 2).

A well-known thing for those who work in our disciplinary field is that with the progress of the technical instruments of survey and representation of the built environment, as well as with the progress of the methods of territorial planning, quantitative information have increasingly come to clarify, sometimes to the detriment of qualitative information, which is, moreover, more difficult to return in a systematic manner. Only in the last few decades, thanks above all to the very fast evolving digital technologies (here we do not want to go into this matter), we are more and more working on the possibility of restoring these aspects through experimentations applied to different contexts and related to different purposes [1].

In this context, Laura De Carlo [De Carlo 2015b, p. 11] states that urban studies must be confronted with the new collective agents who create multiple descriptions of the city, in which spatial figures are shared. These lead to the subversion of specialist languages in favour of an approach to urban studies that is as open as possible to disciplinary encroachment and to the integration of sectoral studies, in order to decode the contradictory images of an increasingly complex reality.

Indeed, for centuries the city has been represented in its three dimensions, albeit often improperly from the point of view of geometric precision. For a long time, qualitative information has exceeded quantitative information, which, apart from a few exceptions as the Imola plan by Leonardo da Vinci in 1502 and the Parma plan by Smeraldi in 1589-92, overtake the others through zenithal representations only at the end of the 18th century. From this moment on, the urban descriptions left out most of the peculiarities of the qualitative data, even though they gained a geometric precision that previously was unthinkable (fig. 3).
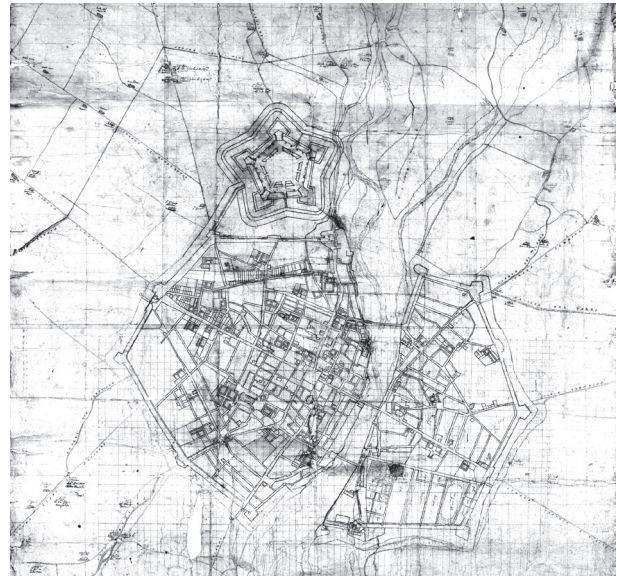

Fig. 3. S. Smeraldi, late Sixteenth century. Map of the city of Parma and surroundings (Archivio di Stato di Parma, Miscellanea).

Representing quantitative aspects/representing qualitative aspects

For several years now, the possibilities offered by computer tools in the acquisition of urban data and their representation [De Carlo 2015a], again allow us to represent the city in three dimensions, considering the issues of representation on an urban scale, between infographic and photography, in the knowledge that the 3D representation of the city allows a specific enrichment of data and an undoubted intuitiveness in understanding (fig. 4). However, this can only be the result of a working methodology capable of selecting the primary elements that build the city: streets, squares and blocks, individual building cells, but also gardens, parks and rivers, all in relation to the orographic configuration of the territory.

Even though we are aware that each urban reality represents a unique one and that each of its representations expresses its singularity, there are invariants that can be defined for each urban nucleus. Their identification is an essential starting point in the drawing of the city, regar-

Fig. 4. 3D model of the city of Parma autogenerated in Google Maps.

dless of the system of representation and the tool used, bearing in mind that, according Anna Osello [Osello 2010, p. 138], in an axonometric or perspective representation the logical passage involves three essential elements: the critical reading of a reality that is always three-dimensional; the drawing of reality through the 2D or 3D elements that characterize it; the perception of reality that a user can have by reading the coded signs that the drawing contains. The representation, as a means of definition and diffusion of images, plays in this context different functions, related from time to time to the method of investigation followed and the purpose of the analysis [Massari, Pellegatta, Bonaria 2006]. The graphic works at urban scale are the language through which the methods of representation relate all the structural peculiarities on multiple levels of knowledge, oscillating between iconography and symbolism, depending on the analytical or synthetic purposes of the study.

Despite their constant and rapid technological evolution, the tools and techniques, are now known and consolidated [Coppo, Boido 2010] for the acquisition and representation of quantitative and material aspects. The integrated survey (from the pencil, to the laser scanner, to the photomodelling) is organized according to the dimensional and formal characteristics of the object and the purposes of the study and it is aimed at the realization of two-dimensional or three-dimensional graphic elaborations more or less dynamic. It allows a structured approach that ensures a reliable result on which to base the analytical readings and subsequent considerations (fig. 5).

Instead, for the qualitative aspects, , the urban studies started in the 1960s by Cullen [Townscape, Cullen 1961] and Lynch [Lynch 1964], in the 1970s by Venturi, Scott-Brown and Izenour [Venturi, Scott-Brown, Izenour 1972] constitute the starting point for the elaboration of methodologies, both analogical and digital, of analysis and interpretation that, through schemes, sketches, graphs and diagrams, lead to express the relationships between architectural and environmental forms as well as the relationships of continuity/discontinuity, contiguity/separateness, inclusion/exclusion that characterize them. They pay more attention to the qualities that arise from the site and its individuality.

For the representation of these aspects, often we used signs or images that have a common meaning to many; these images are expressed through signs/drawings that do not necessarily represent in a realistic way a recognizable object, but they assume a precise meaning related to the signifier they are to represent. If iconic, they are readable in an intuitive way, if symbolic, they are readable through a legend (key code) [Cennamo et al, 2016; Burgio and Moretti, 2017; Luigini and Moretti, 2018; Schianchi, 2018].

In the visual communication, the well-known theme of the relationship between signifier and meaning [Eco 1968] is the primary object of research, in order to find signs that can convey more or less detailed information and can guide the understanding of phenomena of varying complexity [Munari 1968, ed. 2018].

The theme is very delicate when we are working on an urban scale to transmit information of different nature: certainly a material ones, such as geometry, structure and urban morphology, locating the identifying elements of a given urban environment through more or less iconic symbols. But the theme is even more complex in the treatment of the transmission of type information, which may be the result of thematic surveys. They must be communicated in a legible way, both in relation to the field of study, both by deepening the multiplicity of information, often uneven, which have been collected.

The possibility of using digital maps on which, in fact, "to map" the information, finding signs and symbols that, although referring to more or less articulated legends or real databases, is now a concrete *modus operandi* that already sees many applications defined as "Visual journalism". This definition includes the tools of digital communication, mainly visual, through which it is pos-
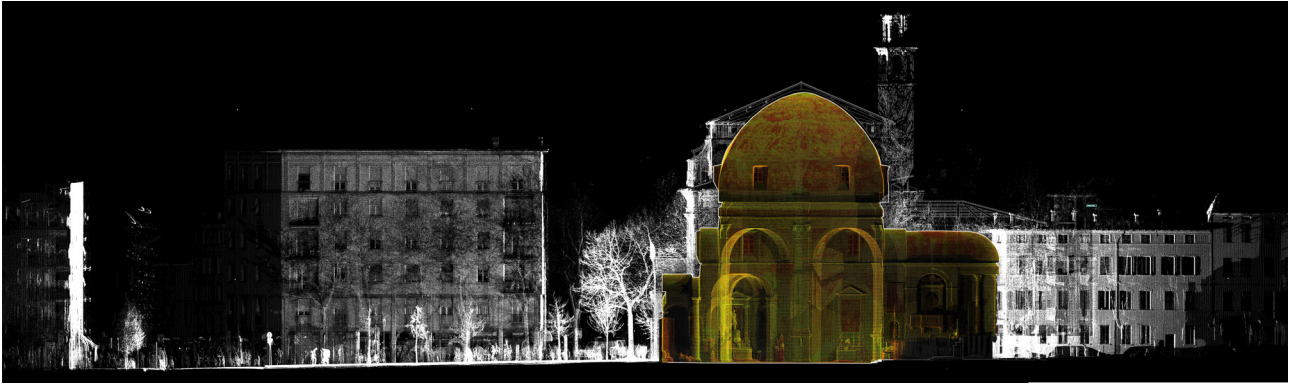
Fig. 5. The laser-scanner survey of the urban area of Piazzale Picelli in Parma, used for the analysis of the relationship between the church of Santa Maria del Quartiere and its surrounding area.

sible to tell the otherness of the city by placing the representation as a preferential system of knowledge and communication of the complexity of the contemporary city [Luigini e Moretti, 2017, p. 1113]. The city is read not only in an architectural or urban key, but also in an anthropological, economic, cultural, etc. key. [Vernizzi, Bontempi in press]

The theme of the representation of information, also in the light of the use of increasingly agile and effective digital systems, deals with the story and the transmission of information itself in a faster and more thorough way, spreading it more effectively than other modes of communication.

The "Data" journalism, a form of hybrid journalism born around the middle of the 19th century and based on the use of data and their representation as a primary source of analysis and communication, has extended to "Visual" journalism, which uses digital graphic-visual tools to represent the results of interdisciplinary urban studies, with an imaged-based and narrative way.

Objective representation/subjective representation

The perception of an urban environment is configured as a true mental construction [Parrinello 2013, p. 36], made up of different processes that are at the same time perceptive, cognitive and affective. Through them, the users of a site acquire consciousness and knowledge.

The phenomenological approach of the Gestalt matrix articulated, in the last century, the study of phenomena through a process of discretization and subdivision of forms and laws that govern the relations, structuring – through perceptual analysis– the definition of a method of analysis and knowledge halfway between the reading of the concrete elements and the behavioural aspects of fruition and understanding of the meaning of spaces.

The experience of a place, perceived through a series of sensory filters partly linked to cultural conditioning, will in fact be different, depending on the subject who performs it [Parrinello 2013, p. 37]. However, the visual perception represents the first and fundamental form of organized relationship that an individual has with his environment. It is an experiential process of the world which combines the simple sensory reaction to stimuli with their processing through an intellectual elaboration. For this reason, the perceptive analysis of an urban environment is preliminary to any kind of objective investigation and is complementary to it. Perceptive processes play a fundamental role, not only for the knowledge of physical space, but also of social aspects, of fruition of the meaning that the space assumes (fig. 6).

Speaking of objective and subjective representations of the urban environment, a reference to projective methods is inevitable, even in the current overcoming of their rigid use, due to the construction of 3D models that allow you to choose a posteriori the modes visuali-

Fig. 6. Drawing Architecture Studio, 2014. "Nao Luo Gu Xang", isometric axonometry of one of the best preserved nutong zones in Beijing. (http://www.d-a-s.cn/en/projectdetail.php?currcategory=drawing&page=12)

zation: parallel (orthogonal or axonometric projections) or central (perspectives).

The possibility of metrically measuring what is depicted in any parallel projection has characterized this type of representation as a more objective result than what is depicted in the central projection, since the perspective is the expression over time of different cultural interpretations of the spatial perception [Parrinello, 2013, p. 18].

Subjective representation: material/immaterial

As known, for its characteristic of being a projection obtained from a real centre of vision, similar to the eye of the observer, perspective is the most widely used projective tool for describing an environment from a subjective point of view.

Perspective [Panofsky 1961], compared to other systems of representation, has always played a special role in drawing precisely because it allows the articulation of an architectural or urban space to be described immediately, simulating the visual perception of the human eye.

Through the construction rules, perspective leads to an objective representation of a concrete reality precisely by virtue of the geometric relationship established between the object, the observer and the painting on which the representation takes place. The perspective builds an objective image of a subjective condition given by the specific position of the observer, in the words of Andrea Casale [Casale 2018, pp. 161-162].

Beyond the geometric and constructive aspects of perspective, is important to underline that, with the same basic approaches, especially in the representation of an urban environment, each author will introduce into his representation aspects that only his sensitivity will allow him to grasp [Merleau-Ponty 1969].

These aspects are not only physical, connected to the consistency of the elements present, their colours, their lights; but they are immaterial and connected to the atmosphere of a place, as impalpable as it is difficult to translate into graphic representation, which only the perspective sketch can help to make, thanks to its "soft" nature, that strengthens and attenuates the rigidity of the geometric rules of construction. It characterizes the perspective drawing of the urban landscape as a tool of methodological support aimed at the knowledge of space and places and its commu-

nication, even in the selection and interpretation of the data and those aspects that strike in a more personal way who draws the forms, materials and colours that characterize the space, defining the uniqueness of the atmosphere (fig. 7).

It is impossible not to mention the digital ways of representing these aspects, which record the complexity of the urban environment, perceived through the kinaesthetic path that refers to a multiplicity of views and references culturally consolidated [Empler, Quici, Valenti 2015, p. 993]. They lead to concepts of psychogeography as the study of the precise effects that the geographical environment, consciously ordered or not, directly exerts on the emotional behaviour of men [5].

There are many contributions to digital culture that since the early 2000s led to irreversible changes in the acquisition and representation/communication of every material and immaterial aspect of the urban environment [Mezzetti 2005; Unali 2008]. Even though it is not

Fig. 7. V. Vernizzi, 2019. Perspective sketch of the bell tower and dome of the cathedral of Parma (private collection).
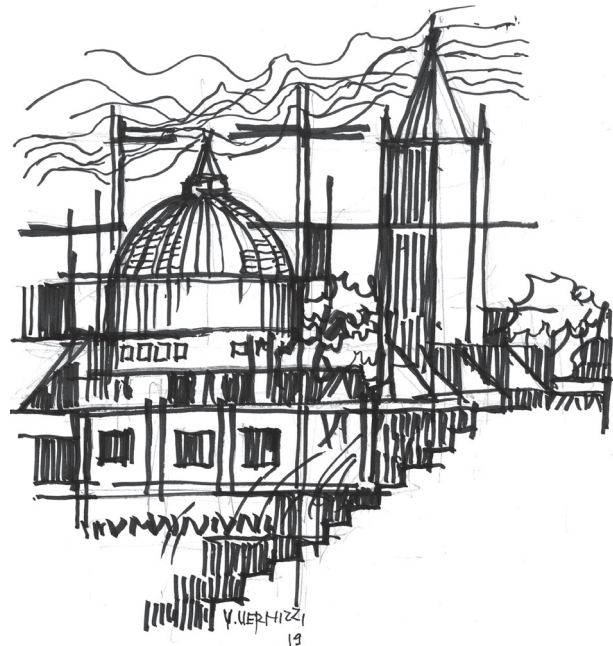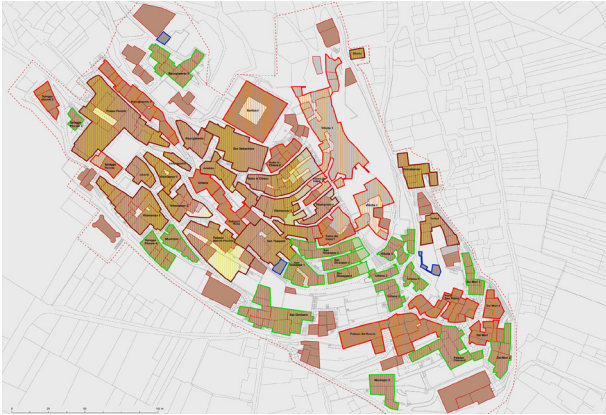
Fig. 8. Identification of the building aggregates of the historical centre of Navelli (graphic work by M. Carra).

a specific object of the present treatise, it is impossible not to mention the theme of reality, which from virtual has increased and become immersive, to the point of extend itself to define ways of managing and connecting quantitative information (Big Data) to sensors and recognition tools on sensorial (not only visual) bases, becoming the beating heart of every process of technological innovation being implemented on the city of today and tomorrow [Ratti, Claudel 2017].

The objective/material representation: the case study of Navelli

The integrated survey carried out on Navelli and Civitaretenga [3], in the crater of L'Aquila hit by the earthquake of 2009, is a good example of interdisciplinary actions preceded by the acquisition of information and documentation of various kinds, especially quantitative, referring to the morphological and typological aspects of the urban system of the countries investigated. More and more capillary information has been added to it, concerning the materials and construction techniques used in a particular context on which a reconstruction plan had to be drawn up, an urban planning tool that could not ignore a basic cartographic representation, faithful and up to date, of the state of things. In this case

we opted for the creation of a product directly aimed at highlighting the peculiarities of the urban site, to create a document of immediate readability. No nominal scale or reference accuracy was therefore set; however, the tolerances of a 1:1000 map, enriched by a series of architectural details characteristic of a higher scale (1:500), were respected. Compared to the cadastral map, the availability of an updated and intrinsically 3D survey, together with the photographic documentation from the ground and from the aerial shots, left open the possibility of producing documents with a much richer informative content than those that could be extracted from the existing cartographic material.

For the acquisition of dimensional data, different methods of instrumental acquisition were integrated: a topographic survey anchored to a GPS framing network, which served as a constraint for a network of planal-altimetric polygonals and as a support for subsequent photogrammetric surveys and laser scanners; a photogrammetric survey carried out by flight with Robinson two-seater helicopter using Nikon D3x high-resolution digital camera with 35 mm calibrated optics; a laser-scanner survey of the most significant areas made with Leica Scan Station C10 laser scanner. The documents restituted from these acquisitions have been integrated by direct survey all the details more minute useful to enrich the description of the urban space. In the case of Navelli and Civitaretenga, the metric survey of the current physical state was conducted by providing a print of the documents at scale 1:500, considered the most appropriate to capture the different aspects peculiar to the two realities in question, to arrive at the realization of a basic plan that would constitute an elaborate that could make it possible to achieve on a single plane of projection the morphological complexity of the towns of Navelli and Civitaretenga (fig. 8).

For both centres, a planimetry of the footprints of the buildings was first elaborated, which also included the representation on an urban scale of all the public connection spaces present in the areas under study, regardless of the altimetric heights to which the road connection system (and consequently the building) is placed.

The integrated survey has allowed to acquire a large amount of data that therefore allowed to create a digital three-dimensional model, simplified according to its use. [Ventura, Montepara, Zazzi 2019]

Fig. 9. Example of thematizations carried out within the HGIS on the historical cadastres of Parma (graphic work by N. Bruno).

Objective/Immaterial Representation: HGIS

As already illustrated, the description of the physical form of a city through drawing is configured as an extraordinary way to travel through time in both directions: on the one hand, in fact, the representation of the city allows not to lose the link with the past and to learn from it, on the other hand it allows to push towards the future prefiguring the effects of any intervention potentially able to affect the lives of future generations. On the other hand, the city undergoes transformations that the drawing, in the traditional sense of the term, does not allow to grasp in an immediate way. Social dynamics, changes in administrative and economic structures, population movements, trade and migration flows are just some of the factors that can modify the intangible and intangible aspects of the city and the lifestyles of its inhabitants, which are instead studied through precise analysis of statistical data and historical documents generally without precise spatial connotations.

Given its great complexity, any research on the city must be addressed by comparing extremely heterogeneous data and using extremely varied documentary sources. Among the most suitable tools for the representation of the city today are the GIS (Geographic Information System) which, thanks to the possibility of associating descriptive data with a georeferenced base map , giving them the spatial connotation of which they are often lacking, are well suited to synthesizing the structure of the city itself.

In recent years, at the DIA of the University of Parma, a highly interdisciplinary project has been launched that has led to the creation of a geographical and historical information system (HGIS) on a cadastral and census basis, aimed at highlighting not only the physical data characteristic of the city, but also those immaterial aspects that are generally not immediately legible in the maps, historical or not, available to scholars [4].

In fact, the geometric land registers (Parma has 4 of them made between 1767 and 1940) are characterized by the fact that they present a double documentary system consisting of cartographic data combined with other alphanumeric data, which allow you to photograph the state of the city at a specific time. In addition to providing objective information of a geometric and dimensional nature, as the type of descriptive combined data varies, the cadastres can allow a wide range of information of a different nature to be extrapolated (fig 9).

The database prepared for the HGIS has also been organised to include the data contained in the censuses that have been carried out in Parma with a certain regularity since the end of the 18th century. In this way, it will be possible to cross-reference the data present in a given cadastre with those of a contemporary census, thus making it possible to locate spatially information that generally does not have this connotation, and thus making available to anyone a large amount of information relating to the material and immaterial state of a city at a specific historical moment. But not only that. In fact, the treatment of the time factor has also been particularly significant, since it has always been one of the most difficult intangible elements to return in a single representation of a traditional type. Since data relating to four different historical thresholds have been included in the system, the system has been designed not only to carry out surveys relating to a single period, thus giving a cross-section of the image of the city in a specific historical period (synchronic surveys), but also to obtain and compare information relating to different documentary apparatuses, allowing the reconstruction of the evolution of the city over time (diachronic surveys).

In this sense, the HGIS, like any other HGIS with more than one historical threshold, is able to provide a sort of "augmented" representation of the city, because it allows to give physical and spatial form to data that cannot be represented differently and to compare them over time in a diachronic view. It therefore guarantees a double level of representation: the material level, linked to the physical structure of the city and conveyed by the geo-referred cartographic apparatus of the land registers, and the immaterial level, relating to the economic-social relations existing within the city, which can be deduct both from the alphanumeric data present within the land registers themselves, and from the census apparatus.

Conclusion

The inevitable consequence of the above considerations is the difficulty, in addition to the unwillingness here, to arrive at a binding definition of procedural indications to establish a series of operations useful to capture and represent the invariant structural elements that support the form of the areas investigated, especially when it comes to the representation of the immaterial.

Fig. 10. C.R. Cockerell, 1848. "The Professor's Dream".

installations, the greenery and then again the signs, signage and artificial lighting, which, thanks to the techniques of acquisition and graphic restitution of their consistence, allow us to have an increasingly precise, faithful and objective representation of urban space in its material consistence, read in a multiscalar dimension, which allows continuous references between different scales of reduction and perception [Quaroni 1977], describing a real special space with several dimensions [Cardone 2015, p. 325].

In this process, historical cartography is always the necessary starting point for reading and analysing the current urban space, the element that allows the complexity to be broken down into the basic constituent elements and to identify the urban structure of the analysed space, the role played by public/specialist buildings compared to private/ residential ones, the nature and characteristics of context architectures, key architectural elements, such as doors and windows, fences and gates, streets, squares, open spaces and landscape elements and their reciprocal proportional relationship.

However, it is impossible to define a unique process aimed at fixing procedural procedures that lead to the representation of immaterial elements perceived in a subjective way, such as the atmosphere of places defined by that indescribable and indefinable mix of factors that only the sensitivity of individual authors can try to grasp and, in a very personal way and graphic techniques, try to communicate, often escaping codes and procedures, giving rise to evocative representations full of suggestions and deep meanings. (Fig. 10).

Urban studies, and in particular the numerous experiences carried out in the disciplinary sector in the field of urban survey, establish in a consolidated way a series of elements to which we can refer in the acquisition of knowledge and in the representation of their material aspects, which we can define as invariant structural elements to which we must necessarily refer in the reading, analysis and representation of an urban environment. They certainly are the streets, open spaces and squares, the skyline, the architectural emergencies (buildings but also monuments or landmarks), the background, the boundaries and barriers, the types of buildings but also the architectural details, the

Notes

[1] See the essays by Michele Calvano, Elena Ippoliti; Maurizio Unali; Caterina Palestini; Sandro Parrinello; Antonella Salucci; Alessandra Cirafici; Tommaso Empler, Fabio Quici, Graziano Mario Valenti; Francesco Maggio, Starlight Vattano published in Marotta, Novello 2015.

[2] Définitiones. In Internationale Situationniste, I, 1958, p. 13 < https:// www.larevuedesressources.org/IMG/pdf/internationale_situationniste_1. pdf> (consultato il 24 novembre 2019).

[3] The surveys were carried out within the framework of an agreement

between DICATeA UniPr and the Municipality of Navelli (scientific director Prof. P.Ventura) aimed at providing activities to support the formation of the Reconstruction Plan of the Municipality of Navelli (AQ) and the hamlet of Civitaretenga, affected by the earthquake of 6 April 2009.

[4] The project was drawn up thanks to the collaboration between the disciplines of Drawing (Prof. Andrea Zerbi), Geomatics (Prof. Riccardo Roncella) and History of Architecture (Prof. Carlo Mambriani). From the work have been born a thesis of magistral degree (Arch. Nazarena Bruno) and one of doctorate (Arch. Giorgia Bianchi).

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