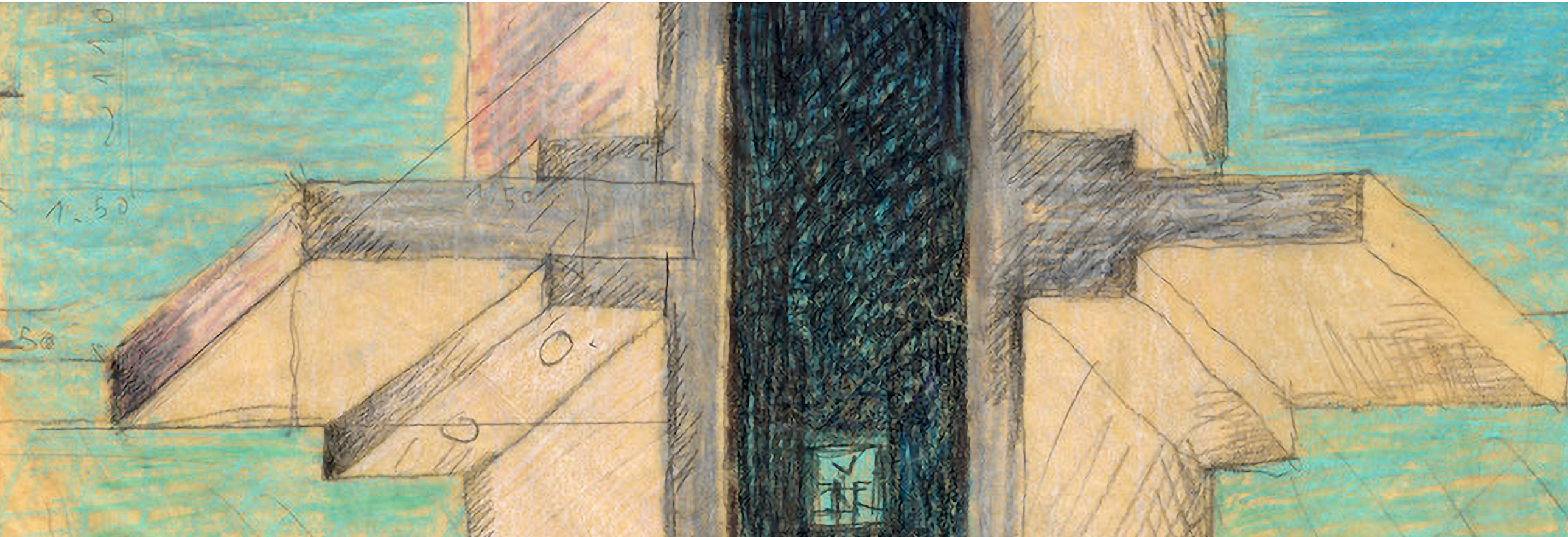
diségno 5.2019

unione italiana disegno
5.2019

diségno

ISSN 2533-2899

english version



diségno

5.2019

THE REPRESENTATION OF LANDSCAPE, ENVIRONMENT AND TERRITORY

diségno

Biannual Journal of the UID Unione Italiana per il Disegno Scientific Society
n. 5/2019
http://disegno.unioneitalianadisegno.it

Editorial office
piazza Borghese 9, 00186 Roma
rivista.uid@unioneitalianadisegno.it

Cover
Massimo Scolari, preparatory drawing for the installation "Gateway for a City on the Sea" for the I Biennale di Architettura di Venezia, 1980. Detail.

The articles published have been subjected to double blind peer review, which entails selection by at least two international experts on specific topics.
For Issue No. 5/2019, the evaluation of contributions has been entrusted to the following referees:
Piero Albisinni, Marcello Balzani, Laura Baratin, Salvatore Barba, Marco Bini, Stefano Brusaporci, Massimiliano Campi, Eduardo Carazo, Emanuela Chiavoni, Daniele Colistra, Roberto de Rubertis, Carlos De San Antonio Gómez, Antonella di Luggo, Paolo Giandebiaggi, Paolo Giordano, Massimo Giovannini, Alessandro Luigini, Carlos Marcos, Giovanna Massari, Andrea Rolando, Salvatore Santuccio, Roberta Spallone.

English translations of the editorial and of the essays by *Dino Coppo, Manuel Gausa, Michela Rossi, Alberto Sdegno, Vladimiro Valerio, Franco Zagari* sono di *Elena Migliorati.*

Published in December 2019

ISSN 2533-2899

5.2019 diségno

5 *Francesca Fatta* — **Editorial**

Cover

7 *Franco Zagari* — Between Drawing and Landscape

Image

14 *Massimo Scolari* — *Gateway for a City on the Sea*

15 *Alberto Sdegno* — *Massimo Scolari's Laconic Landscapes and Oblique Architectures*

THE REPRESENTATION OF LANDSCAPE, ENVIRONMENT AND TERRITORY

Landscape

23 *Rossella Salerno* — Representing and Visualizing in Landscape, between Hard Sciences and Humanities

33 *Giuseppa Novello* — From Maps to Information Systems. Along the Routes of the Drawing Navigating in the Archipelago of the Experiences of a Research Group (1974-2019)

45 *Fernando Linares García* — Los fondos con figuras: la representación de la mirada paisajista sobre el territorio

59 *Maria Elisabetta Ruggiero*, *Ruggero Torti* — Landscape Drawing and Comprehension: the Virtuous Passage of Scale in Digital Representation

Cartography

71 *Vladimiro Valerio* — Observations on Geometry and Cartography: or on the Perception and Representation of Space

81 *Pilar Chías*, *Tomás Abad* — Building Territories and Landscapes: the Royal Site of Aranjuez

91 *Lia M. Papa* — Considerations about Old Maps in the Digital Era

Town

105 *Dino Coppo* — From the Historic City to the Historicized City: Reflections on Several Studies on Urban Form Conducted in the Last Century

117 *Chiara Vernizzi* — The Representation of Urban Environment. From the Survey of the Built City to the Representation of the Intangible Assets

129 *Starlight Vattano* — Graphic Readings on Bressanone: Models and Schemes

Territory

143 *Manuel Gausa* — *Mapping (in) the New Time.* Representations for the New n-City an its Multi-Territories

157 *Giuseppe Antuono* — Waterworks and Water Systems in Sant'Agata dei Goti. Towards an Integrated Informative System

169 *Giuseppe Damone* — Lucania's Landscape and Territory between the XVII and XIX Centuries through Archival Drawings

181 *Barbara Messina, Pierpaolo D'Agostino* — Integrated Procedures for the Drawing of Linear Networks: Digital Graphic Processing of Cycling Path

193 *Paola Raffa* — Between Absolute and Fluid Space: the Representation of the Oasis

RUBRICS

Readings/Rereadings

209 *Carlos Montes Serrano* — A City with a Sense. Back to Kevin Lynch's *The Image of the City* Lynch

Reviews

219 *Marcello Balzani* — Pedro António Janeiro (ed.). (2019). *Drawing (…) City (…) Body, Dwelling on Earth Imagined-Architectures: architectural graphic representation and other image*s. London: CRC Press Taylor&Francis Group, London

223 *Laura Carlevaris* — Agostino De Rosa (a cura di). (2019). *Roma anamorfica. Prospettiva e illusionismo in epoca barocca*. Roma: Aracne editrice

225 *Salvatore Barba, Massimo Leserri* — Jorge Llopis Verdú (2018). *Dibujo y arquitectura en la era digital. Reflexiones sobre el dibujo arquitectónico contemporáneo.* València: Editorial Universitat Politècnica de València

227 *Graziano Mario Valenti* — Michel Calvano (2019). *Disegno digitale esplicito. Rappresentazioni responsive dell'architettura e della città.* Roma: Aracne editrice

230 *Cristina Candito* — Alessandra Pagliano (2019). *Le ore del sole. Geometria e astronomia negli antichi orologi solari romani*. Napoli: Edizioni Paparo

Events

235 *Frank M. Croft* — The 18th ICGG in Milan, Italy, hosted by Politecnico di Milano

238 *Stefano Chiarenza* — XIV International Conference on Graphic Expression Applied to Building APEGA 2019. *De la línea a la nube*

242 *Massimiliano Lo Turco* — Conference The development *of a digital Cultural Heritage Eco-system*

246 *Michela Rossi* — *Faces of Geometry. From Agnesi to Mirzakhany*

249 *Cecilia Bolognesi* — Documentation & Digital vol. 2

253 *Elena Ippoliti* — IMG2019. Graphic Sciences for a Project with Great Cultural Scope

The UID Library

Editorial

Francesca Fatta

The fifth issue of our journal is dedicated to the representation of the landscape, the environment and the territory, a theme very frequently dealt with, as multiscalar models and organisms are generally drawn and represented applying methods and principles that are widely diversified according to various arising needs or circumstances. At the same time, there are, in reality, objective difficulties in finding a common line of definition that brings together the three concepts of landscape –environment– territory, and this uncertainty derives precisely from the multi-dimensionality expressed by their conceptual depth, as well as from the ambiguity of these three terms when they are translated into other languages.
Going back about sixty years, when in 1961 Gordon Cullen published *Townscape*, the index of a long list of apparently disparate terms referring to ways of observing materials and places projected us into a world of words and themes that define the city as a particular form of landscape. For the first time, the polysemic concept of "urban landscape" was thus configured, accompanying, linking and supporting the different scales of architecture and territory.
In fact, complex problems of a territorial nature, linked to the components of social living, converge on the theme of the urban environment: economy, sociology, politics, settlement morphology, architecture, urban planning, behavioral aspects.

The landscape –an absolutely controversial concept given its contemporaneity– is the eloquent mirror of a society and reflects its culture, its relationship with nature, its aspirations and myths, the state of the art of its material and immaterial condition. The landscape is also a projection of our thinking –in our image and likeness– of our personal perception of the history and the future prospects for the evolution of a place, of the awareness and responsibility that each of us has in its regards.
But there is "another" drawing, that is, cartographic drawing: symbolic, rarefied, ideogrammatical, historically defined as "the art of describing physical space on a paper support," as indicated by the term itself, coming from the Latin *charta* and from the Greek γράφειν, which means "to write, to inscribe."
Therefore, amidst territory, environment and landscape, representation operates in dialectical terms that oscillate between creativity and scientific method, realism and symbolism, all systems and methods that aim to restore a global vision of the world, but with different criteria and purposes.
In the drawing of territories, the definition of appropriate criteria and methods has not only produced the development of rigorous specific models, such as that of topographic projection, but has also promoted the introduction of more general systems of representation, from

https://doi.org/10.26375/disegno.5.2019.01

diségno ISSN 2533-2899

the method of orthogonal projection codified by Monge in the 18th century, to the effective photographic systems and procedures that, from aerial photogrammetry to remote sensing, reach the last frontier of digital models for the three-dimensional vision of terrains.
Today we have more and more images, a hyper-production that denotes the extreme complexity of the territorial reality of which the physical space is only one component, and in which the intangible and immaterial characteristics are decisive.
"The representation of the environment and of the territory imposes very high levels of abstraction, codification and normalization, and its practice is therefore essential to an interdisciplinary effort and involves an innovative mix of different methods of representation, whose use is integrated, and has no equal in the area of graphic models," as Vito Cardone wrote in the 'call' for papers (October 2018).
This issue begins with a text by Franco Zagari, full professor of Landscape Architecture who, with his studies and an international professional career, has helped to found in Italy, more than a discipline, a renewed awareness in terms of reading the landscape, directing his contribution towards an attention to the methods and forms of representation.
The poetics of the general theme is reflected in the two images of Massimo Scolari's *Porta per Città di Mare* (one of which is a preparatory drawing never previously exhibited), commented by Alberto Sdegno, while the topics covered have been divided into four sections, with four *overtures*.
The section *Landscape* has been entrusted to Rossella Salerno who, with her scientific contributions, boasts a great deal of experience on the theme of the representation of cultural landscapes. Her contribution aims to capture in a concise manner what is emerging more clearly in the field of digital technologies in regards to landscape representation: a representation revealed in different forms ranging from simulation to virtual/augmented reality, including models of computational design, pursuing in any case a legacy that for centuries has represented the landscape from a perceptual point of view, that is, a visualization that oscillates between the human sciences and the hard sciences capable of simultaneously highlighting the quanti-qualitative aspects of space.
The section *Cartography* opens with an essay by Vladimiro Valerio who, given the recent events, wanted to dedicate it to a great protagonist of our discipline who has just passed away: Anna Sgrosso. Valerio offers a profound reflection on the relationship between geometry and cartography, attempting to find a connection between these two disciplines, taking up a historical and epistemological bond that opens up to further reflections on areas of research related to the complexity of the entire process, from the conception to the realization of a map.
The section *City* is opened by Dino Coppo who, thanks to the great experience matured in research related to the historical city, and to urban form and its hierarchies of values, resumes the most important studies on Turin, also citing those conducted by Carlo Mezzetti and Adriana Baculo, to exemplify various methodologies for reading the urban environment.
And finally, for the section *Territory*, we have asked Manuel Gausa Navarro, professor of Urban Planning at the Polytechnic School of the University of Genoa, to trace the state of the art of what can today be called the map of the new time. He offers us a rich panorama of new analytical-synthetic representations for the new n-city and its multi-territories according to an "indeterminate (inform(action)al) order whose decidedly open, 'undisciplined' character grows as the freedom of movement –and displacement– and the degree of interaction between local situations and global structures increase."
For the *Readings/Rereadings* section, it seemed important to us to welcome the contribution of Carlos Montes Serrano on Kevin Lynch's text with his paper entitled *A City with a Sense. Back to Kevin Lynch's The Image of the City*. This text, published in the U.S. in 1960, a year before Cullen's above-mentioned book (London 1961), represents a constant and topical reference on the ways of perceiving and interpreting the city.
This issue concludes with the reviews of several of the latest volumes dealing with drawing, as well as the most relevant events that have animated our vibrant community, and the updating of our members' latest publications.
Work is already underway on the sixth issue focusing on the themes of the 2019 UID Conference held in Perugia, due to be published in June 2020, as well as on the seventh issue, a thematic issue dedicated to *Drawing and Measurement*, scheduled for December 2020.
I would like to extend my heartfelt thanks to all the Editorial staff for the work they do in such a competent and generous manner and, finally, to express the hope that the contributions in this issue will increase knowledge and offer new perspectives on the theme.

On Drawing and Landscape

Franco Zagari

On the borderline between the disciplines of drawing and landscape design there is a terrain vague with interesting intersections which, in my opinion, should be examined. This is an issue that for me, at least, is more sensitive, today, now that I deal more with these problems in my dear old niche of a studio, that is, the artisan workshop I started out in. I am pleased to mention these intersections on this occasion, in which you give me the honor of introducing such a highly qualified assembly of authors. I believe that between the terms "landscape" and "drawing" we can recognize affinities in the meanings related to the projectual actions that we perform in the transformation of the territory. It is little less than a flash between imagination and reality that is established between these two concepts in comparing them, but at times that flash is enough to produce spectacular effects and to give birth to profound novelties in our vision of the habitat. Both landscape and drawing have, in fact, a common dependency on Vitruvius in their charter of values and vocations, with similar approaches to the diagnosis and interpretation of the contexts in which they operate, as both are sciences of relations, much less objective than those of architecture and urban planning. Both disciplines bring together experiences conducted between material and immaterial elements, actually creating workshops for understanding the recent phenomena of urbanism that are giving rise to entirely new models of inhabitation. The new city of the third millennium, in the search for its own structure and identity, manifests an uncertain and wavering nature. It is perfectly understandable that there is a defensive reaction that rewards landscapes of already acknowledged virtue, but

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.

Fig. 1. Franco Zagari, A Blue Klein lift for the Castle of Krsan (Croazia). Consulting for Marko Frankovich restoration project.

the projectual objectives, as commonly understood, are much too entrenched in conventional and repetitive systems: monuments, historic centers and nature reserves, considered select places virtually favored by public and private financing policies.
The castle of Kršan, in Croatia, located on the Istrian peninsula, was my baptism by fire with the new technologies of representation, under the guidance of Marko Francovic (fig. 1). I discovered a world, a moving X-ray, sections and elevations of great precision and beauty that seem (and probably are) magnetic resonances, millions of points instead of lines, a real revolution, where everything is possible, such as maintaining perfect alignments between interiors and exteriors. All this found in me, a landscape designer, a perfectly prepared spirit; I don't really know why, but as I believe strongly in subliminal contamination, it must be for that reason that I immediately asked myself what to me seemed the most natural question, that is, if it were possible to walk on water. Indeed, what else does "making landscape" mean, otherwise?
It was possible. Form, statute and function of a public space respond primarily to a need of being consistent conceptual moments strongly integrated with each other. A large pedestrian area, whether it be a square, garden or park, should be like the representation of the crowd that will inhabit it, a magnetic field with the variable tension of the many forces and behaviors of the public establishing an equilibrium. We would give great importance to the thickness of the perimeter and its way of filtering the view of the horizon, to the accesses, the strategic routes, the large optical channels that ensure the fundamental lines of orientation and allow us to estimate the dimensions of the site and, of course, to the play of slopes, excavations and backfills. The representation of all this answered my questions perfectly. Here we can understand how such an interactive definition of drawing, in every kind of space represented, leads from a conception in principle only instrumental to a conception that is also projectual, that is, drawing becomes Drawing. This support of our actions is nothing more and nothing less than a tabula, like that of backgammon, or a chessboard, and as such would seem apparently neutral, but of course this is not so. Each of our actions, at least in part, is influenced by the form and representation of space, which here is dense, here is extended, here different and here united, here articulated in activities and flows, a place that in any case should never be too assertive and constrictive, but rather suggestive, in perpetual tension, offering options for both emotional and intimate episodes. You will not have failed to notice that the form of space has been presented as an entity that has its own autonomy of meaning.
The representation of this reality, for better or for worse, has become part of the charter of values that promote, or not, particularly appreciated places, to the point of defining them as World Heritage Sites, of which UNESCO holds a monopoly on preliminary responsibility and monitoring: the novelty is that the culture of Drawing now expresses both a physical and a virtual reality, thanks to the autonomy that the space of representation assumes.
I would like to speak to you briefly again about three authors who in recent years have succeeded in involving thousands of people: Christo and Jeanne-Claude, Cai Guo-Kiang, and William Kentridge. The familiarity between drawing and project is at the basis of works which we initially defined as ephemeral, and which are anything but. The theme is invariably a known reality, a monument, a historical, landscape or geographical context, of which the installation reveals an unsuspected vitality. The public is directly involved, as in a captivating workshop. Some of their works are installations that start from a theme, the pro tempore rewriting of a place in order to highlight its characteristics. This is the starting point for a great deal of research into the vocation of the sites for intervention and into the method and tools for temporarily modifying them. Three extraordinary lessons in drawing. Three. Extraordinary lessons on landscaping.
A first central moment in the conception of a work is the representation of the context and the project idea. Incidentally, for the artists and the public and private institutions involved, this phase is the most important source of the recovery of expenditures and income. Christo is universally renowned, but his installation on Lake Iseo (fig. 2) constituted an absolutely unthinkable novelty, the invitation to cross the lake by foot, on the surface of the water, in an unprecedented procession of over a million visitors, wrote a page of history that will remain in the memory of this enchanting place: the region went into total blackout, all forms of transport were interrupted. Cai Guo-Kiang, perhaps the most well-paid artist in the world, has grafted his deep knowledge of Western classical culture, especially painting and sculpture, with an

Fig. 2. "Floating Piers" installation by Christo on Lake Iseo, 2016 (photo: Marcio De Assis) <https://it.wikipedia.org/wiki/The_Floating_Piers#/media/File:Iseo_Floating_Piers_7.jpg> (accessed 2019, November 10).

Fig. 3. "Transient Rainbow" in Manhattan by Cai Guo-Qiang, 2002 < https://publicdelivery.org/cai-guo-qiang-transient-rainbow/> (accessed 2019, November 10).

expressive material typical of his tradition, gunpowder and pyrotechnics, in memorable explosions of the landscapes of Manhattan (fig. 3) and the historic center of Florence (fig. 4). Kentridge, on the other hand, brought the City of Rome to participate in a high-level international debate for which he was then guiltfully absent. He produced a mural on a stone wall along the Lungotevere (fig. 5), using a pressure washer to remove part of the century-old patina of pollution that had settled there. It is like a strip of film, 500 meters long and 9 meters high, dedicated to the triumphs and lamentations of the City.
The second moment is the physical fruition, when the public visits the transformed place. This is an event that never lasts more than two or three weeks, and it could not be otherwise, due to the very high daily cost of protecting the work and to the impact, caused by the public, that could destroy this object of desire unintentionally, simply for the effects of the success of a visit that this place has never previously sustained.

The third moment, finally, is the place returned to its state *ante operam*, but deeply modified in the awareness of each of us.
The beauty and dignity of the work should be recognized as the most important values to be affirmed in the transformation of the territory. It is for this mission that projectual actions for its protection, management and enhancement are defined. In this new strategy, drawing establishes new orientations and new qualities of centrality, becoming an integral part of a completely innovative conception of activities, flows and behaviors. These objectives should be pursued without any saving of energies and should be distanced from an excessively easy or complacent imagination, restoring them to the power of a function that is, instead, extraordinary, having its roots in our critical reasoning. In this, drawing today has a function that has been completely divested of a purely technical and executive meaning, and has taken on a value that fully represents the aesthetic, ethical and knowledge-related contents of

Fig. 4. "City of Flowers in the Sky" in Florence by Cai Guo-Qiang, 2018.

Fig. 8. "Triumphs and Laments" in Rome by William Kentridge, 2016.

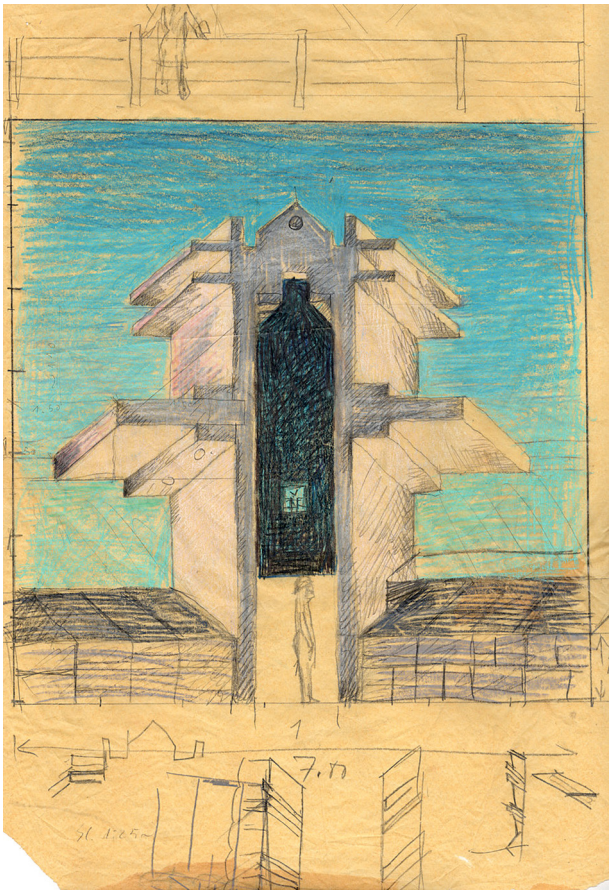
the contexts that we face. After all, both concepts depend on a selection of data from reality or our imagination. But I will stop here, prudently: *Hic sunt leones*... Behind the beauty of a flower, a landmark, a garden, a square, a park, a field, a settlement, a factory, an infrastructure, or even systems that interest vaster areas such as coastlines, valleys, ridges, there must always be a project, which is an indispensable testimony of civilization. Between landscape and drawing there exists a conceptual affinity that is easily intuitable and that would deserve, thanks also to the following contributions, a future work of confrontation and dialogue.

Author

Franco Zagari, Mediterranean University of Reggio Calabria, info@francozagari.it

Gateway for a City on the Sea

Massimo Scolari



https://doi.org/10.26375/disegno.5.2019.03

diségno ISSN 2533-2899

Massimo Scolari's Laconic Landscapes and Oblique Architecture

Alberto Sdegno

"Landscapes uncontaminated by the usual aesthetic prejudices of human sight" [Moneo 1987, p. 4]: this is how José Rafael Moneo comments the works in the catalogue of the exhibition *Hypnos*, held in November 1986 at Harvard University and dedicated to the work of Massimo Scolari. The exhibition also included the painting *Gateway for a city on the sea* (*Porta per città di mare*), realized a few years earlier –in 1979, exactly forty years ago– and described by Scolari in the same volume in the transformation from painted landscape to physical architecture, on the occasion of the 1st Venice Architecture Biennale [Scolari 1987, pp. 54-57]. If the work will be particularly significant in the author's work –considering the appreciations of authoritative critics– the Biennale itself will have a noticeable importance in the cultural debate, as the recent volume by Léa-Catherine Szazka testifies [Szazka 2016]. The event in the lagoon city, in fact, will start a new attention on architecture on a supranational scale, also because singular spaces –like that of the Corderie of the Arsenale– will be used for the first time in exhibition environments. Precisely in this area with a longitudinal extension –created to produce the ropes of Venetian boats– twenty internationally renowned architects will be invited to design the urban fronts of a hypothetical *Strada Novissima* [1]: of these, Massimo Scolari is the only one who has decided not to practice the profession, having chosen to study the problems of architecture exclusively with the tools of representation. But the transmutation of the *Gateway*, we mentioned before, from painting to scenic installation, is not uncommon in his work. Often, in fact, in his activity as a painter, Scolari decides to go beyond the limits of the two dimensions of the imaginative, to propose a stereometric translation of

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.

the figurative apparatus. This is precisely what happened with this work, but also to other founding objects to which he has turned his attention: for example, the *Ark* (*Arca*), which we often find depicted in his watercolors and which in 1986 landed materially –with a subtle and ingenious play of scale– at the 17th Triennale in Milan to distinguish *The Room of the Collector* (*La stanza del collezionista*) [Scolari 1986]; but also for the figure of the *Glider* (*Aliante*), which floats in many of his painted skies, built in laminated wood for the 5th Architecture Biennale [Scolari 1991] and now permanently positioned on the roof of the Venetian place of the IUAV University of Venice; and again for the *Turris Babel*, which was realized, in dismantled form, for the 9th Venice Architecture Biennale [Scolari 2004].
It is precisely in the *Gateway*, however, that several of the *operating modes* recurrent his work can be found: this oil painting, in fact, shows a brick portal anchored to a natural landscape, placed on a narrow sea passage, which reveals an inner space where the façade of a small building set into a mountain slope can be distinguished. The waves are counterbalanced by a threatening sky, against which two wings, which frequently populate his works, stand out. In other words, we have in front of us a synthetic essential "laconic" architecture, to use a term often found in the titles of his works. In this case, the flat representation becomes a model, a bit like the outline drawn by a maiden of her lover's shadow –described by Pliny the Elder to describe the origin of drawing [Plinio Secondo 1988, p. 473]– which was transformed into a silhouette of pressed clay thanks to the skillful hands of the potter Butades of Sicyon.
But this painting, apparently balanced, actually presents an iconographic conflict, generated by the use of two dissimilar methods of figuration. As Tafuri points out, in fact, "the use of two systems of representation –perspective for the landscape, axonometric for the architectonic figure– makes the view of the mountainous island in the background a problematic one. The disclosure of the dam alludes, in fact, to a perspective center embodied by the small house set at the foot of the mountain. But that disclosure is deceptive, for it does not belong to the landscape which is in itself already 'too constructed', but rather, to a projective space whose secret laws are known only to the immobile V in the sky" [Tafuri 1980, p. 14]. The trained eye expects to see the convergence of the architectural lines of the portal, which instead proceed in *paralleli modo*, towards that improper center of projection that governs all axonometric drawings.

Perspective landscape *versus* oblique architecture: an imperative that we find in many of his works. The further moment of disorientation is manifested precisely in the desire to bring to an end this double communicative register present in the painting. The architecture, in fact, presented in cavalier oblique projection, becomes solid axonometry in the installation at the Corderie, skillfully described in the construction drawings of the 1:1 scale model set up there. A physical, material and tangible axonometry that can be perceived through the perspective vision of the visitor's eye, making the parallel lines, that remain separate in the pictorial figuration, converge in the center of projection itself, anchored on the horizon and rigorously identified thanks to the methods of descriptive geometry. In addition to the technical drawings supplied to the executors of the work in the Arsenale in Venice, and synthesized in a watercolor now in the archives of the Centre Pompidou in Paris, few sketches remain to document this transition from painting to architecture. We have proposed one of these –never previously published [2]– next to the famous oil painting. A detail of the sketch –in keeping with the logic of this journal– is presented on the cover, to underline the centrality of drawing and the necessary analysis to which the materials published are subjected, as though observed through a magnifying glass. This preparatory drawing shows human figures –rarely present in Scolari's works– sizing the space that will welcome visitors. Measurements and numbers reduce the scene to a certain extent, and in the vertical space in the center, against the black background, a rectangle appears on which there is the little 'V' that Tafuri spoke of. As Scolari reveals, to those who have not had the opportunity to walk down this *Strada*, that rectangle recalls the original painting from which the installation was generated, where the 'V' is the mark of the wings in the painting: "In this work –comments the author– I wanted to construct the parallel distortions of axonometry, exactly as it is done with converging deformations in theatrical perspective. In order to eliminate any 'projectual' ambiguity, I placed the painting 'Gateway for a city on the sea' immediately inside the entrance, so that *upon entering the representation* one finds only another representation" [Scolari 1987, p. 54].
But it is no coincidence that axonometric drawing governs many of his figurative works. In his theoretical writings, Scolari frequently declared his interest in this method of representation: for example, in the text *Elementi per una storia dell'axonometria* [Scolari 1984] published

in the Issue No. 500 of *Casabella*, now re-proposed in the volume *Oblique Drawing. A history of anti-perspective* [Scolari 2012, pp. 1-24] which brings together many of his research studies on this subject, including *Soldierly perspective* [Scolari 2012, pp. 287-324] and *Drawing in 'paralleli modo'* [Scolari 2012, pp. 325-340].
Combining axonometry and perspective in the same figurative context can only redirect the observer away from a reassuring and usual vision to an enigmatic representation. Often those who observe one of his paintings or watercolors, in fact, are led to continuously move closer to, and then away from, the work in question: to understand both the precision of the mark and the message held in the communicative register, but also to understand the subtle –often skillfully hidden– visual distortion that the eye encounters. Near and far, then. With a behavior similar to that of the two well-known figures described by Walter Benjamin, that is, the surgeon and the magician who, each in their own way, treat the patient differently: by touching the inside of his organs or by imposing their hands from a distance [Benjamin 1969, p. 13] [3].
And we cannot but agree with what Mario Gandelsonas wrote about Scolari's *theoretical landscap*es, in which he noted "a sophisticated 'confusion' of rules: the natural rules are applied to the geometrical or architectural landscape; the architectural rules are applied to the natural or geometrical landscapes" [Gandelsonas 1976, p. 61]. The observer, therefore, is led towards a sort of disorientation, whereby, perhaps, he is invited to lose rather than to find himself in the work. Thus the comment by the well-known German critic mentioned above, written in memory of his *Berlin childhood* could be fitting: "Not to find one's way around a city does not mean much. But to lose one's way in a city, as one loses one's way in a forest, requires some schooling" [Benjamin 2007, p. 103].

Notes

[1] The *Strada Novissima* was realized by Cinecittà S.p.A., with the collaboration of other companies [Cellini et al. 1980, p. 5]. On the 1st Venice Biennale of Architecture, see also: Szacka 2016.

[2] We thank Massimo Scolari for kindly providing the drawing.

[3] On *The work of art in the age of mechanical reproduction*, see also: Sdegno 2018, and the bibliographical references cited.

Author

Alberto Sdegno, Polytechnic Department of Engineering and Architecture, University of Udine, alberto.sdegno@uniud.it

Reference List

Benjamin, W. (1969). The work of art in the age of mechanical reproduction. In H. Arendt (ed.). *Illuminations*, pp. 1-26. New York: Schocken Books.

Benjamin, W. (2007). Infanzia berlinese intorno al millenovecento. Brani scelti. In Id. *Immagini di città*, pp. 103-123. Torino: Einaudi.

Cellini, F. et al. (a cura di). (1980). *La presenza del passato. Prima mostra internazionale di architettura*. Venezia: Edizioni La Biennale di Venezia.

Gandelsonas, M. (1976). Massimo Scolari. Paesaggi teorici. In Lotus international, n. 11, pp. 57-63.

Marzari, G. (a cura di). (2007). *Massimo Scolari.* Milano: Skira.

Moneo, J.R. (1987). Prefazione. In M. Scolari. *Hypnos*, pp. 2-7. Cambridge, Mass.: Harvard University.

Plinio Secondo, G. (1988). *Storia naturale. V. Mineralogia e storia dell'arte. Libri 33-37*. Torino: Einaudi.

Scolari, M. (1984). Elementi per una storia dell'axonometria. In *Casabella*, No. 500, pp. 42-49.

Scolari, M. (1986). La stanza del collezionista. In G. Teyssot (a cura di). *Il progetto domestico. La casa dell'uomo: archetipi e prototipi*, pp. 20-21. Milano: Electa. Catalogo della XVII Triennale di Milano. Vol. *Progetti*.

Scolari, M. (1987). *Hypnos*. Cambridge, Mass.: Harvard University.

Scolari, M. (1991). L'ingresso alle Corderie dell'Arsenale. In AAVV. *Quinta Mostra Internazionale di Architettura*, pp. 40-45. Milano: Electa - La Biennale di Venezia.

Scolari, M. (2004), Turris Babel. Installazione per la 9. Mostra Internazionale di Architettura. In N. Baltzer, K.W. Forster (a cura di). *Metamorph. 9. Mostra Internazionale di Architettura. Traiettorie*, pp. 30-31. Venezia: Marsilio.

Scolari, M. (2012). *Oblique drawing. A history of anti-perspective*. Cambridge, Mass.: The MIT Press. [English translation from *Il disegno obliquo. Una storia dell'antiprospettiva*. Venezia: Marsilio 2005].

Sdegno, A. (2018). L'opera d'arte nell'epoca della sua riproducibilità tecnica di Walter Benjamin. In *diségno*, No. 2, pp. 161-168. DOI: https://doi.org/10.26375/disegno.2.2018.17

Szacka, L.-C. (2016). *Exhibiting the Postmodern. The 1980 Venice Architecture Biennale*. Venezia: Marsilio.

Tafuri, M. (1980). The Watercolors of Massimo Scolari. In M. Scolari. *Architecture between Memory and Hope*, pp. 2-15. New York: The Institute for Architecture and Urban Studies -MIT Press. [Italian text in: Marzari 2007, pp. 265-283].

THE REPRESENTATION OF LANDSCAPE, ENVIRONMENT AND TERRITORY

Landscape

Representing and Visualizing in Landscape, between Hard Sciences and Humanities

Rossella Salerno

Introduction

The issue proposed in the call 'The representation of landscape, territory and environment' is placed in the crossing of various disciplines: geography, ecology, urban design, architecture, but also social sciences and humanities, till to include the latest interdisciplinary exchange between life sciences and techniques which is on the basis of computation.
At first glance, landscape representation seems today to include –because of diversified applications coming from digital technologies in the field of data processing– the territorial and environmental representation too; in fact it employs both data information of geomatics, and opposite, the interpretative images of the ambiance, characterized by time/space parameter which is subjective and cultural.
In other words, landscape representation appears to take an original position, making use of geographic data processing and sensory depiction concerning the tangible and intangible components in a territory.
In our generation, the approach to landscape outlined in the very well-known book of Vittorio Gregotti *Il territorio dell'architettura* (1966), was a reference point –as properly for a multilayered reading open to the diverse geographic and anthropologic facets– so, it could be use-

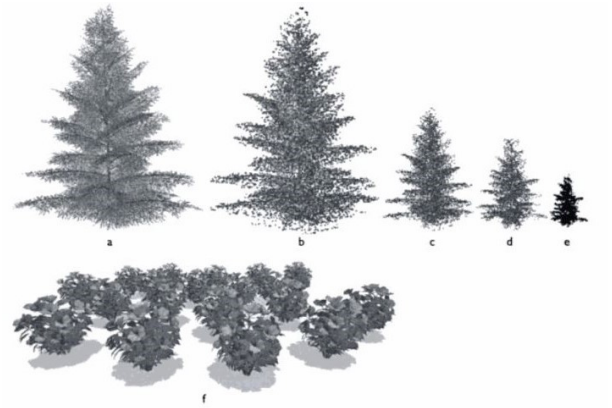
This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.

ful to question what is changed over the years, if we wish to represent such complexity [Gregotti 1966].
Today, what is emerging in a very clear way is that, considering the many and different digital graphic outputs created by a diversified processing of a huge quantity of territorial data, we are more and more moving towards a visualization topic, or, in other terms, it is now arising a very specific attention in visually depicting the geometrical description and the interpretation of geographic contexts, namely the picture of quantitative and qualitative aspects: last but not least, we can consider landscape representation as the result both of data coming from hard sciences and from the more blurred facets of subjective perception of environment.

Landscape Visualization

In such direction, over the last twenty years major developments implied the realistic depiction of vegetation; in parallel, the visualization of terrain turned out to be more and more effective and we can watch images and terrain models automatically generated applying GIS data.
As state Bishop and Lange in *Visualization in Landscape and Environmental Planning* [Bishop, Lange 2005] –which has been for over a decade a cornerstone in the field of landscape digital representation– recently, important step forwards have been made as concerns computer graphics employed to visualize environment in three or four dimensions, applying mainly animations required to record different time phases, or more in general, introducing movement in space representation.
In the book's foreword Stephen M. Ervin, in a little unexpected way –mainly for the position of the text in the field of the exact sciences– writes that words and images are same necessary, actually they get stronger each other in visualizing and communicating landscape, both in designing and planning the environment. Furthermore, Erwin underlines the relevance of communicating e discovering knowledge in the field of site visualization, because they are two fundamental features in the cognitive and imaginative process of representation, and more in general he emphasizes the role played by representation, because it "is not purely artistic, like a painting or a poem, but is rather embedded in a real-world context, often with social, ethical, economic, political and other implications. These real-worlds demands are part of what make the art and science of landscape visualization so important" [Erwin 2005, p, xii].
In a way, the consciousness of the representation's potentialities, as result of two intertwined components of knowledge and communication, is what allows to start the engine of applications used for visualizing landscape in forestry, agriculture, energy and the urban milieu (fig. 1), that is, in all those fields where creating a likely 'aided by computer' image is employed to answer questions like: How will that design solution work? But also: How shall it look like?
Considering that the 'eye/brain system' is a very sophisticated instrument, able to recognize pattern and to focus on differences, visualization can finally result an effective help detecting correlations, implications, anomalies, and not only playing a role of aesthetic control.
More broadly, the goal which the visualization of landscape seems so to aim, is to make visible the facets beyond their aesthetic dimension, and so, to go into the substance of the dynamics between anthropic and natural components; in other words, to use visualization is a clever tool when we want to make the invisible, visible, employing it as an excellent test for functional and visual aspects in the field of landscape planning and design.

Fig. 1. Digital models of trees, levels of detail description: a) geometric description of a pine tree, b) representation by 13,000 points, c) 6,500 points, d) 3,250 points, e) 1,600 points, f) group of cloned plants. (from Bishop, Lange 2005, p. 59).



Simulation, Virtual and Augmented Reality

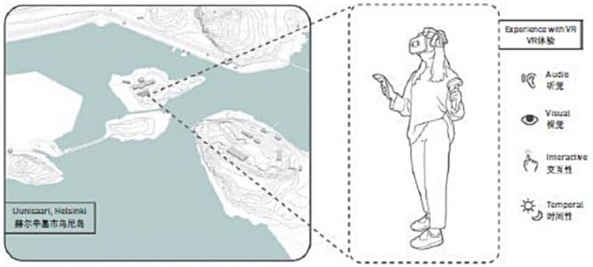
Visualization is equally crucial in experiential landscape simulation process: in this case it is possible to observe an increasing of perceptual components which involve not only the visual

dimension but also sound and touch, so describing an all-round environmental experience. What makes similar this approach to the one previously described, is the 'anticipative' feature of the graphic outputs, "enabling a trustful and comprehensive understanding of places that are not reality yet, in order to ease their quality assessment in advance" [Piga, Morello, Salerno 2017, p. 2] (fig. 2).
The experience made in exploring dynamically a site is based –as previously said– on perceptual parameters which realize reference's elements in elaborating both the analytical phases and the design's ones. The experiential simulation of space implies to apply digital modelling: modelling and simulation are so strictly connected for the evaluation of the cumulative environmental effects, necessary for the designer project solution.
The centrality of visual control is considered relevant also in the most up-to-date technologies about Virtual Reality/Augmented Reality which can be addressed to check, anticipating it, a landscape project, utilizing a user-friendly visual language.
VR in fact aims to simulate experience, reproducing it as a whole, in an entirely virtual environment; differently AR shares in the same simulation space, real world and digital contents, so the part which is 're-built', 'augmented', turns out to be represented by digital information added in real time, leaving the 'real real' in background.
Pia Fricker, who is responsible of Digital Landscape Architecture Laboratory in Helsinki Aalto University, considers immersive technologies able to intuitively interact too, in a similar way namely to a process which happens in a real environment; the benefit coming from AR/VR so derives by employing digital and information models capable to cause quickly interaction (fig. 3).
Immersive technologies of visualization allow to check interactive audio-visual fields and meantime, to interpret the

Fig. 2. St. James's Park, London, 3D Landscape Visualization for an experiential text of sounds effects (from Lindquist, Lange, Kang 2016, p. 218).

Fig. 3. Interactive Data-Sets in Virtual Reality. Digital Landscape Architecture Laboratory, Aalto University in Helsinki.

Fig. 4. VR technology layout for immersive co-design applications: investigation of temporal, interactive, visual and audio aspects. Digital Landscape Architecture Laboratory, Aalto University in Helsinki.



data flow deriving from specific places, using novel and diverse tools to implement the awareness of changes in our life environment (fig. 4).
These innovative tools incorporate different features of the human cognitive neuroscience system –perception, experience, memory– and decision making; about the issue, the space perception resulting from analytical methods applied to complex systems, permits to better simulate the design result, establishing to easily take part in decision making processes about urban environment.
Definitively, the AR/VR digital technologies consent to open a shared vision of landscape projects to an increasing number of people, so they get able to understand the complexity of territorial dynamics.

Visual techniques and visual representation of ideas

In the Anglo-Saxon world, a wide professional field embracing both urban design and landscape disciplines, shows great attention to perceptive environmental analysis which employs a wide range of representation techniques to describe visual aspects. Such tradition, also moving towards digital, maintained a visual approach, as it is well shown in the Nadia Amoroso's book, Representing Landscapes: Digital, which systematizes the most effective examples of "good visual techniques and visual presentation of ideas."
In this book, we can find several papers connected by a unique leitmotif which "captures visually various landscape types and case projects using drawing conventions (drawing types), composed digitally, and taught in the profession to communicate concepts" [Amoroso 2015, p. 3].
Besides the conventional techniques of representation –such as, plans, sections, axonometries digitally 'translated'– are shown some innovative tools as Mapping, that in "landscape architecture is often related to visual markings and notations referenced to geographical areas" [Amoroso 2015, p. 3].
So, Mapping seems to have a double employment, playing a role meantime as an abstract depiction and as a visual representation: on one hand it is considered like a creative process which helps to understand the site's complexity, 'visually abstracting' some selected parts from a geographical context, on the other it allows "visually recording objective and subjective measures of the site" [Amoroso 2015, p. 4] (fig. 5).
Also in the case in which Mapping synthetizes the abstracted facets of a place, it preserves a visual component,

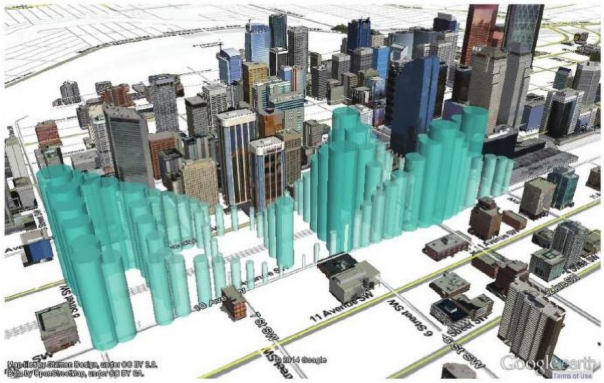
an attention to the perceptive dimension that returns also in other forms of representation as, for example, perspective drawing: "The designer –Amoroso writes– can compose fairly realistic 'view' of the landscape via a photorealistic application in a perspective drawing […] We have adopted a new term to draw the perspective drawing –'photoshopping'. Textures, colors, and effective lighting can be quickly added to change the space. Existing sites transform into new landscapes with the addition of elements, textures, people, and lighting effects overlaid on the aspects of existing site contexts" [Amoroso 2015, p. 5]. (fig. 6).

Visual Data Mapping and Landscape Visualization

Data Mapping and Landscape Visualization are in the core of some research labs and centers over Europe; among them, there is ETH Zurich DARCH – Landscape Modelling and Visualizing Lab, guided by Christophe Girot who is developing an interesting methodology of point cloud modelling for large scale projects, using geographic data coming from territorial surveys realized by drones provided with laser scanner.
Images resulting from these environment's surveys, are characterized by a complex coordinates system which ensures an extremely high exactness level; an employment of high precision instruments, deriving from structural engineering, consents so very accurate simulation of real, where datasets of tiny dots in the point cloud model obtain a final effect recalling, in a way, the pointilliste painting (fig. 7).
A fly-through model is often joined to sounds recording carried out in the same place, which denotes how –despite the high technological complexity in the graphic output– an aesthetic visualization of landscape more or less intentionally remains in this kind of representation, emphasized by visual and sound perceptual components (fig. 8).
By the way, it is important recalling how a basic idea in Girot's program for MAS LA (MASTer of Landscape Architecture), is thematically questioning which data should be used in order to detect the more relevant ones in the design process. A visual control is anyway based on those applications implementing meantime 3D GIS and Geo Data; in fact, these ones offer to landscape architecture and urban design suitable tools to analyze and visualize data from multi-dimensional perspectives (fig. 9).
The 'animated maps' drawn up by Nadia Amoroso, applying DataAppeal Software, utilize a webGis able to visua-

Fig. 5. Mapping of pedestrian movement (from Amoroso 2015).

Fig. 6. Rendered Perspective (from Amoroso 2015).



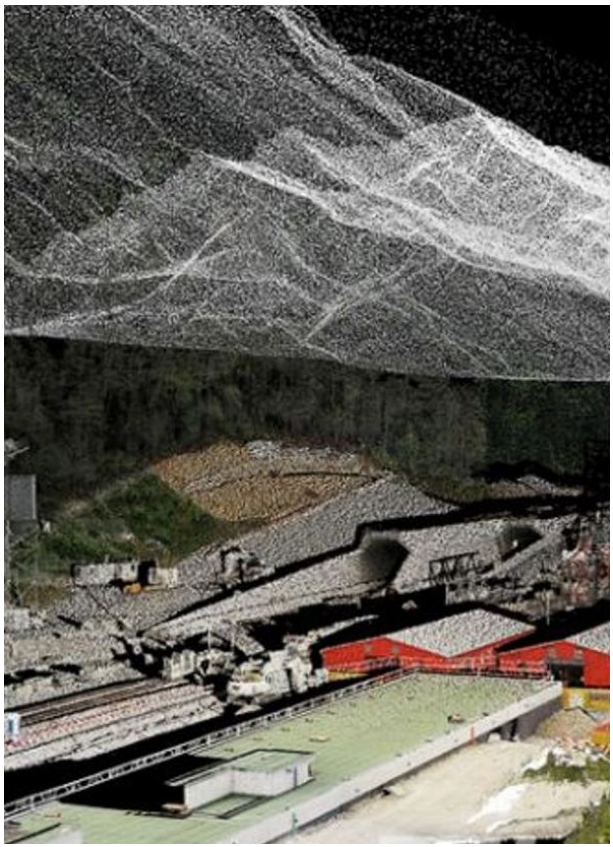
lize hidden data in a clear way and so they are useful also to be employed in participatory processes. As Amoroso herself wrote promoting this app: "DataAppeal provides a simplified GIS platform, therefore landscape architects without any GIS training can use the application to get visually engaging site analysis, that can be used to retrieve further insights on the site and can also be used for visual communication purposes" [Amoroso, Sechter 2012, p. 352]. These graphic outputs derive from 'row' data processing, stored in government's website dedicated to natural resources, so thousands of information scripts can be visualized in landscape images (data-map) to reveal trends differently hard to share.
However, it is clear that a dataset's representation can be often be meant, easily and in a unaware way, in an incorrect manner, so as some specialist suggest, among them Pia Fricker, Big Data visualization in the field of landscape architecture, together with understanding data, requires literacy in coding field to have an independent control position using data and to be successfully able to transform them in design tools (fig. 11).
In fact, data and statistical representations are addressed to communicate complex ideas in a clear, exact and efficient way, even if to visualize information today takes first to give meaning to huge amount of data to extract results from them.

Fig. 7. Point Cloud Model, ETH Zurich DARCH – Landscape Modelling and Visualizing Lab.

Computational design thinking and landscape representation

As in the previous paragraphs it has been shown, both landscape architecture and urban design by the means of update representations, have forwarded in exploring digital technologies, however without being able to really employ them like a medium for the design project: a thought-provoking hypothesis suggests that thin unsatisfaction comes from a weak theoretical discourse which contributes to the difficulties to conceptualize a role for technologies, from a theorical and cultural point of view, inside the design process [Fricker, Kotnik, Piskorec 2019, p. 240].

Fig. 8. Gotthard Landscape, The Unexpected View, ETH Zurich.



On the same issue, it has been observed that if digital media are usually considered 'inadequate', it is because they are mostly employed to re-produce the hand-drawing techniques, rather than to explore in deep the possibilities embodied in the media themselves.
Instead computational design seems to introduce a novel approach that will have consequences not only on the large scale project, but also on its representations: "Computation is an approach to design that consciously explores the potential of the defining elements of a computable function as design tools: the formal relationship between sets of entities, the quantifiable properties of these sets of entities, and the algorithmic transformations and interaction of different quantifiable properties" [Kotnik 2010, p. 7]. We are namely facing a way of depicting geographical contexts and of describing the changes produced by design, based on relationships among data, geometry and space, generated through parametric modelling, first addressed to represent not as much form as the process underlying.
Now, it is relevant to highlight how, from a theorical point of view, computational design refers to structuralism, not in the anthropologic meaning given by Ferdinand de Saussure, rather to structuralism of life and technical sciences, grounded in Norbert Wieser's studies on cybernetics and on Bartalanffy's work on general system theory.
In such perspective of structuralism, computational design is a fertile ground for an interdisciplinary exchange between life and technical sciences, further it opens a new way in connecting paths of scientific and artistic thinking by means of computation.
The landscape representation, and so the landscape design project, is based in this context, on the research of local parameters of a specific site (urban growth, flows, sedimentation, water dynamics, human factors), in order to obtain a systematic approach and 'translate' the results in patterns.
Although patterns are abstract models aiming to interpret data and to foresee design solutions, it should be noted that the graphic outputs correspond, also in this case, to visual and aesthetic control parameters.

Conclusion

This paper aims to catch in a synthetic way, what in matter of landscape representation is emerging more clearly in the field of digital technologies. Attention has been given not as much to technological process methods of graphic outputs, as to figurative forms that the graphic outputs take in turn.

Fig. 9. Data map visualization, MAS LA (MASTer of Landscape Architecture), ETH Zurich.

The visual research area seems today to be ongoing in depicting the landscape dimension, even if it reveals diverse forms ranging from simulation, to Virtual/Augmented Reality, including computational design's patterns, so pursuing a legacy that for ages represented landscape from a perceptual point of view and not only in terms of quantitative and technical parameters.

Fig. 10. Washington Ave, Miami Visual Study, Night-time activity and sound levels, Data-map designed using DataAppeal application (from Amoroso, Sechter, 2012).

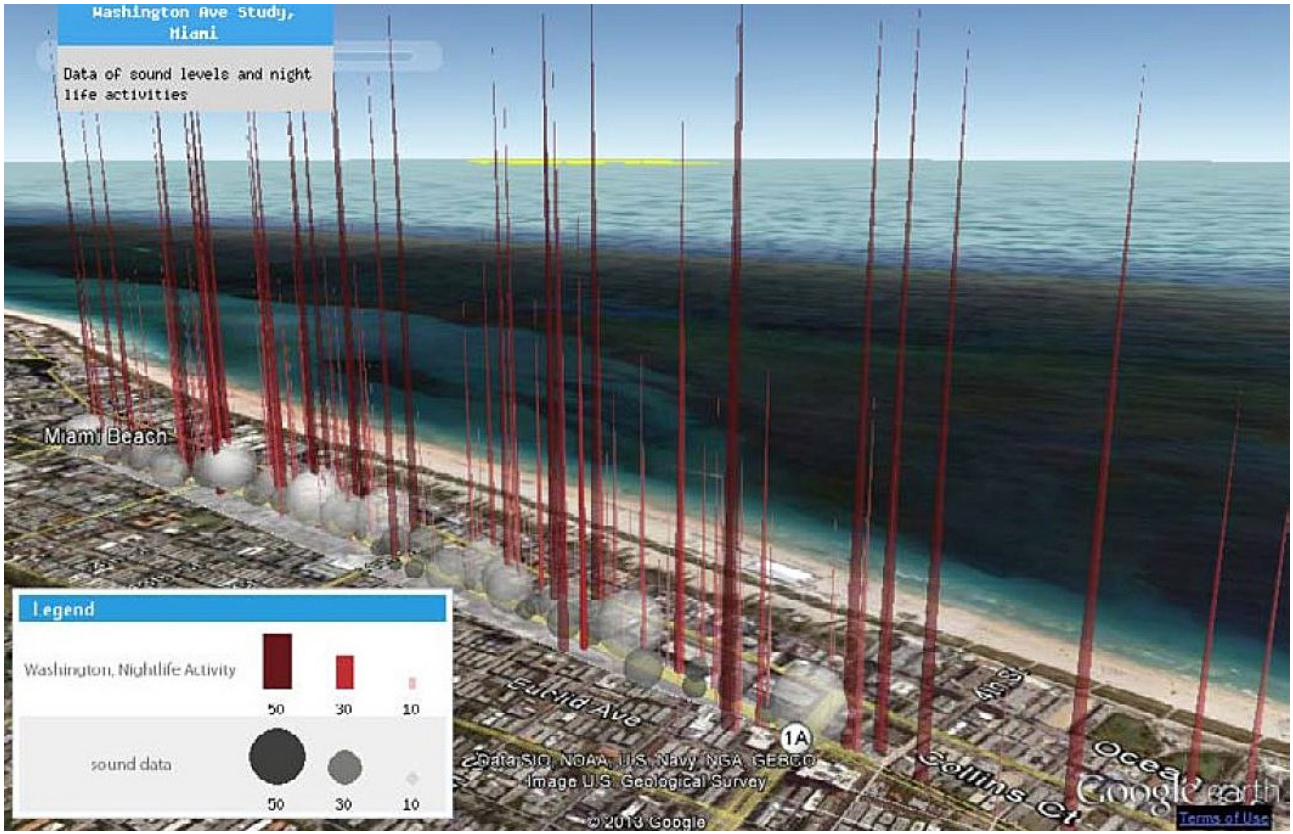


Fig. 11. Big Data Visualization. Map of views along a path. The algorithm developed can determine the visibility of all areas for any area along the path. The different areas are drawn around a place, each within their own radius. Students A. Comninos e A. Theodoropulos' project (from Fricker, Munkel 2015).

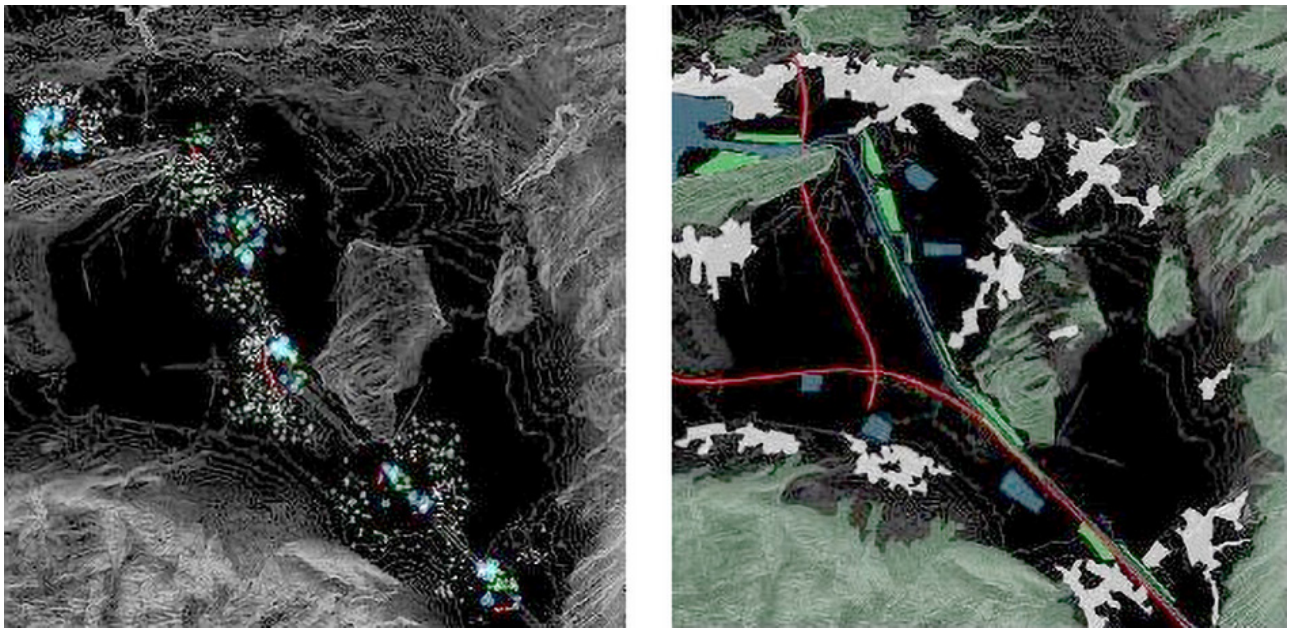
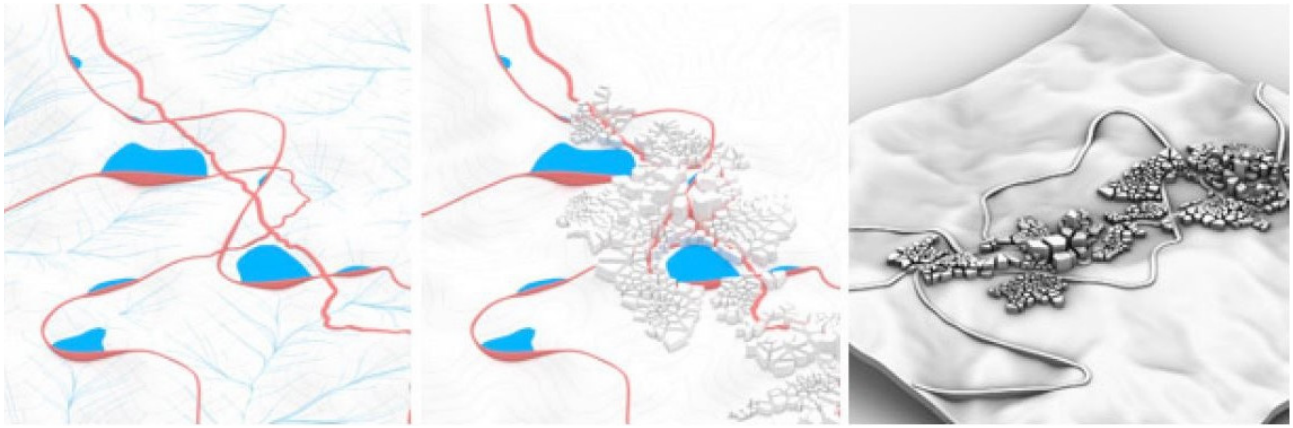


Fig. 12. HUT, High Urban Terrain, project by S. Døskeland e J. Saarinen. The project concentrated on generating a road network on the hilly terrain, which provided an opportunity to create dams and artificial lakes around which the city could grow (from Fricker, Kotnik, Piskorec 2019).



Author

Rossella Salerno, Department of Architecture and Urban Studies, Politecnico di Milano, rossella.salerno@polimi.it

Reference List

Amoroso, N., Sechter, H. (2012). 3D Geo-Design Mapping Using DataAppeal. In: *Peer Reviewed Proceedings Digital Landscape Architecture 2012*. Wichmann, pp. 346-355.

Amoroso, N. (2015) (ed). *Representing Landscapes: Digital*. London: Routledge.

Bishop, I. Lange, E. (2005). *Visualization in Landscape and Environmental Planning: Technology and Applications*. London: Taylor and Francis.

Erwin, S.M. (2005). Foreword. In Bishop, Lange 2005, pp. XI-XIII.

Fricker, P. (2019). Virtual Reality for Immersive Data Interaction. In *Landscape Architecture Frontiers LAF*, n. 7 (2), pp. 153-159.

Fricker, P., Kotnik, T., Piskorec, L. (2019). *Structuralism: Patterns of Interaction Computational design thinking across scales. Journal of Digital Landscape Architecture*, n. 4, pp. 239-247.

Gregotti, V. (1966). *Il territorio dell'architettura*. Milano: Feltrinelli.

Kotnik, T. (2010). Digital Architectural Design as Exploration of Computable Functions. In *International Journal of Architectural Computing,* n. 8 (1), pp. 1-16.

Piga B., Morello, E. Salerno, R. (2017). Foreword. In B. Piga, R. Salerno (eds.). *Urban Design and Representation*, pp. 1-7. Cham: Springer.

From Maps to Information Systems Along the Routes of the Drawing Navigating in the Archipelago of the Experiences of a Research Group (1974-2019)

Giuseppa Novello, Maurizio Marco Bocconcino

Abstract

As we perceive it today, the territory is not always the organic result of natural and anthropic processes of change and transformation linked to the development of environmental, cultural, social, economic and political contexts. The contribution illustrates this assumption by critically reviewing the research experiences conducted in the field of Representation aimed at supporting better and more effective government actions and protection of material and immaterial systems concerned. The results of surveys that have been the methodological foundation and essential cultural heritage for a series of research groups formed since 1974 in the then Institute of Technical Architecture of the Politecnico di Torino are recalled: occasions that required working on representations of different levels of detail, organized in an increasingly integrated system of information, where the vastness of the fields of investigation and approaches has anchored itself to the tradition of the cleverest Italian culture, finding, over time, that unprecedented support offered by information technologies that has allowed us to reach new scientific milestones.

Keywords: Information systems, resilience, education and research.

Introduction

The territory presents itself to the observer as a dynamic result of actions and transformations produced over time and still alive and it does so not only through its purely visual aspects; their interpretation is allowed by tests, tools and knowledge offered by various sciences and application disciplines. It is necessary to study the analytical tools that, also through the use of the most abstractly objective structures of drawing, can help to clarify the complex process of reading, both by looking at the most innovative thematic expressions, sometimes of exclusive use by professionals, and by considering other elements of figuration and art.
Both with regard to the definition of their typology and with regard to the vastness of the approaches that compete with the experiences conducted, the drafting of the contribution is articulated by comparing two levels of reflection separated by an osmotic membrane that relates the aspects more properly critical and methodological with a more figurative overview, expressed through diagrams and drawings, which is aimed at exposing the application areas and their outcomes.
The representation of a territorial system (including in this environment, landscape and territory) derives from an orderly set of appropriately processed data [Baculo 1992; Centofanti, Brusaporci 2016]. The government of complexity has in this order the founding element, the classification of cognitive elements within homogeneous categories allows to schematize without simplifying, giving

rise to stratified models; each layer corresponds to unique codes of representation that must harmonize with those associated with the other layers, ensuring the permanence of the quality level of information that allows to recompose the cognitive synthesis pursued.
This passage of state, from the data to the information, must be supported by transparent and verifiable procedures at every moment of the processing. The drawing on the paper is based on the final selection of the data according to a given path of study and analysis; the paper is a support for the content, but it does not contain all the data that distilled it, formed in the process of de-icing from the cloud of data to the drawn tract. The nature of the current representation tools goes beyond the static nature of the paper support, becoming liquid. Not only that. Content and container merge in the processing space, the place of analysis is also that of condensation and then distillation, a moment in which the representation supports the analysis by highlighting the substantial elements in an orderly fashion and concealing them on the others.
In the following, after some considerations of merit on the scientific field in which the application experiences have matured, there will follow a review of some experiences of teaching and research significant to highlight methods and tools that support the representations for the governance of territorial systems.

Brief notes on the scientific-cultural matrices of reference

The Institute of Technical Architecture of the Politecnico di Torino, directed by Professor Augusto Cavallari Murat, since the sixties of the past century has addressed issues of research on the historical city and on the fabrics that characterize the urban form and the territory of Turin, from this intense study has derived the need to assess whether and how they could express the forms of representation in relation to the historical contexts and trends of development of the city, designed in its territory and immersed in its environment, with attention to both the phases of knowledge and importance as well as those aimed at the related design actions.
In relation to the objective of defining the codification proposals for conventional representations of building and urban fabrics, one of the results of the work carried out was the definition of a system that, taking into account the functional aspects together with the philological and congectural hypotheses, was recognized as a standard for urban relief in 1973 (UNI 7310-74).
The Department of Engineering of Building and Territorial Systems (DISET) has collected in the eighties of the last century the legacy of the Institute and has deepened, for specific fields of application and through collaborations with researchers from other complementary scientific fields, the results of previous research activities.
In particular, some research sectors focused on Representation and Relief have expanded the areas of investigation pursued so far through:
- studies on the urban form and on the conventions in the urban survey with historical-critical purposes in which the environmental factors have been represented through diagrams, cartograms, graphs, and moreover the fabric of the historical centers has been returned through philological congectural maps, distributive ideograms of the cellular structure, ideograms of monumentality [Istituto di Architettura Tecnica del Politecnico di Torino 1968; 1975];
- research related to the system of Cultural and Environmental Heritage of the City of Torino (as preparatory studies for the Municipal General Regulatory Plan) [Politecnico di Torino. Dipartimento Casa Città, 1984];
- specific studies on the natural and anthropized environment of mountain aggregates [Scarzella 1997];
- surveys on valuable environmental systems with complementary analyses that integrate the survey of the architectural structure with the context, and with reference to areas undergoing transformation [Novello 1999; Coppo, Osello 2006];
- relevant experiences aimed at the representation of urban fabrics affected by natural disasters and representations of support for environmental assessment studies;
- research on drawing and design of rail transport networks and road communications in the Piedmont region;
- survey of the system of porticoed axes and areas dedicated to open-air trade in the city [Coppo, Davico 2001];
- critical reviews and analysis of the evolution of representation techniques for the planning and design of underground works [Novello 2007).
With regard to the forms of processing adopted for the conduct of some specific, more recent research, computer-assisted management systems have been favoured so as to allow flexible access to information and maintain information quality both for archiving and for processing

Fig. 1. Integrated reading of the application experiences [edited by the authors].

Fig. 2. The analysis of the territorial and environmental factors of the Tavoliere di Torino and of the urban plant in Alba [Istituto di Architettura Tecnica del Politecnico di Torino 1975].

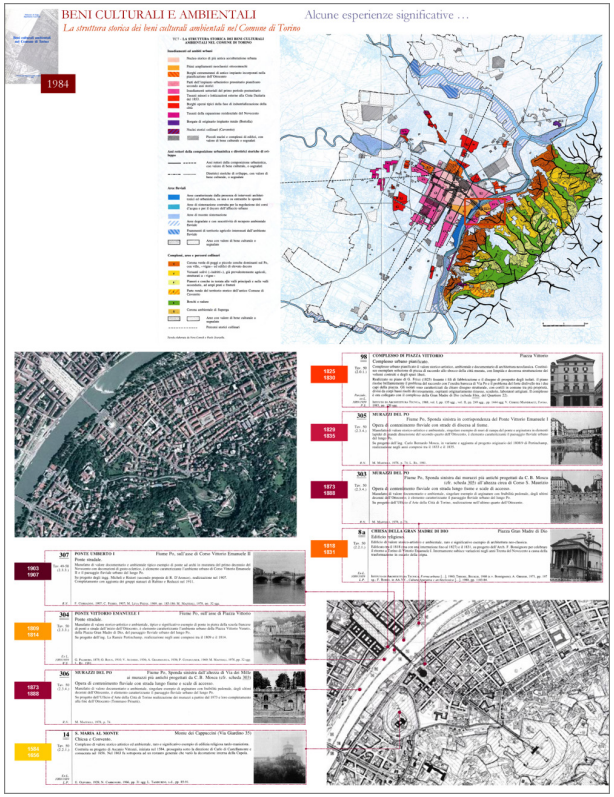


Fig. 3. The identification of the Cultural and Environmental Heritage of the City of Turin [Politecnico di Torino. Dipartimento Casa Città 1984].

the results through the establishment of information systems for environmental and territorial management and analysis.
In the following illustrations (figs. 1-6) – places of stratification and analysis for different purposes – are highlighted some themes and some significant representations related to experiences conducted by the Institute of Technical Architecture and the Department of Engineering of Building and Territorial Systems of the Politecnico di Torino, with particular attention to the techniques of representation used for territorial, urban and environmental analysis.

Travelling stages between training and research

Representations, images and physical ideas of the territory play a fundamental role in orienting and defining projects and processes of transformation. These images behave like discursive practices, establishing limits and boundaries with respect to what can be expressed, while at the same time providing explicit and even implicit rules, as shared, with respect to the ways in which the contents of representation interact; it is at the same time a study of current and past territorial realities and a foreshadowing of their possible futures.
Images and ideas of territories have played a decisive role in directing and defining practices of conceptualization and reconstruction of the physical city. There are points of passage and rupture, where the new images deconstruct the previous ones, opening the way to new meanings and values, while maintaining a character of continuity.
There are many experiences conducted by the research group of which the authors are part, these are methods and areas of experimentation tested and evaluated on several occasions, we briefly report some, to illustrate the variety of themes and tools in the field of representation have engaged for years activities related to training and research. The first field in which the experimentation of hypertextual languages for the communication of urban relief has been carried out dates back to 1992, with Margherita Ognibene. The Piedmontese floods of 1994 required the organisation of infrastructural assets within a multirelational alphanumeric database [Tarditi 1996] (fig. 7). In 2000, a relational database was drawn up entitled *Computer elaborations and proposals for representation protocols for the management of road infrastructure design.*

Again with Cristina Boido's doctoral thesis [Boido 1998], the documents of the survey of the citadel of Alessandria were organized in a database that can be consulted in the form of a hypertext (fig. 8), a methodology then applied in the training of student architects for the case of the Murazzi along the Po of Turin.
The importance of the representations in the processes of transformation of the urban territory becomes evident for the case of Turin: some components of the local physical landscape (the rivers, the hill, the relationship between the Turin plain and the alpine circle), or certain historical building figures of the city (the orthogonal grid, the nineteenth-century baroque axes, but also the settlement matrices of the industrial city), are denied or strengthened by the projects when the basic images vary. There are undoubtedly important and symbolic moments in the contemporary history of Turin: the nature of the recent transformations of the city, the role of its image, the great urban projects.
The event of the 2006 Winter Olympics in some ways concludes a first phase of the profound metamorphosis that has affected Turin in the last thirty years.
A transformation that is modifying the genetic traits of twentieth-century Turin, and in which the imaginary and the ideas of the city seem to have a central weight.
The pervasive image of the Fordist city – a gigantic infrastructure at the service of production – was, for much of the twentieth century, the totalizing horizon of reference for the physical construction of the city [De Rossi, Durbiano 2006].
The diffusion of geographic information systems within the spatial planning tools adopted by public bodies has led to the thesis of Degree (urban analysis of peripheral areas 1999) and Doctorate (strategic environmental assessment of Olympic interventions Turin 2006, 2004) by Maurizio Marco Bocconcino [Bocconcino 2004] (fig. 9), then that of Doctorate of Elena Boffa, in particular for urban analysis related to anthropogenic risk.
Changes and permanence characterize the history of the drawing. Technological evolution also offers innovative elements and confirmations of some methods and techniques or the abandonment of others, in favour of more efficient and safe processes.
As mentioned, these studies, which have led people in training to experiment with specific fields of application of drawing through advanced digital tools, have supported part of the research conducted within the then De-

Fig. 4. Integrated Analysis for the Survey [Novello, Coppo 1984].

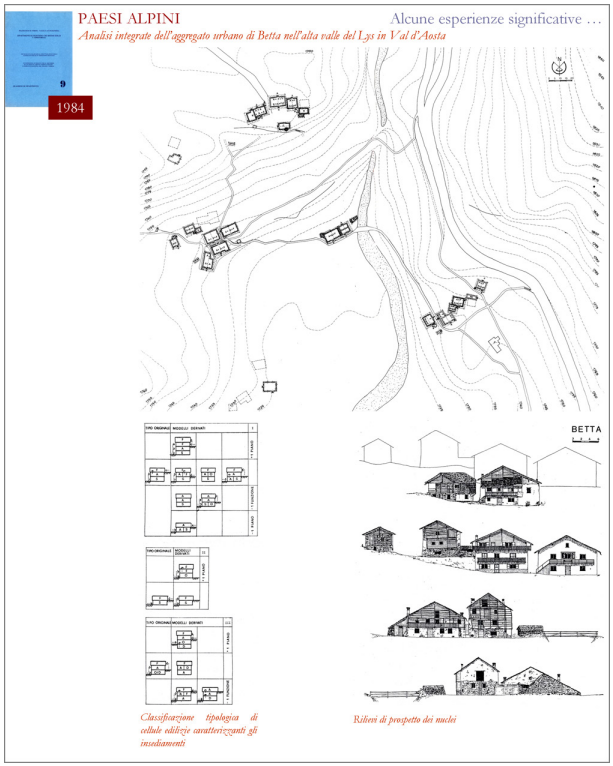
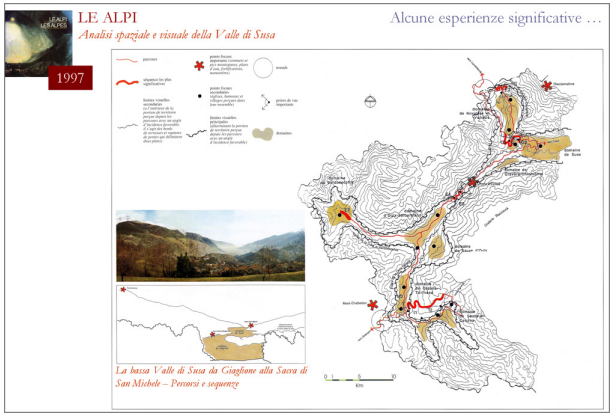
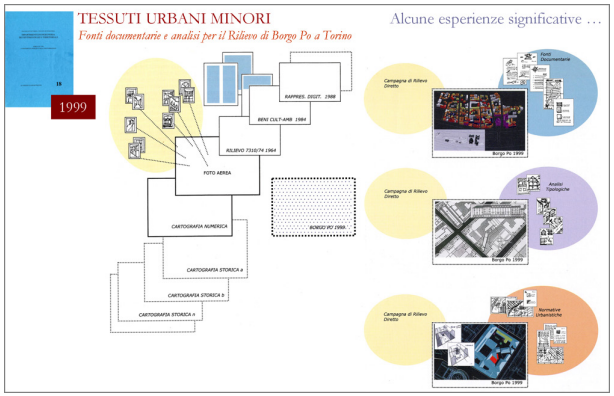


Fig. 5. Spatial and visual analysis of the Susa Valley [Comoli, Very, Fasoli 1997].

Fig. 6. Documentary sources for the Survey [Novello 1999].





partment of Engineering of Building and Territorial Systems. The research contract with the Province of Turin [Novello et al. 2007], for the analysis of the most suitable graphic codes and representation techniques for the visualization of the information relative to the municipal level acoustic restoration plans (PRAC) (fig. 10), is also worth mentioning.
The next paragraph focuses on a significant experience, compendium of the previous ones and very articulated application for the quality and number of experiences involved; it is an experience of applied research, carried out for the Piedmont Region and for the Tourist Observatory [Novello et al. 2009], relating to the census of sports facilities in the region (CISP), in this case setting up methods of monitoring and reporting in real time of the progress of the survey.

An applied research experience: the census of sports facilities in Piedmont

The Piedmontese territory is characterized by the presence of a plurality of constraints of landscape-environmental protection that identify areas that, for their aesthetic, environmental, naturalistic and anthropic peculiarities, characterize the landscape. The actions of protection and the interventions of modification of the state of the places in zones of particular interest are subordinated therefore to the verification of the procedural fulfillments for the safeguard, the management and the planning of the interventions in relation to the landscape values.
Consistently with the nature of a system in continuous movement, the reading and writing of the transformations of environmental and territorial level, including the related methods of management, processing and analysis of information, must be appropriately adapted to correspond to representations that, only if conducted in dynamic processing environments, become useful media to improve the governance of the systems under investigation.
Such shrewdness favours responsible changes, also with regard to the critical aspects of vulnerability due to endemic or induced risks, and lends itself to suggesting prudent actions to trigger sustainable developments capable of respecting territorial vocations, increasing the resilience of the various systems involved: the new drawings and representations, if conveniently renewed, can be

confirmed in their traditional role of active and integrated support to face the different scales of intervention resulting from increasingly complex challenges.
The opportunity to consolidate the census activities conducted by DISET – which, as a practical result, had precisely the definition of a cognitive framework of sports facilities, in particular public property, updated to June 29, 2007 – as an inheritance for future updates or future census activities of infrastructures, including those not related to sport, was seized in the direction of making general and exportable the elements of approach and organization of the different phases of work, the primary objective of each research experience.
The complexity of a system that is constituted by the stratification of its components, both in time and space, by the different relationships that connect them and by the specificity of the different qualifications has required, during the survey of the plant engineering – from the training of the work team to the analysis of the consolidated data in November 2007 – many activities and resources that have been dedicated to the collection, storage, processing and choice of representation techniques for the exchange of updated reports on progress and for the drafting of documentation relating to the final results (fig. 11). The preparation of a special Information System for the collection of data from the sports facilities (SIRIS), supported by computer tools, was interpreted, from the outset, as an essential and functional component for the preparation of regional planning and monitoring tools, an absolutely fundamental and necessary element, wanting to provide that the knowledge levels gained could be shared, available and disseminated on the network, anchored in the present, but necessarily projected into the future, in order to be fully usable. These issues of updating and disseminating information, which have become increasingly important and in use in the academic and research fields, exported to the institutional activities of the public administration and to the fields of application of professional practice, make it appropriate to disseminate information in a way that is oriented towards heterogeneous audiences, not necessarily technically prepared but rather made aware of accessible information methods and with an intrinsic high quality of communication.

Fig. 7. The structure of the database set up for the management of data relating to crossings on the river Tanaro [Tarditi 1996].

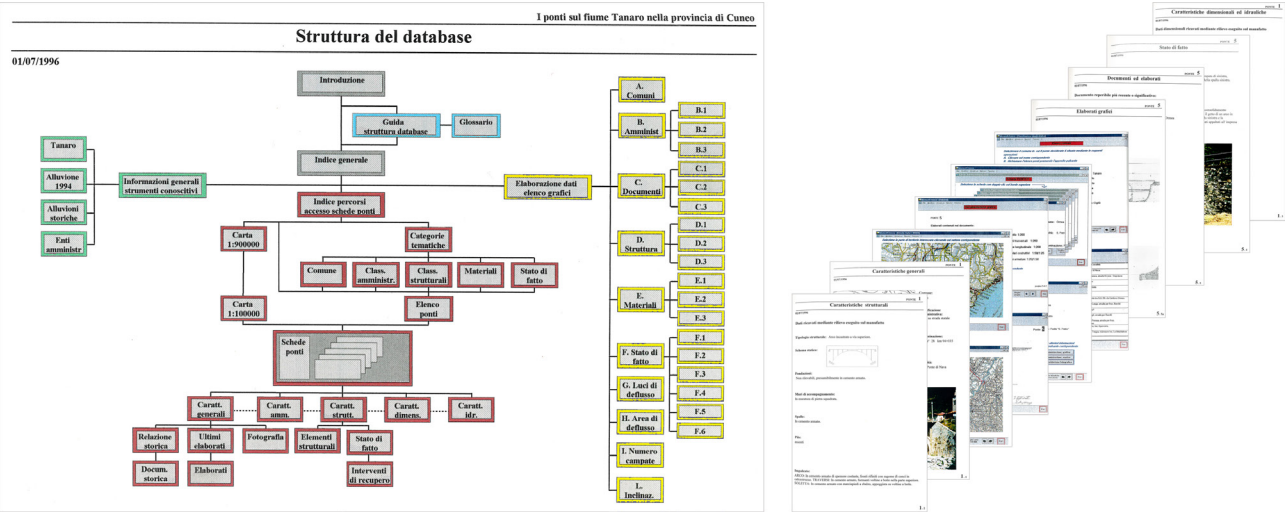
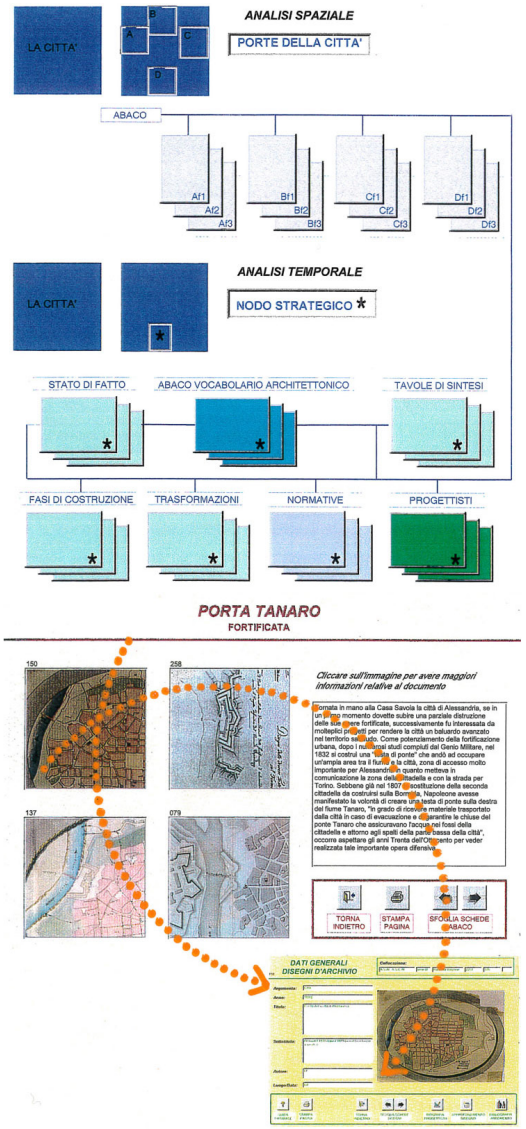


Fig. 8. The urban design of Alessandria between survey and project, structure of the database and analytical cards [Boido 1998].



Conclusions and developments

Currently, the most recent and significant investigations are directed towards further complex work aimed at defining processing equipment to manage information assets of various kinds, designed to make more effective and efficient multidisciplinary research, in order to exploit the information potential of the graphical representation for those environmental and territorial systems of which you want to know and improve the degree of resilience, or the measurement of the ability to absorb and mitigate the effects of critical anthropogenic and natural events related to different levels and scales of influence. The path has therefore been enriched by making new supports for the path of Drawing.

This highly collaborative field of work has found institutional expression at the Politecnico di Torino through the recent establishment of an Interdepartmental Research Centre specifically dedicated to in-depth studies on the theme of resilience, responsibility for interventions and risk (R3C), to which many researchers from different scientific sectors, including our Drawing area, have adhered.

Increasingly, the evolution of information systems is conforming tools and applications towards structures that are easily portable and interconnected at all times. The storage and management of data for their graphic representation follow consolidated criteria and forms of knowledge, but in a more efficient way and towards a wealth of increasingly numerous and heterogeneous information. Technological evolution also offers innovative elements and confirmations of some methods and techniques or the abandonment of others, in favour of more efficient and secure processes. The path that the contribution has taken through a number of fundamental stages, critically analyzed precisely because it highlights elements that have remained compared to those that have been abandoned, has been enriched by making new areas of research and renewed ideas.

Changes and permanences characterize the history of drawing; we wanted to give personal testimony of the aspects of method contained in experiences that we can consider distant, in the face of technical progress that proceeds at high speed, and how these aspects remain in the current developments, thus being able to consider them, reasonably, immutable even with respect to the frontiers that are expected.

Fig. 9. Information system and representations of the strategic environmental assessment of the Turin 2006 Olympic interventions [Bocconcino 2004].

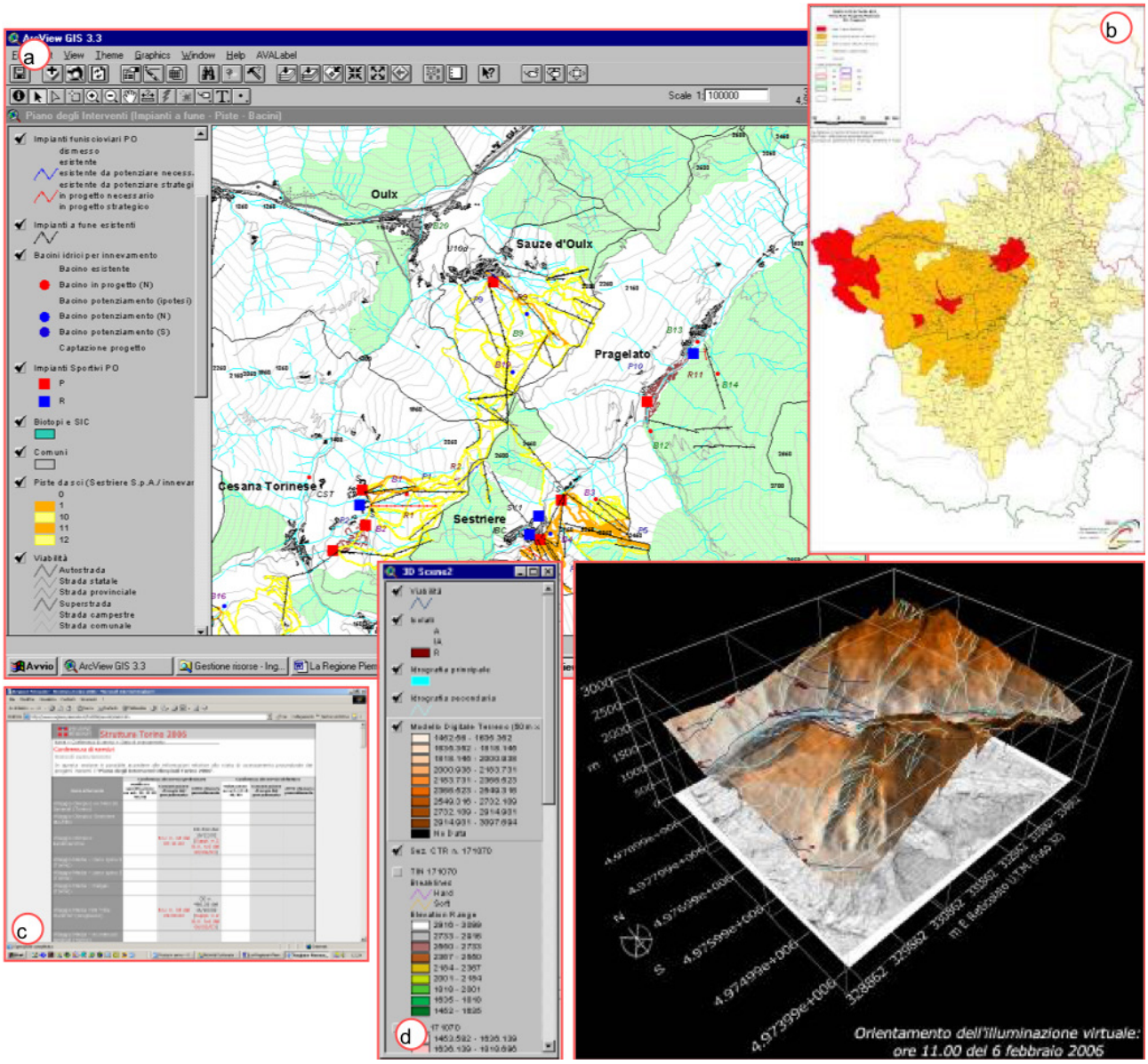
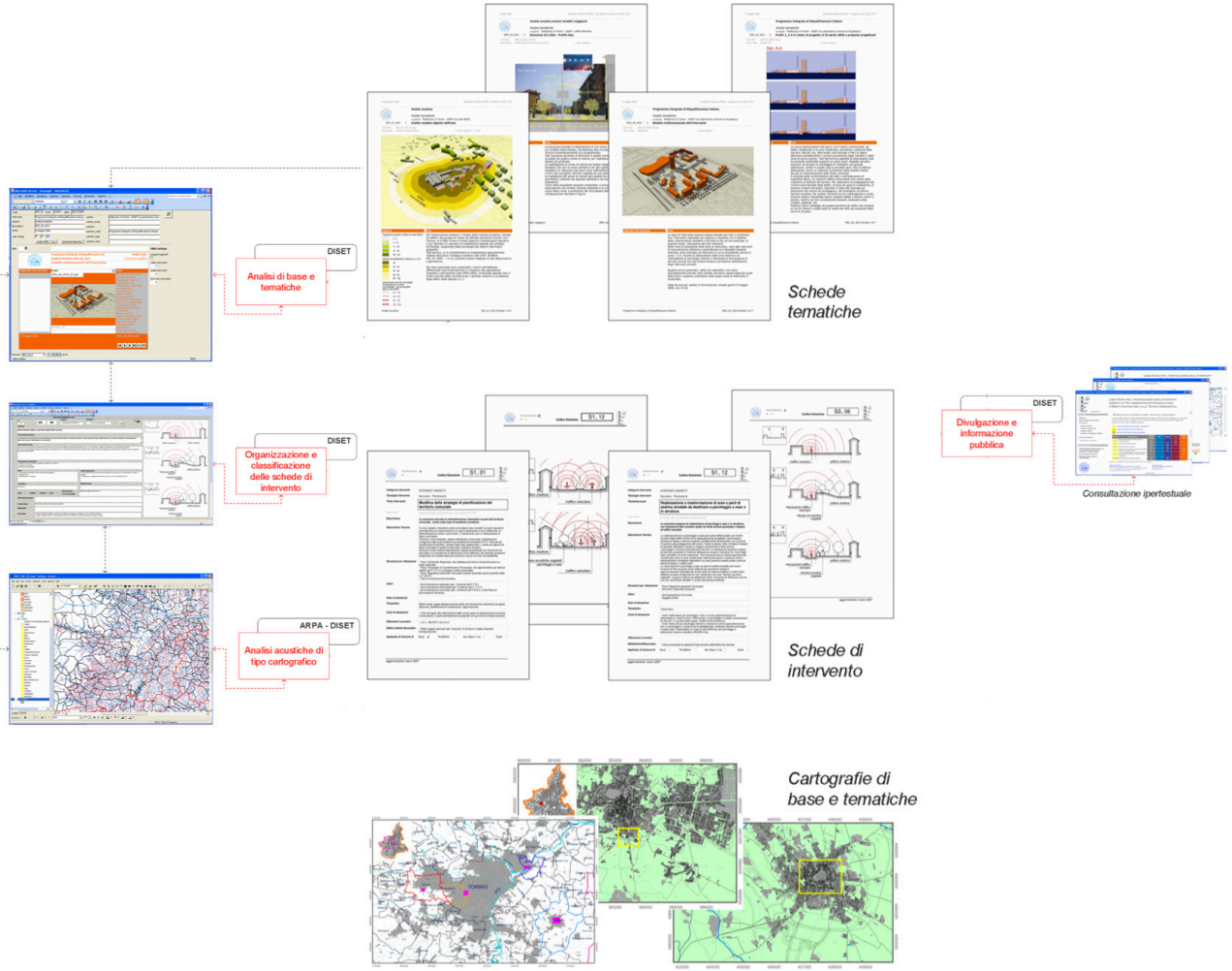


Fig. 10. Elaborations and results of the PRAC research, the information and computer system [Novello et al. 2007].



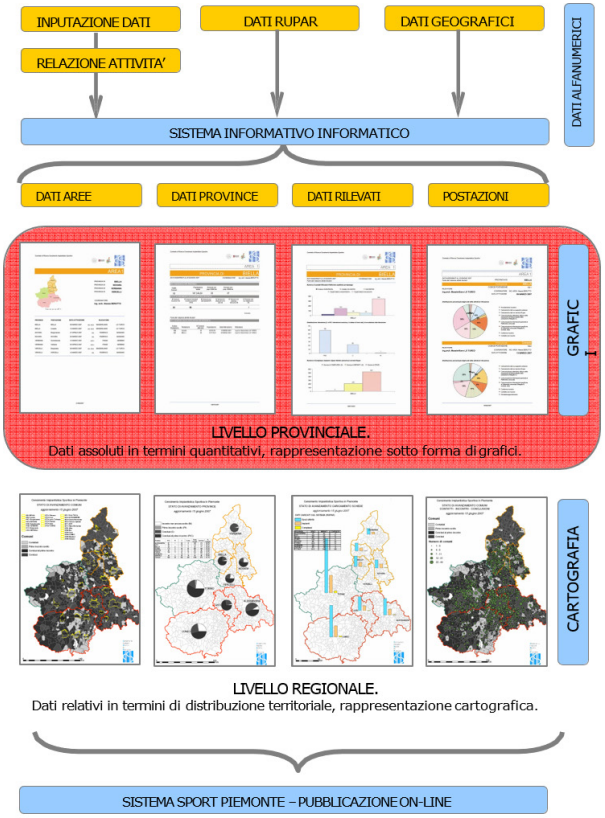


Fig. 11. Elaborations and results of the CISP research, the information and computer system [Novello et al. 2009].

Fig. 12. A keyboard "under the blanket of the territory" is the suggestion of the painter and draughtsman Tullio Pericoli.

Authors

Giuseppa Novello, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, pina.novello@polito.it
Maurizio Marco Bocconcino, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, maurizio.bocconcino@polito.it

Reference List

Baculo, A. (1992). *Napoli in Assonometria*. Napoli: Electa Napoli.

Bocconcino, M.M. (2004). *Rappresentazione e sistemi informativi: il supporto dell'informatica per il Disegno e il Rilievo ai fini della tutela del territorio e dell'ambiente. Il caso della valutazione ambientale strategica del piano degli interventi per i XX Giochi Olimpici Invernali Torino 2006*. Tesi di dottorato di ricerca in Disegno e rilievo per la tutela del patrimonio edilizio e territoriale, tutor prof.ssa G. Novello. Politecnico di Torino.

Boido, M.C. (1998). *Il disegno urbano di Alessandria: le mura dopo le mura. La persistenza del segno della cinta muraria e delle porte della città nell'Ottocento fra rilievo e progetto*. Tesi di dottorato di ricerca in Disegno e rilievo del patrimonio edilizio, tutor, prof.ssa G. Novello, prof. S. Coppo, Università degli Studi di Roma "La Sapienza".

Centofanti, M., Brusaporci, S. (a cura di). (2016). *Sistemi informativi integrati per la tutela la conservazione e la valorizzazione del patrimonio architettonico e urbano*. Roma: Gangemi Editore.

Comoli, V., Very, F., Fasoli, V. (a cura di). (1997). *Le Alpi: storia e prospettive di un territorio di frontiera*. Torino: Celid.

Coppo, S. Davico, P. (a cura di). (2001). Il disegno dei portici a Torino. Architettura e immagine urbana dei percorsi coperti da Vitozzi a Piacentini. Torino: Celid.

Coppo, S. Osello, A. (a cura di). (2006). *Il disegno di luoghi e mercati a Torino*. Torino: Celid.

De Rossi, A., Durbiano, G. (2006). *Torino 1980-2011. La trasformazione e le sue immagini*. Torino: Umberto Allemandi & C. Editore.

Novello, G., Coppo, S. (1984). Un'esperienza di rilievo per il recupero di un tessuto urbano storico minore: il borgo di Madonna del Pilone. In *Quaderno del Dipartimento di Ingegneria dei sistemi edilizi e territoriali del Politecnico di Torino*, n. 9. Torino: Levrotto & Bella.

Novello, G. (1999). Rilievi come sistemi complessi di informazioni Progetti di integrazione per indagini analitiche e sintesi rappresentative. In AAVV. *Borgo Po 1999 Un'esperienza di rilievo della trasformazione*, pp. 85-104. Torino: Levrotto & Bella.

Novello, G., Bocconcino, M.M., Boffa Tarlatta, E. (2003). I sistemi informativi, le tecniche della rappresentazione e la questione della qualità ambientale. In *Tools and Methods evolution in Engineering Design. Atti della XIII ADM – XV INGEGRAF International Conference*. Napoli: Università degli studi di Napoli "Federico II" – Facoltà di Ingegneria.

Novello, G. (2007). Oltre la superficie: le opere ipogee come occasione per parlare della progettazione e delle sue. In P. Boltri. (a cura di). *Sui Codici del disegno di progetto*, pp. 177-186. Milano: Cusl.

Novello, G. et al. (2007). *Linee guida per l'individuazione degli interventi indiretti di tipo amministrativo – pianificatorio e diretti riconducibili alla tecnica urbanistica per i Piani di Risanamento Acustico Comunale*. Torino: Politecnico di Torino.

Novello, G. et al. (2009). *Il censimento dell'impiantistica sportiva piemontese. Metodi, strumenti ed esiti*. Torino: Regione Piemonte Direzione Cultura, Turismo e Sport.

Novello, G. (2016). Una ricerca continua: il Disegno come passione condivisa/A continuous research: Drawing as a shared passion. In P. Chiás, V. Cardone (Dirs) *Dibujo y arquitectura. 1986-2016, treinta años de investigación/Disegno e architettura. 1986-2016, trent'anni di ricerca/ Drawing and Architecture. 1986-2016, Thirty Years of Research*, pp. 280-291. Alcalá de Henares: Servicio de Publicaciones de la Universidad de Alcalá.

Istituto di Architettura Tecnica del Politecnico di Torino (1968). Forma urbana ed architettura nella Torino barocca: dalle premesse classiche alle conclusioni neoclassiche, a cura di A. Cavallari Murat. Torino: UTET.

Istituto di Architettura Tecnica del Politecnico di Torino (1975). Tessuti urbani in Alba. Alba: Città di Alba.

Politecnico di Torino. Dipartimento Casa Città (1984). Beni culturali ambientali nel Comune di Torino. Torino: Società degli Ingegneri e degli Architetti in Torino.

Scarzella, G.P. (1997). Catasti storici e territorio. In V. Comoli, F. Very, V. Fasoli (a cura di). *Le Alpi: storia e prospettive di un territorio di frontiera*. Torino: Celid.

Tarditi, S. (1996). *I ponti sul fiume Tanaro nel territorio della provincia di Cuneo interessati dall'evento alluvionale del novembre 1994 – Principali eventi alluvionali nel bacino del Po dalla metà del secolo XIX al 1994*. Tesi di laurea, relatori prof.ssa G. Novello, prof. G. Mancini. Politecnico di Torino.

La representación de la mirada paisajista sobre el territorio

Fernando Linares García

Resumen

El paisaje es un concepto cultural que implica cierto grado de transformación a lo largo del tiempo. La mirada paisajista conforma la memoria, la huella de los seres humanos sobre el territorio, permitiendo activar el recuerdo de cuantos por allí pasaron; es la visión de la naturaleza alterada por el hombre en el curso de la historia. Vemos lo que somos capaces de reconocer. Representar un paisaje requiere de un adiestramiento para poder entenderlo, de un aprendizaje previo. En occidente esa escuela la ha proporcionado la pintura. Para que disfrutemos hoy de la visión de un panorama ha sido necesario que múltiples artistas vertieran sobre él sus conocimientos y sentimientos, es decir, que lo contemplaran, pensaran y construyeran como una obra de arte. Este texto resume el progreso de la mirada paisajística y su representación en la búsqueda estética del paisaje autónomo, principalmente, durante el paso del simbolismo renacentista del siglo XV al naturalismo holandés del XVII; fijando su atención en la evolución y el cambio de función de los fondos pictóricos, a partir de su interrelación con las figuras e imágenes protagonistas de los primeros planos.

Palabras clave: mirada paisajista, representación del territorio, fondo, paisaje, Historia del Arte.

Introducción

Hablar de paisaje no es lo mismo que hablar de naturaleza. El paisaje no es solo el territorio físico que nos rodea, es algo más, una «construcción mental» [Maderuelo 1997, p. 5]: una relación subjetiva que se establece entre el hombre y su medio natural a través de la mirada; una visión que proyecta un sentimiento emocional sobre el lugar, su *genius loci*. Paisaje no es solo lo que existe, lo que está delante de nosotros, el paraje; no es simplemente lo que se ve, es lo que se percibe. Y percibir es una manera de proyectarse sobre nuestra realidad, interpretándola afectivamente y transformando lo experimentado en un objeto estético; «artealizándolo» [Roger 2007, p. 13] *in vis*u e intensificando lo percibido [1].

La naturaleza se hace bella a nuestros ojos por mediación del arte, el cual, a través de su necesidad de imitación y representación, nos ha enseñado a valorarla más allá de lo físico, idealizándola y contribuyendo a configurar el concepto de paisaje. Siempre debe existir una "ligazón" entre los elementos contemplados. Ese nexo no es solo material, es más profundo. Existe paisaje cuando aparece una comprensión sensible, subjetiva y poética; en resumen, plástica; una suerte de estado de ánimo necesario para contemplar la realidad visual.

La palabra "paisaje" explica la presencia del hombre sobre el territorio, pues «lleva los signos de la antropización de la tierra» [Milani 2015, p. 38]. Es un concepto cambiante, una noción comodín ligada a la evolución de la pintura a partir de los descubrimientos científicos del Renacimiento y de la experiencia estética del viaje. Fal-

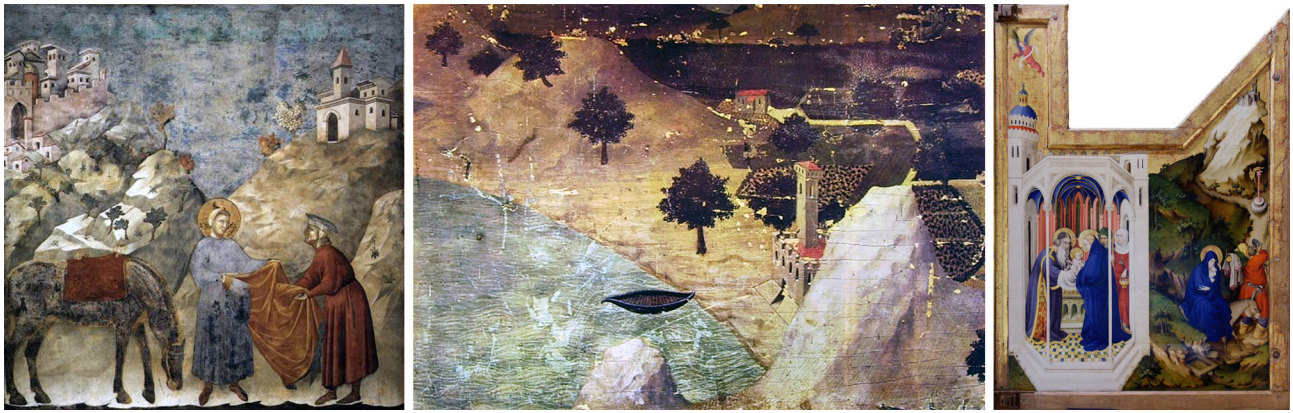
samente se cree que es una idea universal y atemporal. No se puede pensar que todo ser humano goza de la belleza de los paisajes y que toda naturaleza tiene que ser bella. Si la naturaleza se convierte en algo agradable depende más de cómo la miramos que de la observación en sí misma.

Evolución de la mirada paisajista: antecedentes

Aún cuando los griegos vivían inmersos en el medio físico, su cultura estuvo muy poco interesada por la contemplación de la naturaleza. Esto choca con su admirable criterio para elegir el emplazamiento de sus templos. Desde nuestra cultura, maravillada con la visión desde estos lugares, nos parece que en esa elección ha influido una mirada paisajista aconsejada desde la delectación visual.
Vitrubio y Plinio escribieron sobre tratados griegos que describían los ritos de la localización en función siempre de la salubridad y la adecuación, sin hacer la menor referencia a la amenidad de las vistas. Así, templo y territorio formaron un todo perceptivo. El lugar se sacralizaba y su valor trascendía más allá de lo físico. De la contemplación religiosa a la estética, al mero deleite perceptivo, hay un camino muy corto. Epicúreo, divulgador de la vida contemplativa, introdujo en Roma el disfrute del placer proporcionado por los sentidos como valor ético.

Los romanos desarrollaron una tímida pintura figurativa de lugares. Muchos patricios disfrutaron de una vida campestre relajada pues, aún viviendo en Roma, se podían permitir largas temporadas en sus villas practicando el *otium* contemplativo. Incluso generaron términos cercanos al paisaje, como *topia* –motivo pictórico de carácter decorativo–, del que son buen ejemplo algunos frescos de las casas pompeyanas, pioneros del paisaje en el arte. Plinio, el Joven, elaboró también algunas detalladas descripciones de lugares con suma afectación, mencionando a un artista llamado Studius como «paisajista» que se ganaba la vida realizando pinturas murales [2] [Gombrich 2000, p. 113]. Aún así, no lograron destilar una sola palabra para definirlo.
Quizá, Roma hubiera desarrollado plenamente la mirada paisajista de no haber sido por el advenimiento del cristianismo, profesado en origen mayoritariamente por esclavos que no entendían las improductivas costumbres epicúreas de sus amos "paganos", permutando el interés de la mirada, del exterior mundano al interior espiritual. En el siglo V, San Agustín se interesó por las artes, rechazando cualquier conocimiento adquirido por vía sensorial: «viajan los hombres para admirar la naturaleza y se olvidan de sí mismos», afirmó. Isidoro de Sevilla, en el siglo VII, al igual que antes Platón, calificó la pintura de mentira. El Concilio de Tours del año 813 mostró ya esa actitud iconoclasta y condenatoria de lo terrenal por co-

Fig. 1. Izda.: Giotto, La donación de la capa (ca.1296); fresco (270 x 230 cm); Basílica de San Francisco en Asís. Centro: Ambrogio Lorenzetti, Castillo al borde del lago (ca.1320); óleo (70 x 48 cm); Pinacoteca Nacional de Siena. Dcha.: Melchior Broederlam, La Huida a Egipto (1398); témpera sobre madera (167 x 130 cm); Museo de Bellas Artes, Dijon.



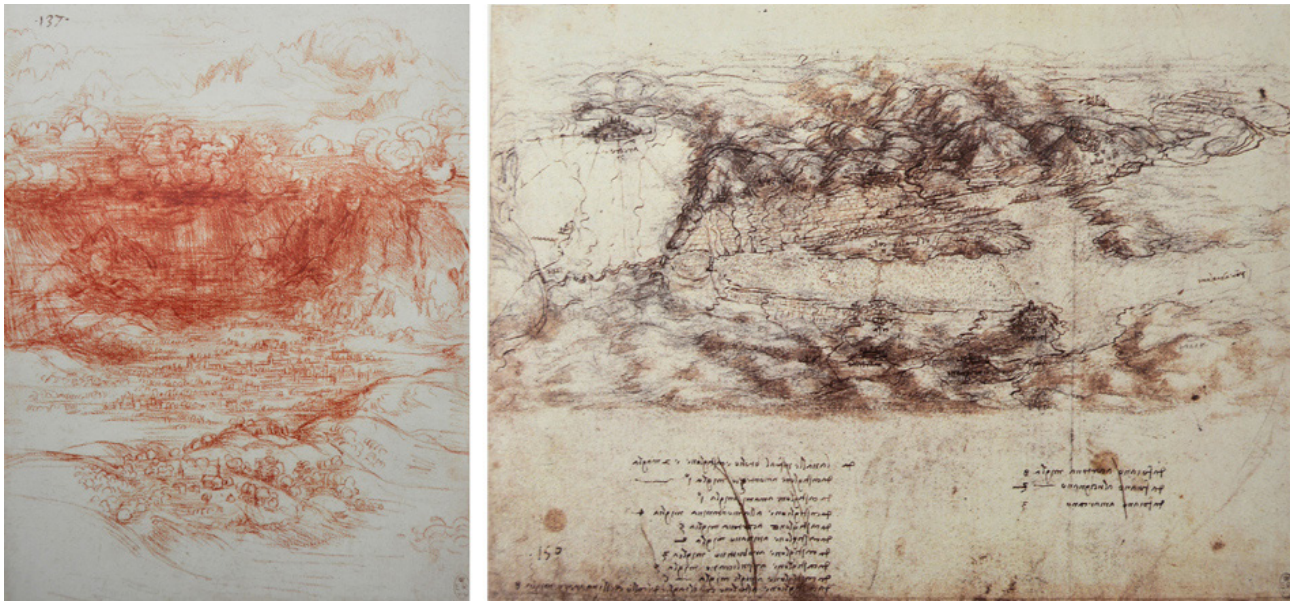


Fig. 2. Izda.: Leonardo, Tormenta en un valle (ca. 1506); sanguina (20 x 15 cm); Castillo de Windsor, Biblioteca Real, Berkshire (RL 1240gr). Dcha.: Leonardo, Vista de Arezzo (ca. 1502); pluma y tinta sobre lápiz negro (20,9 x 28,1 cm); Castillo de Windsor, Biblioteca Real, Berkshire (RL 12682r).

rromper al hombre, reflejando un sentimiento contrario a la representación de imágenes y el abandono de la imitación naturalista. Así, el arte medieval no persiguió la copia; fue un arte de símbolos que solo necesitaba de unos simples esquemas figurativos para hacerse comprender. Por fin, en el siglo XII, San Francisco de Asís se regocija en las sensaciones provenientes de la vista diciendo que «revelaban la belleza de la creación divina».

El prepaisaje simbólico renacentista

Hubo que esperar todavía hasta el Renacimiento para que se desarrollara una auténtica mirada paisajista a través del razonamiento deductivo y con apoyo de la perspectiva. Los pintores renacentistas buscaron en la Antigüedad una orientación para los problemas de la representación naturalista. Las imágenes comenzaron a ser más verosímiles que simbólicas, presentando mayor atención a los fenómenos cromáticos y lumínicos para acentuar la volumetría de los cuerpos y la profundidad de la escena. Tímidamente, rompiendo el hieratismo medieval, a finales del siglo XIII, Giotto abandonó los modelos bizantinos sustituyendo los fondos dorados de las pinturas sacras por escenarios naturales; *La donación de la capa* (ca. 1296) constituyó uno de los primeros intentos de plasmar un paisaje particular con cierta sensación de realidad –sus montes aparentan formas concretas–. Lo mismo sucedía en obras de Duccio o Simone Martini. Aunque eran pinturas simples, donde un árbol representaba un bosque, o una roca, una montaña, superaban de largo las básicas iconografías medievales.

Así, Ambrogio Lorenzetti consiguió una de las primeras visiones paisajistas del arte occidental; su *Castillo al borde del lago* (ca. 1320), ejecutado de un modo intuitivo muy próximo a la axonometría caballera, sin figuras, testimonia una pionera «voluntad de laicizar la mirada» [Roger 2007, p. 73]. Melchior Broederlam en La *Huida a Egipto* (1398) representó emblemáticamente dicho reino como una sencilla ciudadela situada sobre un retorcido monte,

Fig. 3. Sup. izda.: Robert Campin, Madonna con la pantalla de mimbre (ca.1430); óleo al temple sobretabla (63,4 x 48,5 cm); National Gallery, Londres (Reino Unido). Sup. dcha.: detalle. Inf.: Jan van Eyck, Virgen del canciller Rolin (ca.1433); óleo sobre tabla (66 x 62 cm); Museo del Louvre, París.

donde las figuras humanas son más altas que los árboles. Estos artistas no realizaban paisajes en el sentido profundo del término, los representaban alegóricamente a través de elementos emblemáticos, como si de metáforas simbólicas se tratara. Según la Iglesia, cualquier detalle superfluo o fantástico era engañoso e impedía un apropiado entendimiento de las Sagradas Escrituras. Con la visión naturalista y el control de la perspectiva estos signos se irán desprendiendo de la escena (fig. 1).

La representación de los fondos paisajísticos se consideraba una frivolidad, un simple deleite decorativo. Los más cultos se recreaban en la contemplación de historias bíblicas, entendiendo estos "lejos" como meras recetas técnicas. Era imposible encontrar un paraje o un elemento reconocible en ellos. A los pintores renacentistas no les interesó la representación fiel de los lugares. Sus pinturas pretendían cumplir una función catequética: describir y ayudar a comprender los episodios de la vida de Jesús y los santos mediante la visualización de escenas idealizables, sugestivas y detalladas, pero sin identificarlas con nada real, pues se vulgarizaría el tema.

Leonardo afirmaba en sus tratados que el arte del pintor no consistía en imitar la realidad, sino en la capacidad de proyectar ideas y componer historias –*ékphrasis*–; sus notas rebosaban de referencias al paisajismo y a los fenómenos naturales. Nada era lo que aparentaba. Sirva de ejemplo su boceto *Tormenta en un valle* (ca. 1506), en el que se reconocía en vista aérea el paisaje de una vega con casas y un monte; aunque el artista nunca pintó cuadro alguno con este fondo. El dibujo era en realidad un apunte fenomenológico, un estudio subjetivo de cómo se forman y descargan las nubes sobre un territorio. O su *Vista de Arezzo* (ca. 1502), donde se identifica el valle de Chiana, no era en realidad un paisaje, sino una representación topográfica con un alto horizonte cuya verdadera finalidad era proyectar el trazado de una presa. La mayoría de pinturas "sin asunto" del siglo XVI no es que carecieran de tema, es que hoy en día no somos capaces de reconocer sus alegorías o verdaderas intenciones (fig. 2).

Fue el Maestro de Boucicaut, a principios del siglo XV, quien descubrió los efectos perceptivos de la profundidad al observar que «los objetos perdían parte de su sustancia y de su color, desvaneciéndose sus contornos en la lejanía» [3] [Panofsky 1998, p. 63]; esto mejoró el tratamiento de los fondos. Por aquel entonces, Robert Campin revolucionó la pintura rompiendo lateralmente la visión del "espacio-caja" renacentista; en *Madonna con la pantalla de mimbre* (ca. 1430) horadó el cubo escénico en el que se inscribía la es-

cena mediante una ventana lateral que mostraba el exterior y generaba el efecto de un cuadro dentro de otro cuadro, como un auténtico paisaje en sí mismo. Poco después, el detallista Jan van Eyck superó el artificio en la *Virgen del canciller Rolin* (ca. 1433), abriendo la visión por el fondo. Esta visualización indirecta permitió, aún reduciendo el tamaño del panorama, aislar la representación del territorio e introducir el paisaje en el Arte «por la puerta pequeña, o, mejor dicho, por la ventana pequeña», como apuntó Roger [Roger 2007, p. 83] (fig. 3).

En 1444 el pintor suizo Konrad Witz realizó *La pesca milagrosa*, donde representó un pasaje del Evangelio de Juan: el encuentro de San Pedro con Cristo a su resurrección, en la orilla del lago Tiberiades. Según Gombrich, este fue el «primer retrato de un paisaje auténtico que jamás se haya intentado» [Gombrich 2002, p. 255], pues aunque no mostró el lago original, sí el que realmente conocía, el existente en Ginebra. Witz "popularizó" la escena sustituyendo ficticiamente un paraje ideal por otro real; por ello, no puede considerarse como un paisaje estricto, sino una «pieza indiscutible de topografía» [Clark 1971, p. 37]. Algo similar sucedió con la *Piedad* de Fernando Gallego (1470), donde se representó Jerusalén con formas goticistas, como cualquier ciudad medieval conocida; con sentido funcional y no realista.

Los artistas no inventaban nada que ellos ni los fieles no hubieran visto antes. Con el empleo de la perspectiva y las nuevas técnicas pictóricas mejoraban el figurativismo de las escenas para hacer más creíble la historia, pero no se arriesgaban a ser incomprendidos.

Así, Giovanni Bellini en *La Oración en el Huerto* (1459) concentró su esfuerzo en la percepción realista de la profundidad simulando «la pérdida de agudeza visual con la distancia» [Maderuelo 2005, p. 232]; para ello, suavizó los contornos de las montañas de Jerusalén e iluminó el cielo desde el horizonte creando un efecto crepuscular, idealizando y sublimando el desierto. A Perugino también le gustaba aplacar los contrastes progresivamente acentuando la lejanía; además de ser un gran constructor de vastos espacios (fig. 4).

Aceptación del paisaje: los fondos toman protagonismo

Los pintores intuían que el lugar, además de servir de base para la escena, podía ser la escena en sí misma, consiguiendo cada vez, a partir de la observación em-

Fig. 4. Sup.: Konrad Witz, La pesca milagrosa (1444); temple sobre tabla (13,2 x 15,4 cm); Museo de Arte de Ginebra.
Inf.: Giovanni Bellini, La Oración en el Huerto (1459); temple sobre tabla (81 x 127 cm); National Gallery, Londres.

pírica de la naturaleza y sus fenómenos, un mayor grado de realismo. Los fondos acabaron engullendo el primer plano. El mensaje residía ahora en lo que la vista podía captar. Aunque todavía se primaba la pintura de historia, poco a poco, el paisaje comenzaba a aflorar. Mientras, los personajes de las escenas religiosas mermaban hasta prácticamente desaparecer o se veían simbolizados por los elementos del paisaje. Pasada la primera mitad del siglo XVI, el paisaje se convirtió en un tema aceptado y se extendió a la casi totalidad del cuadro.

Otro talento con voluntad paisajista fue Giorgione. Su *Tempestad* (ca. 1508) está considerada como un hito paisajístico por la historiografía, siendo en verdad «indescifrable porque carece de tema» [Maderuelo 2005, p. 235]. Cual fantasía autónoma, parece pintada sin pretensión narrativa alguna, como por libre contemplación del artista, considerándolo por ello el primer pintor moderno.

Fig. 5. Giorgione, Tempestad (ca. 1508); óleo sobre lienzo (82 x 73 cm); Galería de la Academia, Venecia.

Por ser un enigma se la ha calificado de "protopaisaje" con figuras. No se trata de un mero fondo ampliado: la escena aparece bajo una atmósfera homogénea, siguiendo las directrices venecianas del momento basadas en la delicadeza del color y el estudio tonal de la luz; además, las figuras no ocupan una posición central a la manera clásica, están dispuestas como elementos propios de la composición general. Giorgione murió prematuramente sin concluir su camino hacia el paisaje puro; y la Contrarreforma, con su vuelta al orden y su oposición a todas las conquistas del humanismo, incluyendo los descubrimientos perceptivos del mundo [4], impidió culminarlo también a sus seguidores (fig. 5).

Una figura clave fue Durero, «cuyo genio inauguró la moderna valoración estética del paisaje» [Milani 2005, p. 21]. El alemán tenía un afán insaciable de conocimientos, capaz de absorber cualquier técnica o idea, lo que le indujo a pintar siempre con gran detalle. Por costumbre, durante sus viajes registraba en su cuaderno *–mein Büchlein–* escenas cotidianas, lugares reales carentes de figuras; «nunca se habían realizado con tal economía de medios, de forma tan vigorosa, vistas topográficas tan exactas y manteniendo el carácter de lo que se ve» [Roger 2007, p. 84]. Se conservan un millar de sus dibujos; algunos de ellos, por su sentido panorámico y descriptivo, podrían pasar por paisajes si no se hubieran reutilizado como fondos preparatorios de grabados, como su acuarela *Casa junto al estanque* (ca.1496) que muestra un sereno paraje real sin otro motivo aparente que retener un instante especial [5]. Ahora bien, ejecutando el apunte *El puerto de Amberes* (1520) le sucedió algo inesperado: el artista levantó la mano dejándolo inacabado. No lo hizo por falta de tiempo, sino por haber colmatado su mirada estética; según Panofsky, «le satisfizo tal como estaba» [1982, p. 228]. Es en este deseo de delectación donde se encuentra el verdadero sentido del paisaje (fig. 6).

Las escenas pictóricas se fueron transformando en un mero pretexto para representar paisajes. El flamenco Joachim Patinir fue autor de numerosas visiones paisajistas [6] donde minimizó en extremo el tamaño y la importancia de las figuras. Todas sus composiciones son escenas religiosas cuyos personajes se ven dispersos sobre el territorio. En ellas predomina una altísima línea de horizonte. En Paisaje con *San Jerónimo* (1517) el protagonista parece relegado en una esquina del cuadro ante la vastedad del panorama; y en *El Éxtasis de Santa María Magdalena* (ca. 1515) miniaturizó tanto a la santa que

prácticamente la ocultó. Sus vistas combinaban un minucioso detalle naturalista con la fantasía lírica, cobrando un extraordinario protagonismo la profundidad. La naturaleza a vista de pájaro se muestra como espejo simbólico del orden divino. Su uso del color por "enfriamiento progresivo" de los tonos, le ayudó a acentuar la sensación de distancia sobre los grandes espacios: desde los cálidos ocres en los primeros planos, pasando por los verdes, hasta los fríos y lejanos azules. Formado en esta misma tradición, incidiendo en el reduccionismo de las figuras, Herri met de Bles trabajó también visiones rocosas con puntos de vista elevados, perfeccionando la profundidad y los efectos atmosféricos.

Los experimentos perceptivos se sucedían. Pieter Brueghel en *Caída de Ícaro* (1558) contrastó el tamaño de las dos figuras del primer término para acentuar la profundidad visual. Aquí el protagonista desaparece de la escena –asoma levemente los pies del agua–. Carente de iconografía a los ojos actuales, esta pintura reveló una voluntad paisajista, no porque se vea el mar y las montañas, sino por el esfuerzo de mostrar un panorama "inventado", elevando la visión sobre el acantilado para seducirnos con el tratamiento de la distancia. Brueghel aportó a las pinturas sus conocimientos geográficos; pudo ser el primero en dotar de autonomía al paisaje, pero su naturalismo y predisposición a plasmar caracteres humanos pudieron más que su facultad de representar territorios imaginarios. También desaparecieron los personajes en los dibujos de Albrecht Altdorfer o Lucas Cranach, que realizaron vistas fabuladas de grandes extensiones con detalles miniaturistas; aunque dotados de mirada paisajista, sus trabajos no pueden considerarse auténticos paisajes por ser ensayos para obras narrativas (fig. 7).

A las vistas del natural se las denominó «paisajes de hechos» [Clark 1971, p. 33] para diferenciarlas de las fantasías o paisajes "de invención", tipo El Bosco; composiciones ideadas para recrear episodios bíblicos o mitológicos, pero perfectamente verosímiles por su tratamiento, entre las que destacaron la calidad de los estudios atmosféricos del alemán Adam Elsheimer o el realismo de los bosques frondosos del flamenco Gillis van Coninxloo [7]. Un caso enigmático de visión paisajista en el límite entre fantasía y realidad lo representó la vista de Toledo de El Greco, ejecutada aproximadamente en 1610; una interpretación dramática, sin figuras, en la que el artista deformó a su antojo la perspectiva de la ciudad. Su subjetividad induciría futuras visiones expresionistas (fig. 8).

Fig. 6. Sup. izda.: Alberto Durero, Casa junto al estanque (ca. 1496); acuarela (21 x 23 cm); British Museum, Londres. Sup.dcha.: Durero, Virgen del mono (1498); grabado calcográfico (19 x 12,3 cm); Albertina, Viena. Inf.: Durero, El puerto de Amberes (1520); pluma y tinta (21,3 x 28,8); Albertina, Viena.

Fig. 7. Sup. izda.: Joachim Patinir, Paisaje con San Jerónimo (1517); óleo sobre tabla (74 x 91 cm); Museo del Prado, Madrid. Sup. dcha.: Patinir, El Éxtasis de Santa María Magdalena (ca.1515); óleo sobre tabla; (26,2 x 36 cm); Kunsthaus Zurich. Inf. izda.: Herri met de Bles, Paisaje con el destierro de Hagar (ca.1540); óleo sobre tabla (23 x 35 cm); Bonnefantenmuseum, Maastricht. Inf. dcha.: Pieter Brueghel, Caída de Ícaro 1558; óleo (83 x 114 cm); Museos Reales de Bellas Artes, Bruselas.

La colmatación del paisaje en los Países Bajos

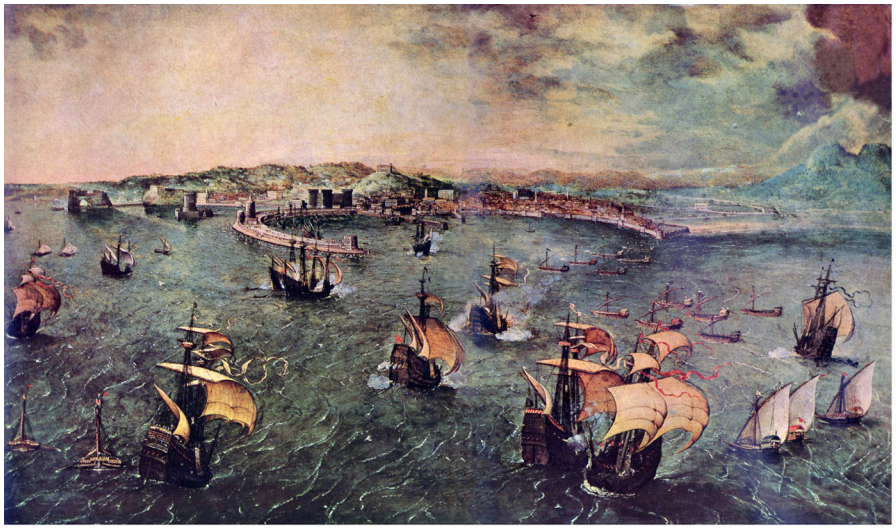
La visión paisajista del Renacimiento resultó ser más simbólica que perceptiva. Según Gombrich, «los paisajes del siglo XVI no eran "vistas" sino sobre todo acumulaciones de rasgos individuales; eran conceptuales más que visuales» [Gombrich 2000, pp. 116]. La materialización del paisaje deviene de la paganización del arte, cristalizando en los Países Bajos durante la guerra religiosa de los Ochenta años. Durante ese periodo, los calvinistas holandeses reaccionaron al lujo católico prescindiendo de sus imágenes y dictaminando que lo único que podía ser representado era la realidad percibida por la vista. La reactivación de la mirada paisajista retomó con el nacimiento del ocio burgués como actividad de disfrute intelectual. En el siglo XVII, una vez ganada su independencia, Holanda se convirtió en el país con la renta *per cápita* más alta.
Surgió así un coleccionismo de objetos artísticos como distracción; una nueva afición que apreciaba las obras más por sus valores estéticos que por su función o asunto.
Los pintores nórdicos buscaron nuevos clientes entre la sociedad, explorando otros caminos de carácter más laico con temas sencillos y cotidianos, especializándose en retratos, bodegones y paisajes [8]. Ya no trabajaban por encargo directo, sino para un mercado anónimo, con la esperanza de que sus pinturas pudieran gozar del favor del público. Principalmente, se promovía la afición por las vistas de sus ciudades y territorios como bien decorativo, fomentando el orgullo nacional: «No hay casa de zapatero remendón sin un paisaje alemán», afirmaba Vasari [Gombrich 2000, p. 110]. Se vendieron más de cinco millones de cuadros pintados. El precio se establecía en función de las horas de ejecución. Ser artista en Holanda era simplemente un oficio, no una vocación.
Los descubrimientos geográficos impulsaron el desarrollo de la cartografía para documentar los nuevos territorios. Las primeras expresiones gráficas de lugares reales tuvieron una utilidad práctica, además de un sentido artístico innegable. Surgieron nuevos tipos de representación con un alto grado de abstracción, como los mapas, complementándolos con las vistas topográficas. Se necesitaba entender el territorio desde el cielo, mezclando para ello el conocimiento técnico con la ilusión pictórica. Estas vistas decoraban la mayoría de casas holandesas. Muchos artistas trabajaron previamente como cartógrafos o topógrafos, como Augustin Hirschvogel o Hanns Lautensack.

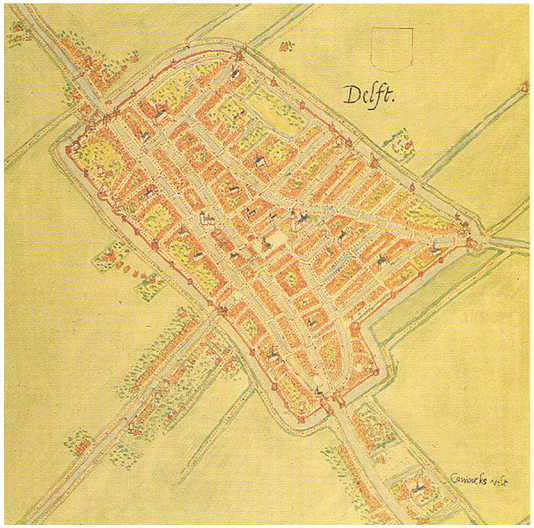
Fig. 8. El Greco, Vista de Toledo (ca.1610); óleo (121 x 109 cm); Museo Metropolitano de Arte, Nueva York.

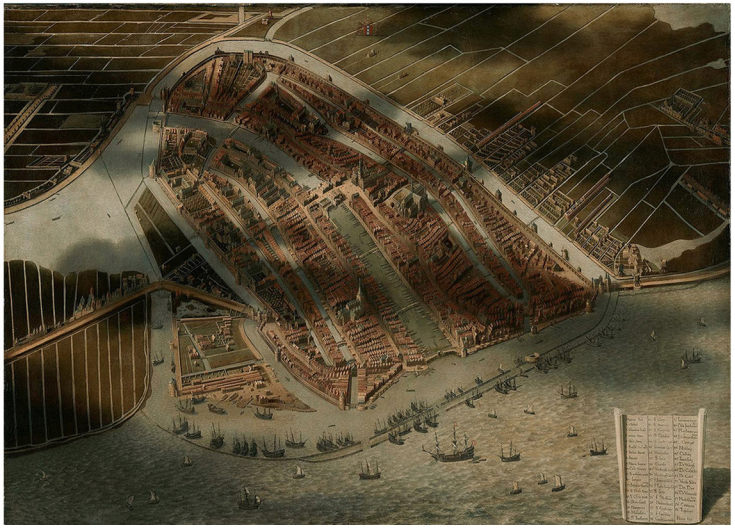
En 1572, mientras Joris Hoefnagel publicaba su famosa colección de grabados de vistas urbanas en el álbum *Civitates Orbis Terrarum*, en España Anton van den Wyngaerde realizaba de forma similar para Felipe II el levantamiento de sus principales ciudades (entre 1562 y 1570), con una gran exactitud en el detalle: 72 vistas acuareladas con suaves tonos y sin excesos pictóricos.
Curiosamente una de ellas, la *Vista de Úbeda y Baeza* (1567), no representó ninguno de los dos núcleos, sino el espacio localizado entre ellos: un panorama natural cubierto de cerros. Esta fue una sencilla descripción topográfica sin pretensiones de servir de fondo de historias; simplemente daba fe de un lugar real antropizado sin atender a lo que verdaderamente era la esencia del encargo, las ciudades. Por ello, bien podría considerarse de forma autónoma como el «primer paisaje del arte» [Quesada 2007, p. 101]; o tratarse de un simple «estudio preparatorio para una vista más detallada que nunca llegó a terminarse» [Kagan 1986, p. 261] (fig. 9).
No cabe duda de la profunda relación entre la cartografía y estas pinturas paisajistas. Un cuadro como *Batalla en la bahía de Nápoles* (1558) de Pieter Brueghel encajaría perfectamente dentro de las vistas topográficas de puertos, como se aprecia al compararlo con el Frontispicio (1595) del cartógrafo Willem Barentsz; revelando su relación con los mapas y planos urbanos: el horizonte sumamente alto y la presencia de hitos. Así, Jan Christaensz Micker pintó la *Vista de Ámsterdam* (ca.1652) en el límite entre un mapa y una pintura –si se compara con el plano de Delft de 1556–, combinando la naturaleza gráfica del primero con las cualidades realistas de la segunda: la ciudad aparece suavemente coloreada y salpicada de manchas de luz que se filtran entre las nubes. Es precisamente esa "instantaneidad" ocasional, esa mirada fugaz y subjetiva a través de un fenómeno metereológico –las sombras de las nubes sobre el suelo–, lo que convierte una precisa representación topográfica en un auténtico paisaje (fig. 10).
La vasta llanura holandesa favoreció que las vistas se extendieran hasta el horizonte. El formato de las pinturas aumentó en beneficio de la visión panorámica. Bajo influencia de Brueghel, el flamenco Hans Bol acercó más la vista topográfica a la pintura, ampliando las visuales con un gran impacto sobre la profundidad, como se aprecia en su *Vista sobre el río Scheldt* (1575). En 1603, Hendrick Goltzius dibujó *Dunas cerca de Haarlem*, considerado uno de los «primeros paisajes realmente autónomos» [Maderuelo 2005, p. 293]; una visión panorámica independiente de un terreno natural con la sencilla pretensión de mostrar lo que se veía, basándose solo en sus cualidades descriptivas. «El paisaje de Goltzius no señala el comienzo del realismo –una noción cuanto menos escurridiza– sino la trasposición de un género cartográfico a la representación del paisaje» [Alpers 1987, p. 203]. De forma similar, Rembrandt ejecutaría un número considerable de bocetos de los alrededores de Amsterdam; su vista *El campo del recaudador general* (1651) es un ejemplo del estilo topográfico holandés; aunque de escaso tamaño, fue el panorama de mayor amplitud de su obra: desde una pequeña elevación, ofrece una amplia visión de 180 grados de los alrededores de Haarlem, con unos primeros planos libres y de trazo vigoroso, donde los elementos del paisaje quedan casi reducidos a formas abstractas (fig. 11).
Ya no existía la necesidad de insertar figuras que reclamaran la atención principal. «Estos primeros paisajes holandeses carecían de las convenciones de género, es decir, los elementos que, ubicados en el primer término, enmarcaban la visión» [Maderuelo 2005, p. 296], acentuando el carácter plano de la vista, asemejándola a un

Fig. 9. Anton van den Wyngaerde, Vista de Úbeda y Baeza (1567); pluma y tinta (21 x 111 cm); Victoria and Albert Museum, Londres.

Fig. 10. Sup. izda.: Pieter Brueghel, Batalla en la bahía de Nápoles (1558); óleo sobre tabla (39,8 x 69,5 cm); Galleria Doria Pamphilj, Roma. Sup. dcha.: Wilem Barentsz, Frontispicio de su libro sobre cartas de navegación (1595); grabado en folio de atlas (42 x 32 cm); Biblioteca de la Unversidad de Yale. Inf. izda.: Jacob van Deventer, plano de Delft (1556). Inf. dcha.: Jan C. Micker, Vista de Ámsterdam (ca.1652); óleo sobre lienzo (100 x 137 cm); Amsterdam Museum.







mapa con horizonte; surgían parajes despoblados donde los elementos humanos: campanarios, molinos, granjas, etc. servían con precisión como hitos orientadores. Estas representaciones, herederas de las técnicas de la cartografía, en especial de los mapas con alto horizonte [9], no fueron utilizadas como base para reelaboraciones posteriores, por ello ya son consideradas como paisajes al uso, abriendo el género. Hay razones para justificar que surgieran de la práctica del dibujo y no de la pintura, principalmente, por la mayor idoneidad de la pluma para tomar datos *in situ*.

El horizonte elevado fue disminuyendo gradualmente para dar mayor presencia al cielo –más de dos tercios de altura–. Las vistas destacaban ya más por su creciente expresividad que por su fidelidad. Estas obras mostraban algo más que una realidad desnuda. La costumbre de componer en el estudio a partir de bocetos del lugar [10] generaba imágenes muy manipuladas y armoniosamente concebidas, fruto de las licencias propias de un artificioso «naturalismo selectivo» [Sutton 1994, p. 22]. Los detalles se redisponían para conseguir composiciones sorprendentes. Y aunque existía la necesidad de determinar algún elemento identificable, como la silueta de alguna torre o ciudad, ya no se trataba tanto de copiar la naturaleza exacta, sino de mejorarla prístinamente, permitiendo ciertas licencias creativas.

Los cuidados efectos lumínicos, junto con el tratamiento dramático de los cielos, fueron los que definitivamente alejaron el paisaje de la topografía y emanciparon como género las obras de autores como Jacob van Ruisdael, Jan van Goyen o Philips Koninck; sutiles y cálidas pinturas tonales de granjas, prados y caminos en las que no existían sucesos, tan solo algunas pequeñas figuras alegóricas al territorio con sus atuendos tradicionales mirando al paisaje [11]. Las dimensiones de los formatos se ampliaron. Empezó a crearse un paisaje más erudito,

Fig. 11. Sup.: Hendrick Goltzius, Dunas cerca de Haarlem (1603); pluma (9 x 15 cm); Museum Boijmans Van Beuningen, Rotterdam. Inf. Rembrandt, El campo del recaudador general (1651); aguafuerte (12 x 21,9 cm); British Museum, Londres.

con tonalidades más restringidas y mayor uso de la atmósfera: cielos tormentosos, brumas, ocasos,... Nada era casual. Todo dependía de una idea particular de belleza que adelantaba ya la visión romántica. «El paisaje nunca volverá a ser natural, sino sobrenatural» [Roger 2007, p. 13]; unos se inclinarían por las vistas salvajes y desoladas, otros hacia lo sosegado: las dunas, los ríos, los bosques; mostrando todos un alto grado de fidelidad formal hacia los modelos del natural (fig. 12).

Conclusiones

El arte, a través de su necesidad de imitación y representación, nos ha enseñado a observar y valorar los escenarios de la naturaleza más allá de lo físico, idealizándolos y contribuyendo a configurar la mirada paisajista. El paisaje ha sido una invención estética cambiante. Se fraguó a partir de la observación y el talento de múltiples artistas, evolucionando a lo largo de los siglos. Su representación, el "paisaje-imagen", despuntó con los avances renacentistas como el control de la perspectiva y el dominio de la profundidad, aunque no culminó con ellos. Superada la narración del arte religioso, los fondos de las pinturas se hicieron más verosímiles, restando gradualmente protagonismo a las figuras alegóricas de los primeros planos hasta, prácticamente, hacerlas desaparecer. Los parajes ideales se sustituyeron por otros reales. En menos de dos siglos, entre el XV y el XVII, el arte pasó del simbolismo narrativo a la iconicidad naturalista, aceptando al paisaje como género.

Fue en los Países Bajos donde la cartografía y la pintura se aliaron descriptivamente. Una vez superada la utilidad técnica del mapa, la pintura figurativa holandesa aumentó el conocimiento visual del mundo, convirtiéndose en sustituto del ojo, de igual manera que lo hace actualmente la fotografía. La naturaleza fue poco a poco dominada gráficamente. Los artistas flamencos añadirían al paisaje una experiencia visual creíble; «fueron revolucionarios porque sustituyeron el interés del asunto por la representación como fin en sí misma» [Sutton 1994, p. 52], como espejo de la realidad; promoviendo la idea del "arte por el arte" y evocando la expresión del lugar agradable, del *locus amoenus* que todos quisieran disfrutar. Ellos ofrecieron la primera versión moderna del campo, convirtiendo la tierra en un lugar de esparcimiento mental a través de una sublimada visión estética.

Y en esa valoración sentimental del territorio, en la frontera entre la realidad vista y la representada, entre lo concreto y lo imaginado, entre naturaleza y artificio, es donde los holandeses hicieron del paisaje un asunto pictórico: «el género más revolucionario» [Gombrich 2000, p. 108]; trascendiendo la simple descripción objetiva para idealizarlo bajo una visión subyugante; presagiando su posterior triunfo como fuente de inspiración del movimiento romántico y del pintoresquismo del siglo XIX: Gainsborough, Friedrich, Turner, Constable, Corot y tantos otros.

Fig. 12. Jacob I. van Ruisdael (1647); óleo sobre tabla (34,8 x 67 cm); Museo Thyssen-Bornemisza, Madrid.

Notas

[1] Para Kepler la percepción era en sí misma un acto de representación [Alpers 1987, p. 75].

[2] Vitruvio, en su *Libro VII* (cap. 5), indica que los pasillos de las villas solían decorarse con vistas locales.

[3] Un siglo después, Leonardo todavía desmentía que un paisaje se ensombrecía en proporción a su distancia.

[4] El Concilio de Trento (1545-1563) sólo permitía representaciones religiosas ajustadas, sin apoyo de la imaginación; los fondos se ocultan con tonos oscuros para acentuar el dramatismo, prevaleciendo escenas de sufrimiento; la pintura servía de propaganda católica.

[5] Sutton insiste en la importancia de «ejecutar dibujos a partir de modelos naturales como base de futuras pinturas» [Sutton 1994, p. 20]. En los dibujos del natural predomina la visión del conjunto sobre los detalles, perdiéndose ésta al ser reelaborados.

[6] Durero lo calificó como "*der gute Landschaftmaler*" –el buen pintor de paisajes–.

[7] Al que Karel van Mander denominó en 1604 como "*landtschap maker*" –hacedor de paisajes–.

[8] Los paisajes nunca fueron del gusto de las clases altas.

[9] Velazquez en Las lanzas (1635) representó también el fondo paisajístico respecto del modo holandés, mediante una alta línea de horizonte –a un sexto de altura– con la intención de ubicar el lugar.

[10] Como se aprecia en la imagen de Adriaen van Ostade *El paisajista en su estudio* (1663).

[11] Figuras que todavía tienen que ver con los modos cartográficos, pues en los mapas aparecían personajes típicos del país; así, en el mapa del *El Arte de la Pintura* (1666) de Veermer figuran dos pescadores.

Autor

Fernando Linares García, Escuela Técnica Superior de Arquitectura, Universidad de Valladolid, flinares@arq.uva.es

Lista de referencias

Alpers, S. (1987). *El arte de describir*. Madrid: H. Blume [1ª ed. 1983].

Berque, A. (1997). El origen del paisaje. *En Revista de Occidente*, n. 189, pp. 7-22.

Clark, K. (1971). *El arte del paisaje*. Barcelona: Seix Barral [1ª ed. 1949].

Gombrich, E.H. (2000). La teoría del arte renacentista y el nacimiento del paisajismo. En *Id. Norma y forma: estudios sobre el arte del Renacimiento*, pp. 107-121. Madrid: Debate.

Gombrich, E.H. (2002). *La Historia del Arte*. Madrid: Debate [1ª ed. 1950].

Kagan, R.L. (1986). *Ciudades del siglo de oro: las vistas españolas de Anton Van de Wyngaerde*. Madrid: El Viso.

Maderuelo, J. (1997). Introducción. En *Revista de Occidente*, n. 189, pp. 5-6.

Maderuelo, J. (2005). *El paisaje. Génesis de un concepto*. Madrid: Abada.

Milani, R. (2015). *El arte del paisaje*. Madrid: Biblioteca Nueva [1ª ed. 2005].

Panofsky, E. (1982). *Vida y arte de Albert Durero*. Madrid: Alianza [1ª ed. 1943].

Panofsky, E. (1998). *Los primitivos flamencos*. Madrid: Cátedra.

Quesada, S. (2007). La memoria del paisaje. En *Aldaba*, n. 22, pp. 97-107.

Roger, A. (2007). *Breve tratado del paisaje*. Madrid: Biblioteca Nueva.

Sutton, P.C. (1994). *El Siglo de Oro del Paisaje Holandés*. Madrid: Fundación Thyssen.

Landscape Drawing and Comprehension: the Virtuous Passage of Scale in Digital Representation

Maria Elisabetta Ruggiero, Ruggero Torti

Abstract

The latest developments in digital representation and communication of architectural and environmental heritage offer an extremely diverse range of opportunities in which to experiment and implement new models of user involvement in cognitive paths. The study proposed here investigates –according to a methodology of critical reading– which are the aspects that can be considered most innovative, not only in terms of formal results but above all in terms of contents that can be expressed as a result of the use of new technologies. In particular, reference is made to the landscape drawing and to the possibility of overcoming the scale representation gap of a subject who, otherwise, is significantly affected by the limit dictated by the finite nature (or finite dimension) of paper supports. New figurative models –if you think of satellite navigators– new possibilities of relationship between different forms of expression –think about photography and synthetic design– also change the figure of the possible users of such visual narratives.
The aim of the study is therefore to arrive at a critical reading of what happens in the context of landscape representation in order to optimize the possibility of introducing unpublished scenarios and points of view.

Keywords: landscape, representation, method, communication.

Introduction

The representation of landscape is a theme of great complexity because of the multiplicity of factors that characterize it: in fact, it is a matter of graphically restoring a subject that, even when it is characterized by the presence of human works, is composed of elements that for their nature haven't a regular conformation in geometric terms and, moreover, are extremely changeable, sometimes in rather contained temporal spans, or, as in the case of an urban landscape, the stratifications of different interventions. alternated over time, make the recognition of a regular matrix rather difficult.
In many cases all this can be associated with the natural degradation and the degradation caused by the depletion of the resources used to maintain the artifice-nature or city-territory union, determining a further alteration of a state that is, in itself, already complex to be interpreted.
Nevertheless, many examples of correlation between the work of man and the landscape constitute a precious patrimony of the cultural traditions of a civilization that, however, in many cases is going towards serious cases of abandonment or of difficult accessibility.
The here presented study investigates some examples of enhancement of this heritage, made possible thanks to the potentiality introduced by the new technologies available for visual communication.

The representation of landscape: from a diachronic logic to a synchronic one

The complexity of the theme, referring to the representation of the landscape, has been tackled according to a wide range of expressive registers declined according to specific needs that have, in some cases, even invented visual languages ad hoc created, to better meet the needs of restitution of all the plurality of elements that converge into a part of landscape.
For example this happened for the thematic maps: articulated on the level of contents, synthetic and descriptive according to a logic of symbols and abstractions but, all in all, far from perceptual immediacy and for this reason, perhaps, rather complex to be understood by an non-attached interlocutor non-attached to these works.
In fact, although conceptually exhaustive, they are always of a product defined by signs and images mediated by a code being the more pushed the more the amount of contained data is [1]. Moreover, where a formal, historical, or perceptive deepening is necessary, the change of register, also referring to the change in the scale of representation, introduces a formal discontinuity evident in the representation, sometimes defining a sort of caesura with a more general reading.
Today, thanks to the technologies we have at our disposal, this forced articulation can be overcome precisely by virtue of the possibility of integrating different expressive languages among them, above all avoiding the necessary division between a scale of representation and another, which are proper to different purposes: therefore a sort of continuum in which, for example, even virtual approaches and departures determine expressive passages that, precisely as they are progressive, are almost not perceived as different languages, but as natural consequences of a "vision" that everyone can manage independently.
Today to all this there is added the possibility of integrating static and two-dimensional representations with actual narratives where multiple images, even if of a heterogeneous nature, can be composed in order to define a more articulated narration of a complex reality, such as the landscape is [2].
These apparent naturalness and immediacy in the landscape among forms of representation allow the development of informative and cognitive processes that we could define as highly inclusive, that is offering a possibility of access to visual narratives even for those who do not necessarily have a technical background.
Let's think about the use of satellite navigators or systems such as Google Maps, in which three-dimensional visions

Fig. 1. Collection of drawings for the study of Ligurian terraces. The graphic design of each drawing includes the choice of the scale of representation and consequently the level of detail achieved. The obvious limit is given by the physical size of the support and its reproducibility.

are placed side by side with planimetric, photographic and in some cases even symbolic visions, often coded also according to different interpretative logics, and yet these differences are not detected such as they are, but instead we are witnessing a fast, and now almost inherent, ability of the user to decipher the proposed image although characterized by variable graphic syntheses, often due to different programs and tools.
Therefore simplifications, even if apparent, and integrations of languages, introduced by digital technologies, determine a process of facilitation in the understanding of some forms of landscape representation. It is therefore legitimate the wish to reflect on what the potential of these new approaches can be to the representation and communication of the landscape that today we have at our disposal.
Especially in the context of what we could define as "cultured disclosure", the possibility of having this potentiality makes possible the reinterpretation –for example– of a whole mosaic of images (fig. 1) that once it was possible to consult only according to a progressive logic, while now –let's think of augmented reality– can be integrated in a mutual and simultaneous way.
In a certain sense, the expression of the research nowadays assumes a correspondence in the forms of methodological development: before the digital era the cognitive approach

took place in contiguous but still autonomous phases (such as bibliographical [3], historical, photographic researches, and then surveys with consequent graphic translations – in the different scales and in the different methods of representation) and then to return, in a sort of spiral design, to the reformulation of the overall narrative of what was acquired, today –in a different way– there is a prevailing tendency to a process of integrated type where the research sources can be found simultaneously, also thanks to the web.
Similarly some digital representation tools allow the simultaneous processing of images and models in which even the definition of material or lighting characteristics can vary, if only in the output phase, instantaneously (fig. 2) the simulators are the final expression of this process of conceptual and expressive simultaneity. Therefore the choice of more effective languages for the communication of a concept. becomes relevant, in the light of the availability of the expressive models at our disposal, Technology, programs, devices and network connections make possible a sort of expansion of the concept of the vector of images, but, however, the process of choice, of reading and critical proposition through a visual language, remains essential.
Among the most interesting declinations of recent technological development in the field of visual communication, the diffusion of personal portable screens can be taken into consideration, that is considering telephones as extensions of computers, if not the reverse. This consideration can, therefore, open the experimentation of new models of representation and narration of the landscape with tools that, in turn, require specific languages.
In this study we want to approach two case studies [4] that have in common the representation of the landscape for informative / tourist purposes: on the one hand an agricultural landscape with a very high historical, architectural and aesthetic value such as that of the Ligurians "5 Terre" [Ambroise, Frapa, Giorgis, 1993, pp.76-81], in which to articulate a tourist route, and on the other an urban landscape in which to develop a path between two polarities –The Galata Museum and the Lantern of Genoa– separated from a very complex city part that is difficult to approach. Two very distant realities for which to identify different methods and languages in relation to the different conditions of use (fig. 3).
In both cases the representation of the landscape has been therefore diversified in relation to the formal needs of each graphic project.
In the first, the one linked to the agricultural landscape, the binding element for the project is the systemization of a series of historical and technical-constructive knowledges that can be useful in understanding and consequently enhancing an important testimony of the work of anthropization of this part of the Ligurian territory [Ruggiero, 2018, pp.11-95].

Fig. 2. Synchronic representations; the two images show contextual views: the first at a diatopic level and the second at the level of graphic methods and languages. right: screenshot by bing images (March10th, 2019); left: image by NavNet 3d navigation system.

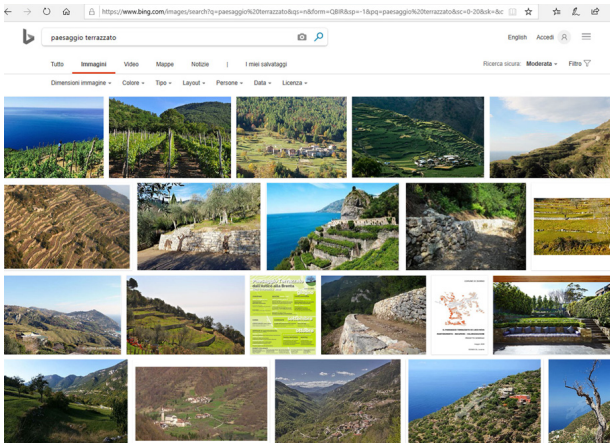


Fig. 3. Monterosso al Mare (Sp) and Genoa. Environments and characteristics of the two case studies: the differences to which the choices regarding visual communication correspond are evident.

In this case the landscape is characterized by a strong identity and a spectacularity that lends itself well to a tourist development. Furthermore, the development of the rather simple and contained urban fabric can facilitate orientation and logistics, despite some difficulties in accessing some parts of the land tissue due to the nature of the rather steep territory and with routes sometimes uneven and not safe.
Nevertheless a village, with limited vehicular traffic and mostly pedestrian, is characterized by a series of visual, auditory and more generally perceptive stimuli that favor attention towards subjects that are not very evident.
Quite different, on the other hand, is the opportunity to define a path between two polarities in an urban context characterized by a mixture of functions and visual stimuli to which a complex reality, such as the one of a commercial port, is also associated. In this case, not only the distance covered is more extensive, but it is also much more complex and difficult to manage, especially from a perceptive point of view [5].
Therefore, in both two cases, the choices have been oriented along two different lines. The first case was dealt with a communication on panels showing the route layout and some salient historical elements, with the possibility of accessing images of virtual reality, if for non-immersive, with three-dimensional model visualizations regarding non-immersive parts directly visible (such as hypogeum or dangerous structures to reach due to the pathway or access degradations); this choice was determined by the need to define selected observation positions in relation to panoramic views and safety in a context that is however steep and, in some cases, difficult to reach.

The repertoire of images to be systematized has turned above all to those that allow to enhance the historical value of some artifacts and the technical expertise necessary for their construction; in this case, in particular, the modeling of some structures has proved essential for the purpose of explaining their functioning.
In the second case, on the other hand, communication has been developed on different levels: the main objective is to identify and indicate the path to reach the historical and current symbol of the city: the Lanterna [Leoncini, Bertolucci, 2018, pp. 1-192]. The choice, therefore, fell on a paper map, where the representation of the urban net was simplified so as to facilitate the recognition of essential references, to which signage panels were placed where the language was easily identifiable in the landscape, mostly visually and acoustically compromised, where the track develops [6]. The signage, in particular, has used a graphic synthesis of the goal to be reached, represented in two colors so as to be as easily distinguishable in the context (fig. 4). It has been decided not to associate apps that indicated the route since traffic congestion and the heterogeneity of the routes makes attention to the context a priority, making up for this with fixed signs out of "scale" and therefore easily recognizable at a distance.
Nevertheless, in the vicinity of the main architectural emergencies, access to "episodes" of augmented reality has been envisaged with the aim of not distracting the interlocutor's attention, but rather to increase, if anything, the curiosity towards some intermediate points during his approach to the goal.

On this described basis we can state, therefore, that analogical and virtual models can constitute an opportunity for the development of visual languages and communications in which words, drawings and signs [Falcidieno, Giulini, 2006, pp. 11-95] are declined with articulated and integrated methods, in order also to find a renewed possibility of using image directories, only until recently destined for mere paper support.
The simultaneous nature of communications of a general nature with others of a punctual nature, in a continuous change of scale, in these two presented studies has allowed the structuring of tourist-cultural routes that otherwise would have had considerable difficulties to be an integral part of such a heterogeneous repertoire of information.

The representation of the landscape between virtual, augmented and mixed reality

The knowledge and enhancement of cultural heritage in recent years are subject to substantial changes due mainly to the now consolidated technological evolution at the service of the development of visual representation and communication techniques for architecture and environment.
The divulgation of innovative forms of use allows, in fact, to broaden the access to content through in-depth analysis and exploration of the context, capable of generating a different approach to architectural and environmental cultural assets by increasingly demanding, interested, informed users and dynamics [7]. In fact, digital is an integral part of our lives, and so the boundaries between real and virtual are narrowed in the field of visual perception.
The understanding and critical analysis of the scientific values and potential of the most recent technological and digital developments linked to virtual reality (VR), augmented (AR) and mixed (MR) [8] serving the enhancement of the architectural and landscape heritage, are the objectives to be pursued. These information technologies, in fact, not only favor the spreading of information to a wider public, but also cover the role of fundamental tools for the acquisition of a greater knowledge of the immense cultural heritage, above all thanks to the interaction and relationship methods that take place among users and context.

Fig. 4. The Lanterna of Genoa and its representations: from the 15th century to the graphic synthesis of the coordinated museum image, up to the useful interpretation of the project signage. Historical image by Hartmann Schedel's Weltchronik (Nürnberg 1493).

Fig. 5. For the valley of Buranco (Monterosso al Mare) an informational sign is proposed to which images of virtual reality are associated.

Fig. 6. For the Genoa Lantern a uniquely directional signage is proposed to which images of augmented reality are associated.

It is therefore necessary to understand the different approaches to fruition related to the use of virtual reality or the emerging augmented reality, to critically read its potential and limits with reference to the specific purpose in view. As is known, both digital realities are based on the visualization of the data in the visual field, but while in an augmented reality the information –visible only through the use of devices– overlaps reality without obscuring it if not marginally, in virtual reality an environment is recreated digitally characterized by an incredible photorealism, capable of enveloping the user within it and completely obscuring the surrounding reality [9]. Emphasizing the differences means being able to choose one or the other to optimize the pre-set result: thanks to virtual reality and augmented reality, therefore, we are able to communicate landscapes, places, paths, architectural emergencies, works of art in an alternative way and anything else that deserves to be valued.
It is of course understood that the so-called "new media", of a highly popular nature, do not replace the traditional methods of data representation and communication, but make use of them, implementing them.
Even a communication with a popular value can be an occasion for investigations and studies in which to experiment and implement new models of users' involvement in cognitive paths able to create various possibilities of relationship among different expressive forms and to introduce new scenarios and points of view; it is in this context that we want to propose the experience of two different case studies linked by the same objective, namely the visual communication of two cultural paths: the former rural, the latter a urban one.
The proposal to enhance visual communication, the subject of study for the first rural tourist itinerary, ¬ presents numerous coinciding points with the urban itinerary, despite the different contextual reality, but at the same time also significant differences: the place is the "Valle del Buranco" in Monterosso al Mare and one of the differences with the urban route is the uneven, and not always entirely possible, access to the paths.
Although they are inserted in a less dispersed and congested context –from the point of view of the project communication choices– the analysis and identification of suitable and incisive graphical-visual tools, necessarily functional and coherent with the representation of a tourist rout, included within an agricultural reality such as that examined, are substantial [10].
The adoption, therefore, of a synthetic graphic language, immediate and easy to be understood by the possible users, is manifested with the adoption of traditional communication tools alongside the contemporary multimedia and interactive instruments related to augmented and mixed reality, which are able to transmit information in places of complete safety, without lowering the attention that the users must have as for the followed path.
In this complex agricultural system, communication and disclosure of information are therefore provided through the use of information panels located along the tourist route

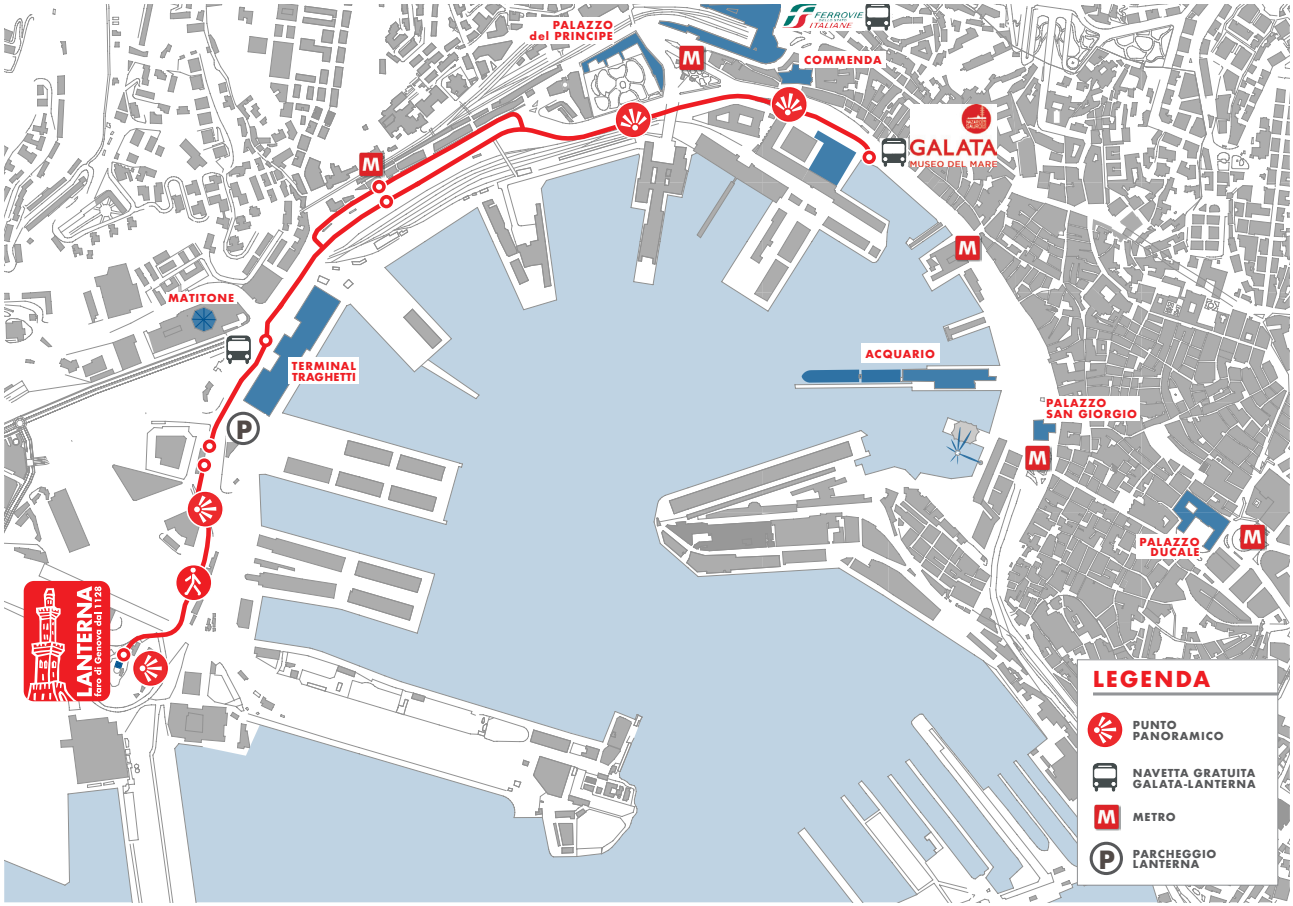


Fig. 7. Plan with the layout of the path that joins the Galata Museum with the Lantern. The main visual, logistic and narrative references, present along its development, are here highlighted, and moreover the graphic synthesis that appears in the signal panels is inserted.

and near the no longer accessible underground irrigation facilities at the service of lemon groves; the static nature of the information provided on the information panels is then accompanied by dynamic images, videos and animations in virtual and augmented reality, accessible thanks to the ever more performing devices capable of disseminating information and, by means of 3D reconstructions in virtual reality, allowing the knowledge and understanding of elements or structures that no longer exist or are inaccessible (fig. 5).

Once framed on the information panel, the trigger images such as a graphic sign, a photograph or a non-georeferenced marker [11], the device software recognizes them and, on the display, shows the overlay, that is an increased reality consisting of other images, videos, music or three-dimensional models.
The second itinerary stems from the need to connect the Galata Museo del Mare to the Lanterna of Genoa along a context marked by an advanced state of functional, architectural and semantic stratifications, therefore not purely

Fig. 8. Sequence of augmented reality images, correlated to signage panels, for the Prince's Palace in Genoa located along the access path. The communication is oriented to the description of the building in its original appearance and the fountain of Neptune.

for tourist purposes, even though it is undergoing a redevelopment phase.
The identified communication strategy has allowed the study and identification of an optimal itinerary for distance and urban quality along which a connotative graphic sign is repeated at different scales of representation: the stylization of the Lantern (fig. 6). The idea is to lead the visitor to the destination through an alternation of traditional visual communication means, such as a floor plan included in a leaflet (fig. 7), totems and signal panels alongside the AR, VR and MR technologies, commonly visible through smartphones and tablets.
Along the tourist route, in fact, it is not difficult to see architectural emergencies such as the sixteenth-century Palazzo Doria Pamphilj, known as the "Villa del Principe", a sumptuous noble residence now used as a museum near which the positioning of the signposted panels linked to the path of the Lantern is foreseen, implemented by the presence of an AR-VR symbol which, once framed with the camera of your smartphone, allows the user to be involved and interact with the artwork itself through a virtual reality tour or in augmented reality: texts, images, 3d models and sounds overlap the context and so the user is enveloped by the presence of virtual and interactive information that coexist with physical reality, thanks to an accurate localization and calibration between the real environment and virtual environment, such as to allow a perfect fusion between the two worlds and a greater diffusion of the awareness of the place and of the works of art it contains (fig. 8).

Conclusions

In conclusion, the contemporary media, thanks also to their divulging nature, cover the undisputed role of protagonists of the renewed models of representation, making use also of the consolidated previous experiences; alongside the traditional typographic tools of information representation and dissemination, there are therefore increasingly high-performance and advanced digital tools capable of spreading capillary and real-time multi-knowledge and returning lost or inaccessible realities to an ever wider and more demanding basin.
In a certain sense the right combination of a certain spectacularity given by the latest technologies, the consequent easy interpretation of languages and the integrated management with more traditional expressive registers can be occasions for the realization of inclusive processes in the cultural sphere. Finally it is considered necessary to propose a reflection on the potential and the limits in the use of some new technologies. If it is true that the fascination of communication by means of digital tools, with characters of dynamism and also of a certain spectacularity, is unquestionably easier to be approached and attractive, it is equally true that it is always necessary to evaluate the context and purpose of the use of these new technologies: that is, they are to be understood preferably as integrative – only in specific cases replacing the actual reality itself.
Not always, in fact, the distraction given by the prevalence of an access facilitation to the perception of a piece of landscape or of an architectural organism is effectively compatible with the keen observation and real understanding of a site [12].

Notes

[1] For a thorough and comprehensive critical reading of the semantic components in the representation of the landscape, refer to the text *Modelli Grafici dell'architettura e del territorio* [Cardone 2015, pp.300-311].

[2] In this regard, we highlight the reflection on the tendency, introduced by recent technologies, to have an increasingly strong correspondence between the real model and representation [Di Luggo, Zerlenga, Pascariello 2016, p. 29].

[3] The progression and consequentiality of the research phases are described in an exemplary manner by Umberto Eco in the text *Come si fa una tesi di laurea* [Eco 1977, pp. 57-75] where he emphasizes the value of a progressive cognitive and gradual pathway. Although the text predates the digital age, the considerations regarding the importance of critical analysis of sources, texts and images are perfectly up to date.

[4] The case study on the terraced agricultural landscape was the subject of research developed, first of all, by M.E. Ruggiero during the PhD thesis in Survey and Representation of Architecture and the Environment, and subsequently, by the two authors, as part of a series of seminars held on the PhD course in Architecture and Design of the Polytechnic School of the University of Genoa in 2018. A further development of these studies is currently underway in a joint research with the Leibniz Universität of Hannover entitled *Exploring responsive territories* and in the framework of a research supported with University-Unige Research Funds (2018) entitled *Visual languages and landscape identity: hypothesis of communicative models*. The study on the urban path for the Lanterna of Genoa is carried out within the framework of the research convention, of 2019, with MUMA – Institute of Museums of the Sea and Migration (Genoa), entitled *Images, communication and artistic paths for a valorization of naval culture in Genoa*, scientific director M.E. Ruggiero, operational manager R. Torti.

[5] The complexity of the factors that converge in the characterization of an urban space and the relative figurative stratifications –historical as well as potential– are the subject of the presentation by Francesca Fatta [Fatta 2014, pp.1-8].

[6] The importance of the semantic part in an urban landscape is specifically addressed in the text *City Signs*, [Falcidieno, Castellano, 2015, pp.19-44] in which the complex case study of the signage of the city of Parma is exposed.

[7] To better understand the scope and meanings of this diffusion, see the preface of *Digital Innovations in Architectural Heritage Conservation: Emerging Research and Opportunities* [Brusaporci 2017, pp. VIII-XII].

[8] Paul Milgram, of the Department of Industrial Engineering, University of Toronto, Ontario, Canada, and Fumio Kishino, creator of ATR Communication Systems Research Laboratories, in Kyoto, Japan, –pioneers of Augmented Reality Systems– in the contribution *A Taxonomy of Mixed Reality Visual Displays* [Milgram, Kishino 1994, pp. 1321-1329] describe the "virtuality continuum", a graphic synthesis concerning the close link between Augmented Reality and Virtual Reality, that is, an enlarged universe that develops into a continuum between reality and virtuality, in a sort of continuity in a well-defined space called Mixed Reality (MR).

[9] Today, two different types of virtual reality can be identified: immersive (IVR, Immersive Virtual Reality) and non-immersive (VR, Virtual Reality). In non-immersive virtual reality the desired results, although of great visual impact and incredibly photorealistic, remain less enveloping than those obtained with immersive reality. The user, in fact, perceives the virtual setting as a three-dimensional model simply reproduced on the two-dimensional surfaces of the displays of his device, without perceiving the sensation of complete obfuscation from the surrounding environment. In an immersive virtuality, instead, the user, once wearing the visor, is completely isolated from the real world and immersed into a digital world entirely rebuilt on the computer.

[10] The rural landscape referred to for the case study is *La valle del Buranco in Monterosso al Mare*, where impressive terracing and covering of the river were built at the end of the 18th century in order to create large lemon groves protected from the wind. The production of lemons was precious, at the time, to prevent scurvy during long voyages. Today these monumental structures are visible, although strongly compromised by degradation phenomena [Ruggiero 2018, pp. 53-64].

[11] Georeferencing can, in some cases, give rise to the activation of signals that, in some contexts, are grounds for inappropriate distraction: this is the case in particularly uneven environments or with excessive traffic and thickening conditions. The choice not to use this technology may introduce the right to choose exactly where a person can access certain information or views.

[12] The authors, while fully sharing the structure of the work, specify that they have respectively written: *Introduction* and *The representation of the landscape: from a diachronic logic to a synchronic one* (M.E. Ruggiero), and *The representation of the landscape between virtual reality, augmented and mixed* and *Conclusion* (R. Torti).

Authors

Maria Elisabetta Ruggiero, Department of Architecture and Design, University of Genova, ruggiero@arch.unige.it
Ruggero Torti, Department of Architecture and Design, University of Genova, mr.torti@arch.unige.it

Reference List

Ambroise, R., Frapa, P., Giorgis, S. (1993). *Paysages de terrasses*. Barcellona: Edisud.

Brusaporci, S. (2017). *Digital Innovations in Architectural Heritage Conservation: Emerging Research and Opportunities*. Hershey PA (USA): IGI Global.

Cardone, V. (2015). *Modelli grafici dell'architettura e del territorio*. Sant'Arcangelo di Romagna: Maggioli Editore.

Di Luggo, A., Zerlenga, O., Pascariello, M.I. (2016). Rappresentazione e comunicazione del paesaggio tra tradizione e innovazione. In F. Capano, M.I. Pascariello, M. Visone (a cura di). *Delli Aspetti de Paesi. Vecchi e nuovi Media per l'Immagine del Paesaggio. Rappresentazione, memoria, conservazione*, Vol. II, Napoli: Federico II University Press.

Eco, U. (1977). *Come si fa una tesi di laurea*. Milano: Bompiani.

Falcidieno, M.L., Giulini, S. (2006). *Parola, Disegno, Segno. Comunicare per immagini*. Firenze: Alinea.

Falcidieno, M.L., Castellano, A. (a cura di). (2015). *City Signs*. Milano: Franco Angeli.

Fatta, F. (2014). Town Files. Tra desiderio e bisogno, la rappresentazione del paesaggio urbano nell'era del pensiero digitale. In *DisegnareCon*, vol. 7, n. 13, pp. 1-8. <https://disegnarecon.unibo.it/article/view/4316> (accessed 2019, November 24).

Leoncini, L., Bertolucci, S. (2018). *La Città della Lanterna. L'Iconografia di Genova e del Suo Faro tra Medioevo e Presente*. Genova: De Ferrari & Devega.

Milgram, P., Kishino, F. (1994). A taxonomy of mixed reality visual displays. In *IEICE Transactions on Information and Systems*, vol. E77-D, n. 12, pp. 1-15. <http://www.researchgate.net/publication/231514051_A_Taxonomy_of_Mixed_Reality_Visual_Displays> (accessed 2019, November 24).

Ruggiero, M.E. (2018). *Rappresentazione e cultura visiva per la valorizzazione di sistemi complessi. Il caso studio del paesaggio agricolo ligure*. Genova: Stefano Termanini Editore.

Cartography

Observations on Geometry and Cartography: or on the Perception and Representation of Space

Vladimiro Valerio

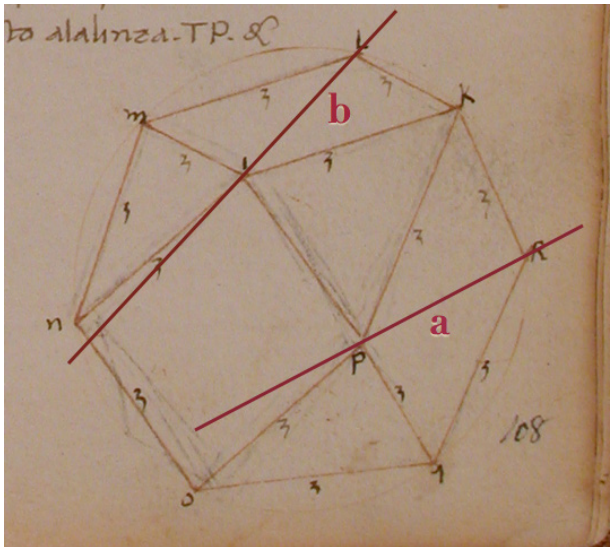
Introduction

In recent years I have found myself reflecting more and more often on the relationship between the geometry of representation and cartography, trying to find a link between these two subjects that could take into account my two paths of life and of research, developed along parallel lines, apparently without points of contact. It is clear that this reflection did not refer to the need of giving meaning to my personal choices, something that can only be of interest to myself, but rather of understanding if there were, and in what terms, a historical, epistemological link between these two disciplines with very indistinct boundaries. For years I have collected and studied maps simply for the pleasure of doing so, and for years I have taught and studied Projective and Descriptive Geometry for academic purposes, as well as, of course, taking great pleasure in doing so.
With this brief and unstructured essay, I would like to clarify this connection, in the hope of soliciting further reflection on all the areas of research related to the representation of space, and which do not refer only to the technical informatics data of drawing (a trend becoming more and more risky today with image digitization, computer graphics and virtual 3D) but to the complexity of the entire process from conception to realization.

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.

Looking at maps, not only ancient ones but those of every age and place, one immediately realizes that these images contain enormous quantity of elements, all to be analyzed: symbols, colors, the presence or absence of geographical and astronomical indications, possible grids and their forms, graphical rendering, lettering and much more. Due to the complexity of the images, the study of maps cannot be reduced to the analysis of the variations of the geographical contents of the area represented, as has often been done, and is still done, having cartography been considered a sort of attribute of geography. Geographical content may also be an investigative factor, but it is not the most important one. The risk is to reduce the complexity inherent in maps, but I would say, in every image, to only one of its aspects: content. Let's imagine what would happen if we wanted to judge a painting by reducing it to its content and to its correspondence to whatsoever real, literary or historical fact. For example, if we wanted to analyze Masaccio's *Crucifixion* by measuring its correspondence to the evangelical dictates, we would not understand anything about the painting's chromatic, compositional and spatial rendering revolution, nor its communicative complexity or its historical contextualization.

Fig. 1. Drawing of a cuboctahedron. From: Piero della Francesca, Abaco, f. 108r. Biblioteca Medicea Laurenziana, Ashb. 359, Firenze. The line segments a and b have been added for illustrative purposes (graphic elaboration by the author).*



What makes the study of maps extremely complex and intriguing is the elaboration produced by the human mind in passing from the spatial to the two-dimensional datum, which is essentially the compositional process, and I have no qualms about using a term borrowed from the world of art.

Perception and representation

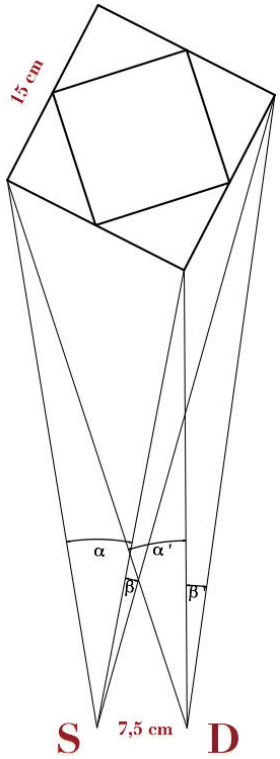
Drawing a map is an ancient way of putting order into the surrounding world using graphic techniques, in other words, it is a cognitive operation that makes it possible to move and orient oneself in space. In this definition, which I used a few years ago for a multimedia encyclopedia project at the Museo Galileo in Florence, Italy, are condensed the two moments of cartographic production that connect maps to psychology and geometry, "putting order" and "using graphic techniques" [Valerio 2008].
These two expressions also identify two aspects of the entire cognitive process: the "perception" of space and its "representation." These are two separate operations that relate to two different activities of the human mind.
The first (putting order) is a purely psychological operation and can be expressed in various, even descriptive, textual forms ranging from live sensations to reminiscences; we could define it as a narrative of spatial sensory sensations. An example of this way of describing space is given to us by Lucretius, in the famous passage on optical illusions: "A portico, / Albeit it stands well propped from end to end / On equal columns, parallel and big, / Contracts by stages in a narrow cone, / When from one end the long, long whole is seen,– / Until, conjoining ceiling with the floor, / And the whole right side with the left, it draws / Together to a cone's nigh-viewless point" [Lucretius Carus, *De rerum natura*, IV, 426-436].
The reading of this passage and the comparison with its coeval pictorial representations have given rise to long-standing discussions and disputes between the supporters of the theses of Erwin Panofsky [Panofsky 1961], who thought of Renaissance perspective as the cultural product of a society, and Decio Gioseffi [Gioseffi 1957], a proponent of the universality of perspective, which he believed to be already known and used in the ancient world, and which translates, univocally and correctly, perception into representation. Many questions would have been solved if the participants in the controversy had kept this fundamental distinction in mind [Vagnetti 1979].
The second operation (using graphic techniques) concerns the way in which a sensory datum is translated into a drawing, the

graphic representation of space, and is a purely cultural product, as demonstrated by the variety of graphic renditions produced over time and in various geographical and cultural areas.
Distinguishing these two moments (perception and representation) is fundamental in order to historicize and contextualize a map or any other graphic representation of space, from the architectural to the geographical dimension.
It is important to underline that Lucretius describes in words the sensation while observing a long portico from one of its extremities; nevertheless, the graphic outcome of this sensation is not predetermined, there is no univocal graphic response to that perception and, in fact, artists his contemporaries do not provide a single unique solution. Even the geometry of the ancient world never attempted to find a solution that could turn the aporia between observed reality and represented reality, because a solution does not exist. All the attempts made over the last few decades to demonstrate the knowledge of Renaissance linear perspective on the part of the ancients (making Lucretius' "perceptive" text a "prescriptive" text) have failed, for the impossibility of finding a single rule to be recognized as a graphic model of spatial representation. For the simple reason that the concept of "projection" is lacking in ancient world [Valerio 1998]. Moreover, as we have said, but it is important to repeat that it has been claimed that the Renaissance rule of perspective, which is none other than a method, an algorithm, a mechanical device, coincided with the "exact" representation of real space. If this were the case, the realization of the photographic camera (which is nothing more than a perfect perspective tool) would have solved all the problems of two-dimensional representation of space.
Rules of an axonometric nature (objectively parallel straight lines represented as parallel straight lines) or rules of perspective with floors, walls or trabeations whose extensions converge in several distinct points, or lines that move "obliquely" on the plane of representation coexist and share the same expressive validity, in the ancient world as in the modern one. We are faced with simulations which attempt to deceive the eye, knowing it provides us with deceptive sensations that only the mind can recompose.

Exactness and error

One of the outcomes of the confusion between perception and representation is the search for the "exactness" of the image, which involves the evaluation of any possible "error."
Exactness is a very ambiguous term that is often identified with numerical precision, making it a characteristic value of scientific disciplines (which would include the representation of space, seen *sub specie geometrica*) as well as an weapon for historical judgment: where there is no exactness there are errors. I find no worse way to approach historical, epistemological and scientific research studies than to search for or report errors.
Exactness in the representation of space lies not in the metric correspondence between the image and reality but in the "precision" of the description. And here I can only refer to what Italo Calvino wrote in his lecture on exactitude in *Six Memos for the Next Millennium* (*Lezioni americane*) [Calvino 1988]. The author addresses the issue of exactitude through the many aspects offered by literature, philosophy and essays;

Fig. 2. Diagram relating to the binocular vision of a cuboctahedron placed at the distance of an arm from the eyes of the observer (drawing by the author).



for him, exactitude had nothing to do with the mathematical (or geometric) correspondence between reality and image but rather with the "precision" with which a certain reality is described, or represented, as we would say. Even the "vague" and the indeterminate in Giacomo Leopardi can be achieved only through "a highly exact and meticulous attention to the composition of each image" [Calvino 1988, p. 60], transcending the contradiction in terms between "vague" and "precise."
The exactness of an image, to use Leopardi's literary vision, which I would make my own, lies precisely in the accuracy with which the spatial context that is the subject of reflection and representation is described graphically. It makes no sense to find the metrical correspondence of a cartographic image or drawing with reality if the "quantity" (understood as metrical correspondence) is not one of the author's objectives. In the study of images, I would find it more appropriate to replace the search for "quantities" with the search for "qualities." We must realize that if the evolutionary method is applied to cartography, all the pre-geodetic maps, prior to the second half of the eighteenth century, are wrong. At the same time, all the projective representations before the mathematical-geometric coding by Monge and Poncelet can be defined as wrong, or without a method, arriving at the paradox that all the scientific theories of the past that have been surpassed by subsequent ones are incorrect. Our past becomes a history of human errors, overcome by the "magnificent and progressive fates" depicted by Leopardi [Leopardi, *I Canti, La ginestra*, v. 51].

Philology and drawing

The right questions to ask would be: what does one want to represent, and with which technical means? It seems clear to me that these questions could be asked in any age and in any place, giving different results depending on the societies and cultures that produced those images, and it seems evident that an answer to these and other questions, including the analysis of the sources used and of the derivative due to the inertia of the images, involves themes that we could define as a "philology of drawing." A fascinating theme that has only been tackled in recent decades, since when the drawings and diagrams present in scientific texts have been analyzed with the same meticulous precision and methodology similar to those used for the analysis of texts. Here I would like to mention the works of the

Fig. 3. Perspective of the cuboctahedron from the point of view S (left eye, see fig. 2), (drawing by the author).

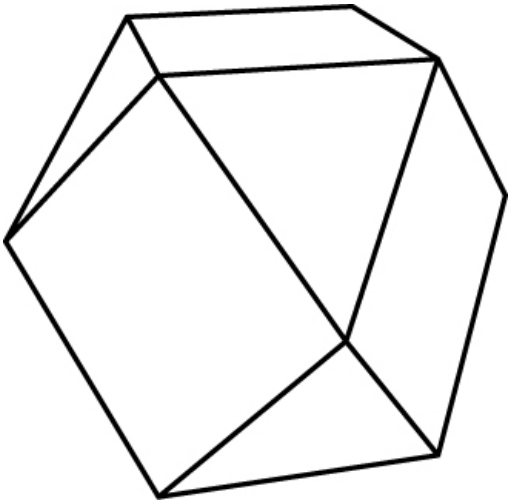
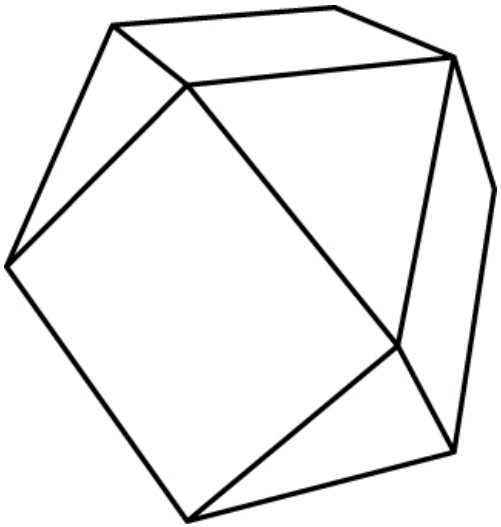
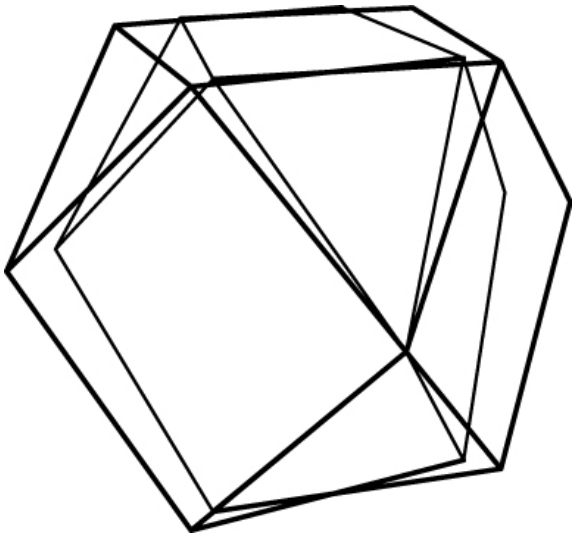


Fig. 4. Fig. 4. Perspective of the cuboctahedron from the point of view D (right eye, see fig. 2), (drawing by the author).



Commissione Nazionale per gli scritti di Piero della Francesca [Piero della Francesca 1995; Piero della Francesca 2012] and of Revil Netz on the Archimedes Palimpsest [Netz 2009]. Even when dealing with simple geometrical schemes, as in the cases mentioned above, we are facing themes of the representation of flat or three-dimensional figures, because the aim of the draftsman is not that of being exact in the graphical representation but readable, "precise" in the description; the task of the historian (of the philologist of drawing) is to read, understand and communicate the construction of an image [Valerio 2012b].
A case that to me seems exemplary of philology applied to the study of a drawing and of the need to not identify an error, but the motivation behind a derogation from the rules, is provided by the "spatial" drawing, (I would not know how else to define it, if not with this contradiction in terms), of a cuboctahedron, one of the 13 Archimedean polyhedra with six square and eight triangular faces, drawn by Piero della Francesca in his *Abacus Treatise* (fig. 108r).
It seems impossible that one of the founding fathers of linear perspective, as well as one of the most refined painter-theoreticians in the study of plane and solid geometry, to represent this solid in an apparently incorrect manner [Piero della Francesca 2012, pp. 126, 127].

Fig. 5. Superposition of the two perspective views of the cuboctahedron from the point S and from the point D (see figs. 3 and 4), (drawing by the author).



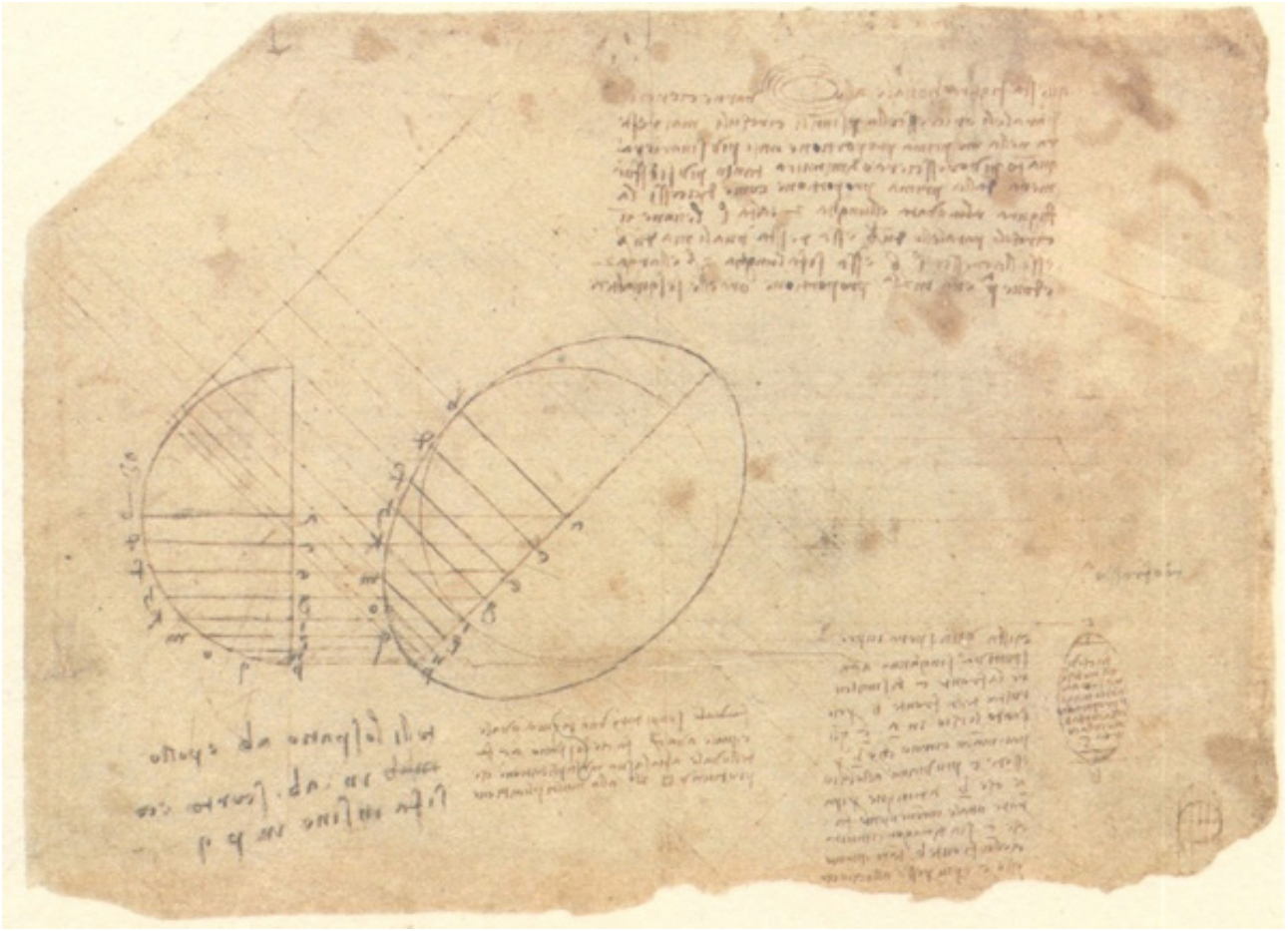
In this figure, two objectively parallel straight lines, deducible from the diagonals of two of the square faces, the lateral one (*a*) and the upper one (*b*), are not coherent (fig. 1); Piero does not draw parallel lines, as in a correct axonometry, that he knew well and applied, nor lines convergent towards the bottom, as in a linear perspective. The two straight lines converge towards the observer, generating the effect of an "inverted perspective".
A possible solution to this dyscrasia can be found in binocular vision, whose parallax, for small objects placed to a short distance from the eyes, such as an arm, generates two different and divergent images.
In this condition (fig. 2), while the left eye (*L*) sees the left face under a greater angle and the right face foreshortened, the contrary occurs with the right eye (*R*). The perception of the object as a whole occurs through the sum of the angles α and β' and is greater than the vision of a single eye (figs. 3, 4), the angle α being greater than α', and the angle β' greater than β.
It is likely that Piero had a cuboctahedron in front of his eyes and that he was drawing it while holding it up with one hand. The use of models of geometric solids is known and attested to during the fifteenth century also by certain iconography, just think of the drawings realized by Leonardo for Fra Luca Pacioli's *De Divina Proportione*, published in 1509, and Piero della Francesca's drawing is a confirmation of this use.
The two faces of the solid seem less foreshortened in comparison to the vision seen with just one eye, giving rise to a sort of natural "inverted perspective" of perceptual origin (fig. 5).
Piero never adopted, not even in the *Libellus de quinque corporibus regolaribus*, a representation of solids through linear perspective, but mainly used an empirical system of parallel line construction, comparable to present-day axonometry. That Piero's main intention was the "legibility" of the solids and, at the same time, the display of their geometrical properties can also be seen in the persistent tangency of the vertices of regular solids to the circumference that identifies the circumscribed sphere, which is a real property of solids, but which is not preserved in the plane image.
For this reason, as we have said, Piero abandoned the use of perspective, of which he was a master, because this would have created foreshortenings and deformations that, given the complexity of some solids, would not have facilitated understanding them: he preferred the precision of description to geometric exactitude.
Of course, this justification for Piero della Francesca's inverted perspective, illuminating in this historical context, cannot fit all the cases of inverted or reversed perspective [Florenskij 1984; Scolari 2005].

Awarness

Another crucial theme that results from the application of philology to the study of drawings, and I do not make any distinction between maps and geometric drawings, is that of the "awareness" on the part of the author of what he is realizing: it is not enough for something to happen, to occur, for there to be an awareness of what is being done or observed.

The perfect ellipses drawn by Piero della Francesca in his paintings and by Leonardo in some of his drawings are not the conscious result of the projective transformation of the circle, but are the result of the application of graphic rules that operate according to projective mechanisms of which both Leonardo and Piero della Francesca were not fully aware [Valerio 2006]. Piero never mentions the word "ellipse" in any of his manuscripts, and when Leonardo finds a graphic system for creating an ellipse from a circle

Fig. 6. Drawing of an "ovata" (ovate) figure. From: Leonardo da Vinci, Codice Atlantico, f. 318b. Reverenda Biblioteca Ambrosiana, Milano.



(incidentally, perfectly drawn) he calls this form "ovataovate" and "ovale" (fig. 6) [Leonardo da Vinci 1973, f. 318b].

Geographical space and architectural space

I would now like to go back to the general theme of the representation of space with no other attributes of scale or content. There are historical moments in which reflection on the representation of space leads to a closer link between maps and, in general, the drawing of architectural and pictorial space become aspects of the same problem of representation.
It is worth analyzing at least two of these periods in Western history that have coincided with the birth of a real cognitive revolution, where drawing became a heuristic tool for revealing reality as well as for representing it: the Renaissance and the Enlightenment.

Everything in the right place

The revolution that took place in the Renaissance on the theme of drawing the space is closely linked to the discovery of a scientific text lost in the Western world and to a particular cultural *humus* which developed around the rediscovery and reinterpretation of ancient scientific culture: namely, Claudius Ptolemy and the early fifteenth-century Florence [Edgerton 1976; Valerio 2012a].
The Alexandrian scientist, active in the second century AD, was the first to write a treatise dedicated to the compilation of maps, a text dedicated to the drawing of images (this redundancy is desired) of the Earth. This was a disconcerting novelty in medieval cartography: to draw a geometric grid within which to place human and natural geographical features (cities, rivers, populations, regions, mountains). Each point on the earth's surface was not defined in relation to another on the basis of a description given by literary sources or by itineraries (egocentric descriptions), but on the basis of a coordinate reference system covering the entire surface of the terrestrial sphere (allocentric geometrical reference). These two terms in parentheses will be explained below.
Of course, all this implies the measurability of the world referred not to the approximate measurements of distances traveled on foot or by ship but to the position of celestial bodies, stars and the sun in primis. For these reasons, and perhaps not wrongly, Jacobus Angelus, the first translator of Ptolemy's *Geographia*, preferred to adopt the term *Cosmographia*, which was maintained in the fifteenth-century printed editions. If it is true that a careful reconstruction of Ptolemaic procedures does not lead to the definition of a true linear perspective based on the basic principles of projective geometry, it is also true that Ptolemy's entire geographical work suggests the possibility of placing objects in space using a reference grid, and the deformations that this grid undergoes are controllable, making it possible to respect the relative positions of objects in space: it allows, in short, the creation of a one-to-one relationship between a flat image and the space it represents [Valerio 1998]. The transition from the representation of geographical space to that of architecture and painting was made by the first Florentine humanists, who saw in the Ptolemaic text not only an operational tool but also a method that can be applied just as well to the regions of the world as to all objects placed in space, giving rise to the birth of linear perspective.
The relationship between geography and perspective is suggested to us by a refined theorist, Leon Battista Alberti, who was the first to describe the method of perspective in painting based on the definition of a square "drawing grid," a sort of system of geographical coordinates (or Cartesian coordinates *ante litteram*) whose drawing, according to the rules he indicated, allows objects to be placed in space with their respective positions and dimensions. Objects are "geometrically" foreshortened and not in an intuitive or simply perceptive manner, as was the case in ancient and medieval perspective. A proof of this mental attitude, of Ptolemaic origin, can be found in the language used by Alberti, who betrays his geographical debt: "*Quo pacto omnes, pavimenti parallelos descriptos habeo. Est enim parallelus spatium quod intersit inter duas aequidistantes lineas de quibus supra nonnihil tetigimus*" and a few lines after, referring to the heights of men, "*Ex quo fit ut picti homines in ulteriori parallelo steterint*" [Alberti, *De Pictura*, I, 20]. Further on, in the same text, just as he would do in the vernacular text, he does not abandon the use of the term "*paralelo*", nor those of "*latitudine*" and "*longitudine*" for indicating the dimensions and shapes of bodies.
For the first time, in the Western world, a process for the construction of a drawing that made it possible to biunivocally transform three-dimensional space into its two-dimensional representation. Cartographic drawing and architectural drawing are both based on the concepts of measurability and position. Pictorial space and geographical space are subject to the same laws of projective transformation, and the interconnection between the two representations of

space runs through the entire arc of scientific experiments from early Humanism to the height of the Renaissance, which saw painters, mathematicians, engineers, architects, scientists and astronomers engaged on the crucial theme of the relationship between a flat image and its three-dimensional counterpart [Kemp 1990].
It should not be forgotten, however, that at the basis of pictorial and cartographic representation of space during the Renaissance there are two different perceptions of space, defined conceptually only in recent years by studies on spatial cognition, a branch of cognitive psychology: one called "egocentric," whose reference is in the observer (as in the case of pictorial perspective), the other called "allocentric," with an external reference (as in the case of Ptolemaic cartography), and which sometimes coexist in the same representation without any contradiction because the synthesis takes place in the composition of the drawing. It is important to remember the distinction between perception (vision) and representation mentioned above.
In egocentric vision, the observer refers everything to himself and to his position while in allocentric vision, the eye of the observer is like that of God (*Apollo's eye*, as written by Denis Cosgrove with a well-turned metaphor [Cosgrove 2001]) who sees everything from a stable perspective not subject to the variability of points of view. They are two complementary, non-conflicting approaches, which have the same origin and which give rise to maps such as that of the territory of Verona in the mid-fifteenth century and of many other maps up to our day [Valerio 2019].

A perfect drawing

Three centuries later the humanistic revolution, in a utterly different historical context and with completely different motivations, this time the war to determined a profound reflection on drawing, the need to find shared ways of representation began to be considered, in order to make cartographic and architectural drawings comparable [Valerio 1987]. There is a text that can be taken as a manifesto of the new way of representing space on the two-dimensional plane of a drawing, and it is the *Mémorial Topographique et Militaire*, published in Paris in the autumn of 1803 [Mémorial 1803].
"*Cette représentation, c'est-à-dire, la manière de dessiner la topographie ou d'y suppléer par des notations ou signes de convention, […], était jusq'ici livrée à l'arbitraire; chaque école, ou plutôt chaque topographe, avait sa manière*." With these words, Joseph Pascal-Vallongue, general of the *Corps du Génie* and director of fortifications (as well as vice-director of the *Dépôt de la Guerre* in Paris), introduces the work of the commission specially convened at the *Dépôt Général de la Guerre*, made up of "*tout ce que les divers services avaient d'officiers ou d'employés les plus instruits en cette partie*". The commission was charged with the task "*de simplifier et rendre uniformes les signes et les conventions en usage dans les Cartes, les Plants et les Dessins topographiques*". We have to keep in mind that only about ten years earlier (1794), Gaspard Monge had given a name to an ancient and renewed discipline of drawing, *Géométrie Descriptive*, published for the first time in 1799 and mentioned several times in the *Mémorial*. The commission met in Paris between September and November of 1802, and within a few months the results were published in the fifth volume of the *Mémorial*. The seven volumes of the *Mémorial* published between 1802 and 1810 [Bret 1989] in which various technical provisions in the field of topography appeared (from advanced geodesy to surveying, from detailed drawing to military reconnaissance) together with historical studies for use in military art, closed an era of cartography and heralded in modern cartography and technical drawing.
Through a careful analysis and examination of contemporary production, uniform rules for drawing are established: clear and shared symbols relating not only to topography but also to mineralogy, hydrography and the distinction of troops for drafting battle plans. In short, all the aspects of cartographic production are analyzed, from the representation of orographic features to the use of colors, arriving at the definition of typographic characters, establishing their bodies and dimensions in various scales; the most suitable types of paper for the drafting of manuscripts and prints are also discussed, up to the techniques of engraving. In the *Mémorial-No.5* for the first time the perfection of a map, defined in no uncertain terms as a "*carte parfaite*," is associated with an exact correspondence to reality, not only as regards the metric aspect, which is not everything (here I refer to what I pointed out at the beginning of this paper), but also and above all the formal and communicative precision: topographical drawing, according to the Commission, must represent "*la nature elle-même revêtue de ses formes et de ses couleurs, mais réduite aux dimensions de l'échelle*" [Mémorial 1803, p. 41].
A drawing must allow those who observe or use it to immerse themselves in reality, to be able to experience it, we would say today, as a virtual reality.

A matter of scales

The only distinction that arises among all the drawings that somehow represent spatial problems that are geographical, urban or architectural is the scale of the drawing. Following the very recent introduction of the meter in Republican France (abolished with the downfall of Napoleon) and of the decimal system, the scales of drawings are determined in a univocal and universal way, as a direct relationship between them and reality, something that had never even been imagined before. Previously, the correspondence between a drawing and reality was filtered by modules and units of measure: a certain module of the drawing corresponded to a given real measure, the result was not a scale ratio but a modular ratio. This was a revolution in the way of conceiving drawing that no historian of architecture or epistemologist has ever given due attention to. Talk about the "scale" of a drawing before 1803 is a historical falsification. The scales we take from "ancient" drawings or maps (1:…) are the superimposition of our knowledge and our way of working on objects imagined and drawn with a completely different mentality.

The Commission of 1802 wanted to make drawings comparable, whosoever made them, or whatever the country in which they were produced, freeding them from local units of measurement, which gave rise to incommensurable scales, and referring them to a single and universal unit of measurement. We may call it a dream that ideally connects the Enlightenment of the late eighteenth century with the Positivism of the late nineteenth century. The Commission determined a taxonomy of drawings that groups, according to the scale, various types of spatial representations: from the "*Topographie de détaildetail*" (1:2,000 and 1:5,000) to the "*Topographie générale*" (from 1:10,000 to 1:100,000) and the "*Chorographie*" (from 1:200,000 to 1:1,000,000) and ending with the "*Géographie*" (1:2,000,000). Drawing, in its broadest sense, including that which "*suivent les ingenieurs des différens services, dans les plans et le dessins, et dans quelques cartes, relatifs aux traveaux publics*" is discussed in a special paragraph entitled "*Des projections et du dessin en general*" [Mémorial 1803, p. 16]. In a table created in order to determine the width of the types to be used for each scale they start even from the 2 to 1 scale (used for industrial drawings) to arrive in an uninterrupted sequence at the scale 1: 20,000,000 (fig. 7).

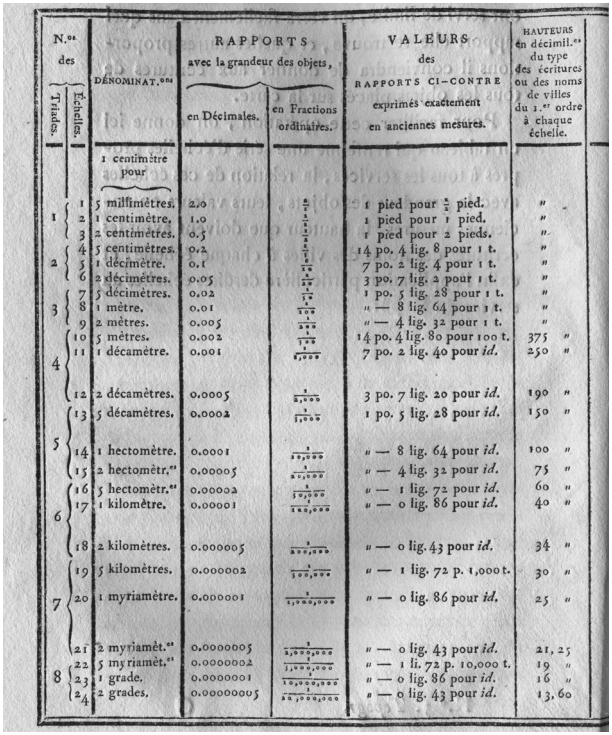
Representations of space, we could say, from the microcosmos to the macrocosmos, find in the *Mémorial* of 1803 their unity through scale ratio and the rules that govern its drawing.

However, even because of the political will to deny the scientific results born from the revolution, after the Congress of Vienna and during the nineteenth century, maps in scales based on local measures and not decimals continued to be published: just think of the scale of 1:86,400 (one inch for 1,200 Viennese *klafters*) adopted for the Austrian map of the Kingdom of Lombardy-Venetia of 1851, or the scale of 1:66,360 (one inch for a British mile) of the Ordnance Survey realized starting from 1817 [Seymour 1980].

The dream of the scientists of the French Revolution would only slowly come true during the nineteenth century, to then reach us, projected into a virtual reality without scales, but perhaps even further from reality.

In memoriam Anna Sgrosso (1927-2019)

Fig. 7. "Tableau présentant . . . les Types des hauteurs d'Écritures affectés aux Échelles adoptées". [Mémorial 1803, p. 98].



N.os des Triades.	Échelles.	Dénominat.ons	Rapports avec la grandeur des objets, en Décimales.	Rapports avec la grandeur des objets, en Fractions ordinaires.	Valeurs des rapports ci-contre exprimés exactement en anciennes mesures.	Hauteurs en décimil.es du type des écritures ou des noms de villes du 1.er ordre à chaque échelle.
		1 centimètre pour				
1	1	5 millimètres.	2.0	1/2	1 pied pour 2/3 pied.	"
	2	1 centimètre.	1.0	1/1	1 pied pour 1 pied.	"
	3	2 centimètres.	0.5	1/2	1 pied pour 2 pieds.	"
2	4	5 centimètres.	0.2	1/5	14 po. 4 lig. 8 pour 1 t.	"
	5	1 décimètre.	0.1	1/10	7 po. 2 lig. 4 pour 1 t.	"
	6	2 décimètres.	0.05	1/20	3 po. 7 lig. 2 pour 1 t.	"
3	7	5 décimètres.	0.02	1/50	1 po. 5 lig. 28 pour 1 t.	"
	8	1 mètre.	0.01	1/100	" — 8 lig. 64 pour 1 t.	"
	9	2 mètres.	0.005	1/200	" — 4 lig. 32 pour 1 t.	"
4	10	5 mètres.	0.002	1/500	14 po. 4 lig. 80 pour 100 t.	375 "
	11	1 décamètre.	0.001	1/1,000	7 po. 2 lig. 40 pour *id.*	250 "
	12	2 décamètres.	0.0005	1/2,000	3 po. 7 lig. 20 pour *id.*	190 "
5	13	5 décamètres.	0.0002	1/5,000	1 po. 5 lig. 28 pour *id.*	150 "
	14	1 hectomètre.	0.0001	1/10,000	" — 8 lig. 64 pour *id.*	100 "
	15	2 hectomètr.s	0.00005	1/20,000	" — 4 lig. 32 pour *id.*	75 "
6	16	5 hectomètr.s	0.00002	1/50,000	" — 1 lig. 72 pour *id.*	60 "
	17	1 kilomètre.	0.00001	1/100,000	" — 0 lig. 86 pour *id.*	40 "
	18	2 kilomètres.	0.000005	1/200,000	" — 0 lig. 43 pour *id.*	34 "
7	19	5 kilomètres.	0.000002	1/500,000	" — 1 lig. 72 p. 1,000 t.	30 "
	20	1 myriamètre.	0.000001	1/1,000,000	" — 0 lig. 86 pour *id.*	25 "
	21	2 myriamèt.s	0.0000005	1/2,000,000	" — 0 lig. 43 pour *id.*	21, 25
8	22	5 myriamèt.s	0.0000002	1/5,000,000	" — 1 li. 72 p. 10,000 t.	19 "
	23	1 grade.	0.0000001	1/10,000,000	" — 0 lig. 86 pour *id.*	16 "
	24	2 grades.	0.00000005	1/20,000,000	" — 0 lig. 43 pour *id.*	13, 60

Author

Vladimiro Valerio, Accademia Galileiana di Scienze, Lettere ed Arti, vladimir@community.iuav.it

Reference List

Alberti, L.B. (1980). *De Pictura*. Bari: Laterza.

Bret, P. (1989). *Le Dépôt général de la Guerre et la formation scientifique des ingénieurs géographes militaires en France (1789-1830). halshs-00002880.* <https://halshs.archives-ouvertes.fr/halshs-00002880> (accessed 2019, October 26).

Calvino, I. (1988). *Lezioni americane. Sei proposte per il prossimo millennio*. Milano: Garzanti.

Cosgrove, D. (2001). *Apollo's eye: A cartographic genealogy of the earth in the Western imagination*. Baltimore & London: The Johns Hopkins University.

Edgerton, S.Y. (1976). *The Renaissance Rediscovery of Linear Perspective*. New York, San Francisco, Evanston, London: Icon Edition.

Florenskij, P. (1984). *La prospettiva rovesciata ed altri scritti sull'arte*. Roma: Casa del Libro.

Gioseffi, D. (1957). *Perspectiva artificialis. Per la storia della prospettiva spigolature e appunti*. Trieste: Istituto di Storia dell'Arte antica e moderna.

Kemp, M. (1990). *The Science of Art. Optical themes in western art from Brunelleschi to Seurat.* New Haven-London: Yale University Press.

Leonardo da Vinci (1973). *Il Codice Atlantico della Biblioteca Ambrosiana di Milano*. Firenze: Giunti.

Leopardi, G. (1998). *I Canti*. Milano: Rizzoli.

Lucretius Carus T. (2013). *On the nature things.* <http://www.gutenberg.org/files/785/785-h/785-h.htm#link2H_4_0020> (accessed 2019, December 15).

Mémorial (1803). *Memorial Topographique et Militaire, n. 5 Topographie*. Paris: Imprimerie de la Republique, Fructidor an XI.

Netz, R. (2009). *The Works of Archimedes. Translation and Commentary, vol. 1: The Two Books On the Sphere and the Cylinder*. Cambridge: Cambridge University Press.

Panofsky, E. (1961). *La prospettiva come forma simbolica e altri scritti*. Milano: Feltrinelli [Prima ed. *Die Perspektive als "symbolische Form"*. Leipzig-Berlin 1927].

Piero della Francesca. (1995). *Libellus de quinque corporibus regolaribus corredato dalla versione volgare di Luca Pacioli. Vol. II. Disegni*. F.P. Di Teodoro (a cura di). Firenze: Giunti. Edizione Nazionale degli scritti di Piero della Francesca.

Piero della Francesca. (2012). *Trattato d'Abaco. Vol. II, Disegni*. V. Valerio (a cura di). Con la collaborazione di Alessandra Sorci. Roma: Istituto Poligrafico e Zecca dello Stato. Edizione Nazionale degli scritti di Piero della Francesca II.

Scolari, M. (2005). *Il disegno obliquo, una storia dell'antiprospettiva*. Venezia: Marsilio.

Seymour, W.A. (ed). (1980). *A History of the Ordnance Survey*. Folkestone: Dawson.

Vagnetti, L. (1979). De Naturali et artificiali perspectiva. In *Studi e documenti di Architettura*, n. 9-10. Firenze: Libreria Editrice Fiorentina.

Valerio, V. (1987). Dalla cartografia di Corte alla cartografia dei Militari: aspetti culturali, tecnici e istituzionali. In *Cartografia e Istituzioni in Età Moderna, Atti del Convegno*. Genova, Imperia, Albenga, Savona, La Spezia 3-8 novembre 1986, vol. I, pp. 59-78. Genova: Società Ligure di Storia Patria.

Valerio, V. (1998). Cognizioni proiettive e prospettiva lineare nell'opera di Tolomeo e nella cultura tardo-ellenistica. In *Nuncius*, vol. XIII, n. 1, pp. 265-298.

Valerio, V. (2006). La forma dell'ellisse. In E. Ambrisi, et al (a cura di). *Arte e Matematica - Un sorprendente binomio*. Napoli: Istituto Italiano per gli Studi Filosofici, pp. 241-262.

Valerio, V. (2008). The History of Cartography in a Nutshell. In *Coordinates, Online Journal of the Map and Geography Round Table of the American Library Association*, Series B, 10, pp. 1-5. <https://oaktrust.library.tamu.edu/handle/1969.1/129200> (accessed 2019, October).

Valerio, V. (2012a). La Geografia di Tolemeo e la nascita della moderna rappresentazione dello spazio. In V. Maraglino (a cura di). *Scienza Antica in età moderna. Teoria e immagini*, pp. 215-232. Bari: Cacucci Editore.

Valerio, V. (2012b). Sulla rappresentazione cartografica del così detto papiro di Artemidoro. In *Revue d'Histoire des Textes*, VII, pp. 371-384.

Valerio, V. (2019). Psicologia della percezione e rappresentazione dello spazio: La quattrocentesca carta del veronese detta «dell'Almagià». In *Albertiana*, XXII (n.s. IV), 1, pp. 105-126.

Building Territories and Landscapes: the Royal Site of Aranjuez

Pilar Chías, Tomás Abad

Abstract

Lands depending on the Royal Site of Aranjuez have undergone several transformations throughout the last five centuries. Their particular geographic features together with the traces related to the historic uses in the service of the King's leisure –but also to a secular agriculture, livestock and hunting exploitation– were shown in an interesting set of maps, plans, paintings and drawings. Ancient cartography still permits to locate the main geographic landmarks, and also the constructions built throughout the territories and the centuries, paying a special attention to the neighboring town and its development. In turn, pictures and drawings depict some particular performances that were supported by a set of more or less ephemeral buildings and traces. An exhaustive fieldwork permitted us to check their state of preservation, and to analyze the lasting remains of historic uses and forms.

Keywords: Royal Sites, Spain, ancient cartography, drawings, 15th-20th Centuries.

Introduction

To get a deep knowledge of a historic building needs an intensive documentation effort and an exhaustive fieldwork. On this basis, the adequate hypotheses about its evolution throughout the centuries can be envisaged and checked.
Similarly, a previous documentation work becomes essential in order to recover the historical memory of a territory or a landscape. Any kind of historic written sources, as well as ancient graphic and cartographic documents, can provide valuable information on the main built landmarks and geographic features and their evolution. In this respect, when we refer to the built heritage, we include crops, infrastructures, and other constructions that merit particular attention because of their qualities or characteristics.

On the other hand, the distinction between territory and landscape corresponds to two conceptual approaches.
The construction of the territory is proposed from an objective perspective that studies both the natural and man induced geographic phenomena, that are described and analyzed from a scientific point of view. In turn, landscape is the way a territory is perceived and experienced by an observer, which establishes some aesthetic, emotional, moral, scientific and cultural relationships with it [Chías 2015; 2018].
As a consequence, our researches seek to know in depth, to enhance the value, and to disseminate cultural heritage from a wide scope including the architectural, urban and land scales.

https://doi.org/10.26375/disegno.5.2019.10

diségno ISSN 2533-2899

To this end, it is indispensable to study the construction of both the territory and the landscape [Chías, Abad 2012; 2014] or, according to Nicolás Ortega Cantero, "the historic geography of the landscape" [Ortega Cantero 2004].

The place

The qualities that characterize Aranjuez as a unique place, are the result of a singular geographical environment that has been wisely used since the Roman era.
The Royal Site is placed in the fertile plain where the rivers Tajo and Jarama meet. But its development, "far from resulting of a free spontaneous land tenure, and of the transformation of the cultivable floodplain, reflects a guiding will and a rational planning" [Terán 1949] (fig. 1).
Although the name Tajo denotes the quality of the river to intrude into high river banks, Aranjuez represents an exception because it has took advantage traditionally of the river water to irrigate the fertile plain. Therefore, the valley starts widening and adopts an asymmetrical profile [1] from the south of Colmenar de Oreja, where the riverbanks are covered with vegetation and there is a thick network of irrigation channels.
In this area, historic orchards and gardens abound, but they were secularly subjected to the changing meanders and the floodings that altered periodically the landscape.

Fig. 1. A. de Navas, General plan of the properties of the Spanish Crown in Aranjuez, 1811. Archivo Cartográfico de Estudios Geográficos, Madrid.

On the other hand, the river Tajo tends to move towards the South and to erode the left margin, digging almost vertical slopes, and carving four terraces that reach 100 m above the river level (fig. 2).
Although human action has played a crucial role in the transformation of these landscapes, the old groves and the gallery forests that once covered this area can still be seen. They once were the main attraction of the Royal Site, and were used for hunting by the successive Kings of Spain.

The history

The plains of the rivers Tajo and Jarama were well populated from the Roman era onwards, even throughout the Early Middle Ages when these territories were under Arabic domination.
Between the 11th and the 12th centuries, they were the border region between the territories dominated respectively by the Christians and the Muslims.
But at the end of the 12th century, war moved closer to Sierra Morena and started the repopulation of these lands. As a consequence, an interesting set of small villages settled in the area. Some of them like *Aurelia*, *Aranzuel* and *Alpajés* have reached our days (and are actually known as Oreja, Aranjuez and Alpajés), while other as *Gulpijares* or *Villafranca* disappeared. All of them were located by the riverside, and took advantage of its waters by constructing dams, water saws, water-powered mills, canals and irrigation ditches, etc., that were still in use not such a long time ago.
These territories were formerly owned by the Grand Masters of the Order of Santiago (fig. 3). King Fernando el Católico was the last one, and accordingly, the estates became a property of the Crown known as the *Real Heredamiento* of Aranjuez.
Since then, there was a decline in the habitation patterns due to the prohibition on building new houses, what significantly reduced the number of villages. Similarly, land uses changed into meadows, while livestock farming and grasslands were leveraged and some areas were reserved for market crops and fruit orchards, as the Huertas de Picotajo at the confluence of the rivers.
Throughout the 16th century, the first Kings of the House of Habsburg (Emperor Charles and King Philip II) fenced and extended the Royal Woods buying many neighbo-

ring estates. The last one started to build the new palace beside the Grand Masters' old residence, by applying the architectural concept of the Italian villa in the countryside [Bonet 1987] (fig. 3).
Philip II also extended the dry farming plots, renovated the Jardín de la Isla, and built new irrigation systems, gardens and orchards, which were accessed through long tree-lined streets.
The last Habsburg Kings increased the agricultural crops, but the definitive impulse to the Royal Site was given by the Bourbon Kings in the 18th century.
King Philip V continued the works of construction of the Royal Palace according to the traces drawn at the 16th century, and his son King Ferdinand VI promoted the development of the population centre following the guidelines proposed in architect Santiago Bonavia's urban plan. Bonavia defined in 1750 a scenographic project based on the highest respect for the existing tree-lined streets, and proposed an asymmetrical plan with a trident of streets to the East, whose perspectives converged in the Royal Palace. The grid of the blocks of the new town should fit into the trident [Sancho 1995] (fig. 4) [2].
Bonavia also designed a new urban space, the square of San Antonio, that was set in parallel to the existing Plaza de las Parejas (square of the Couples), but now with a public character (fig. 5).
A new urban expansion to the south was designed by architect Jaime Marquet in 1759, that included a wide market square or Plaza de Abastos.
King Charles III built most of the urban infrastructures between 1760 and 1786, that included a new hospital, a theatre, a slaughterhouse, and a graveyard, among other

Fig. 2. Spanish Anonymous Painter, View of Aranjuez from the top of the road to Ocaña, 19th century. Biblioteca Nacional de España, Madrid.

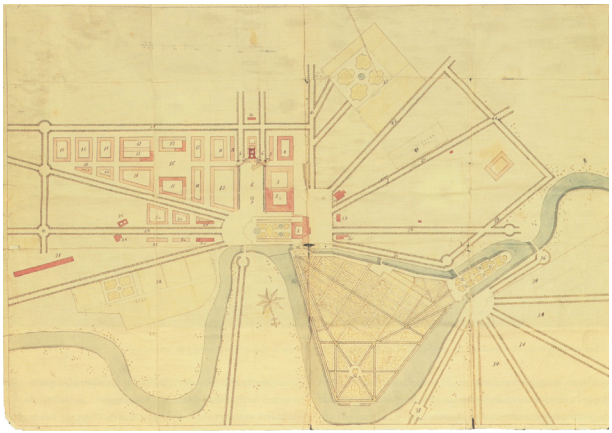
buildings. Simultaneously a set of new private palaces was built according to the "Urban policy of Aranjuez" enacted in 1764.
As a consequence, the town constantly maintained the high quality of its construction, together with an homogeneous design that ended in "the most pleasant, bright and beautiful town that one can imagine" [Álvarez de Quindós 1804].
At the beginning of the 19th century, Aranjuez was the most regular and tidy among the Spanish Sites [Chueca 1958], as it was a successful example of a courtesan town of the Enlightenment, with a late Baroque urban frame and numerous service buildings with a functional character (fig. 6).
Queen Isabella II reigned between 1840 and 1868, coinciding with the last period of splendor in Aranjuez, when new palaces were built by the Royal Family and by the old and the new aristocracies. A new railway connected Madrid with Aranjuez, but the railway station was placed to the west, near the Royal Palace, what damaged an important area of the tree-lined streets in Picotajo.
The Law promulgated in July, 5th 1869 allowed the sale of a significant part of the royal properties, and started a period of dismemberment of the original estates that once conformed the *Real Heredamiento*. Many plots passed onto private hands, while the Crown kept the Palace and the adjacent service buildings, the gardens of the Parterre, la Isla and the Prince, with the House of the Labrador and the Doce Calles area. They all are currently a part of the Patrimonio Nacional, and since 1982 the tree-lined streets and all the rural real estates that still belonged to this public institution, were integrated into the properties of Spanish State.
Among the consequences of the privatization process, the changes in the land uses must be stressed, together with an important transformation of the landscapes.

Images of Aranjuez: plans and drawings

All the process steps in the construction of the territories and the landscapes of Aranjuez were captured by numerous graphic documents. They show the most important objective characteristics of the territory and its main features and landmarks, but also the subjective qualities of the public spaces and the landscapes, that frequently appear on the background of the activities of the court (fig. 7), and sometimes are protagonists in art works like those by painter Santiago Rusiñol (fig. 8).
Regardless of the drawing or painting technique used [3], both the drawings and the engravings of Aranjuez can be classified as: 1/ cartography: maps and plans produced at a territorial scales; 2/ urban plans; 3/ architectural and decoration plans; and 4/ perspectives. Due to the particular

Fig. 3. Michel-Ange Houasse, The Palace of Aranjuez and the ria from the Jardín de la Isla, c. 1720. Patrimonio Nacional.

Fig. 4. S. Bonavia, Urban planning of the new population centre at the Royal Site of Aranjuez, 1750. Archivo del Palacio Real, Madrid.



targets of our study, we have not taken into account other abstract expressions or non-figurative art works.
The main differentiation to be done between the cartographic documents relates to the scale, that introduces a primary categorization of maps and plans, depending if they consider the Earth curvature. A secondary grouping relates to reliability and accuracy of maps, that defines another conceptual milestone from the application of the scientific cartography produced since the beginning of the 19th century.
The oldest maps correspond to the kingdom of the first Habsburg Kings throughout the 16th and 17th centuries, which coincided with the golden era of the printed cartography in the Low Countries, which then belonged to the Spanish Crown.
Among the early maps depicting the territories of Aranjuez, the printed map by Abraham Ortelius included in his atlas *Theatrum Orbis Terrarum* (1584) must be highlighted. It shows in a simple effective way a section of the river Tajo within Colmenar de Oreja and Toledo, as well as the quaternary terraces flanking it (fig. 9). Likewise, among the most reliable maps from the perspective of the topology is the *Toletum Hispanici Orbis Urbs*, that was drawn and printed by I.F. Leonardo and L.M. Portocarrero in 1681 [4].
Among the later maps drawn on a larger scale, the set drawn by Santiago Loup during the Peninsular War (1808-1814) was carefully surveyed and detailed, and shows and interesting display of toponyms and place names.
The production of urban plans began in the 18th century when the town was designed and built. At this time correspond the urban projects that were successively proposed by the architects Santiago Bonavía (fig. 4), Jaime Marquet and Domingo de Aguirre (fig. 6).
Another set of urban plans depicts some particular areas that were then being developed as the Real Cortijo de San Isidro, Sotomayor, or the Campo Flamenco (Flemish Field), among other, drawn by engineer José de Hermosilla, Leonardo de Vargas, Charles de Witte, Vicente Fornells and Bonavía. Among them, the set of plans showing the flood damages and the changes in the courses of the rivers Jarama and Tajo is particularly interesting. The oldest one is a simple sketch dated 1586 (fig. 10) that describes in detail the dams, the irrigation canals and other industries that were located by the riverside and took advantage of the water stream.
The collection of accurate urban plans drawn in the 19th century by the Junta General de Estadística from 1870

Fig. 5. A. Joli, The square of San Antonio in Aranjuez, c. 1757. Private collection.

Fig. 6. D. de Aguirre, Topography of the Royal Site of Aranjuez, 1775. Biblioteca Nacional de España, Madrid.

Fig. 7. F. Battaglioli, Fernando VI and Bárbara de Braganza in the gardens of Aranjuez, 1756. Museo del Prado, Madrid.

Fig. 8. S. Rusiñol, Gardens in Aranjuez: Glorieta II, 1907. Museo Nacional de Arte Reina Sofía, Madrid.

Fig. 9. A. Ortelius, Carpetaniae partis descr., in Theatrum Orbis Terrarum, 1582. Biblioteca Nacional de España, Madrid.

onwards, as a part of the project *Topografía Catastral de España* (fig. 11) [Urteaga, Camarero 2014], together with the local maps produced on the occasion of the sale of the Royal properties, are significant examples of the scientific cartography of the time. Among these, the map surveyed by Roque León del Rivero in 1869 and the printed map included in Almazán's work [Almazán y Duque 1870] must be stressed.

The cadastral watercolour map titled *Plano catastral del Término de Aranjuez* drawn in 1912 by Juan L. de Chicheri and Salvador Aspiazu is particularly interesting due to the detailed crops and vegetation.

The set of architectural plans that still survive correspond essentially to the different stages in the construction of the Royal Palace. Only one is dated back to the 16th century, which is an ink sketch describing a garden and a fountain [5]. In the first half of the seventeenth century, architect Juan Gómez de Mora produced a copy of the original plans by Juan Bautista de Toledo when King Philip IV tried to complete the construction of the Palace [6].

But until the 18th century it could not be finished, and on this occasion some other architects designed successive enlargements of the building, as those by Pedro Caro Idrogo between 1728 and 1731 [7], by Esteban Marchand in 1732-1733, by Leandro Bachelieu, and finally by Francisco Sabatini, who designed the west aisles between 1771 and 1774.

The interior decoration was arranged by Santiago Bonavía and Giovanni Battista Galluzzi. The first one was the au-

thor of the impressive imperial staircase of the Palace, built between 1735 and 1746, whose drawings still show his disagreement with governor Samaniego [8].
Several solutions were proposed to other singular buildings as the Church of San Antonio (fig. 12) and the "houses owned by His Majesty", as shown in the corresponding architectural plans. But there are few graphic documents related to the private constructions around 1786.

The last group of images is composed by the perspectives that were drawn or painted from the 16th century onwards. It's a large group that can also be sorted by the artist's intentions.
The oldest view was drawn by gentleman Jehan Lhermite, who was a preceptor of the prince Philip and spent the last years in the life of King Philip II at the Spanish Court. His manuscript drawings [9] show in detail the buildings

Fig. 10. Anonymous, Drawing that depicts the riverside of the Tajo near the forest of Sotomayor, 1568. Archivo General de Simancas, Valladolid.

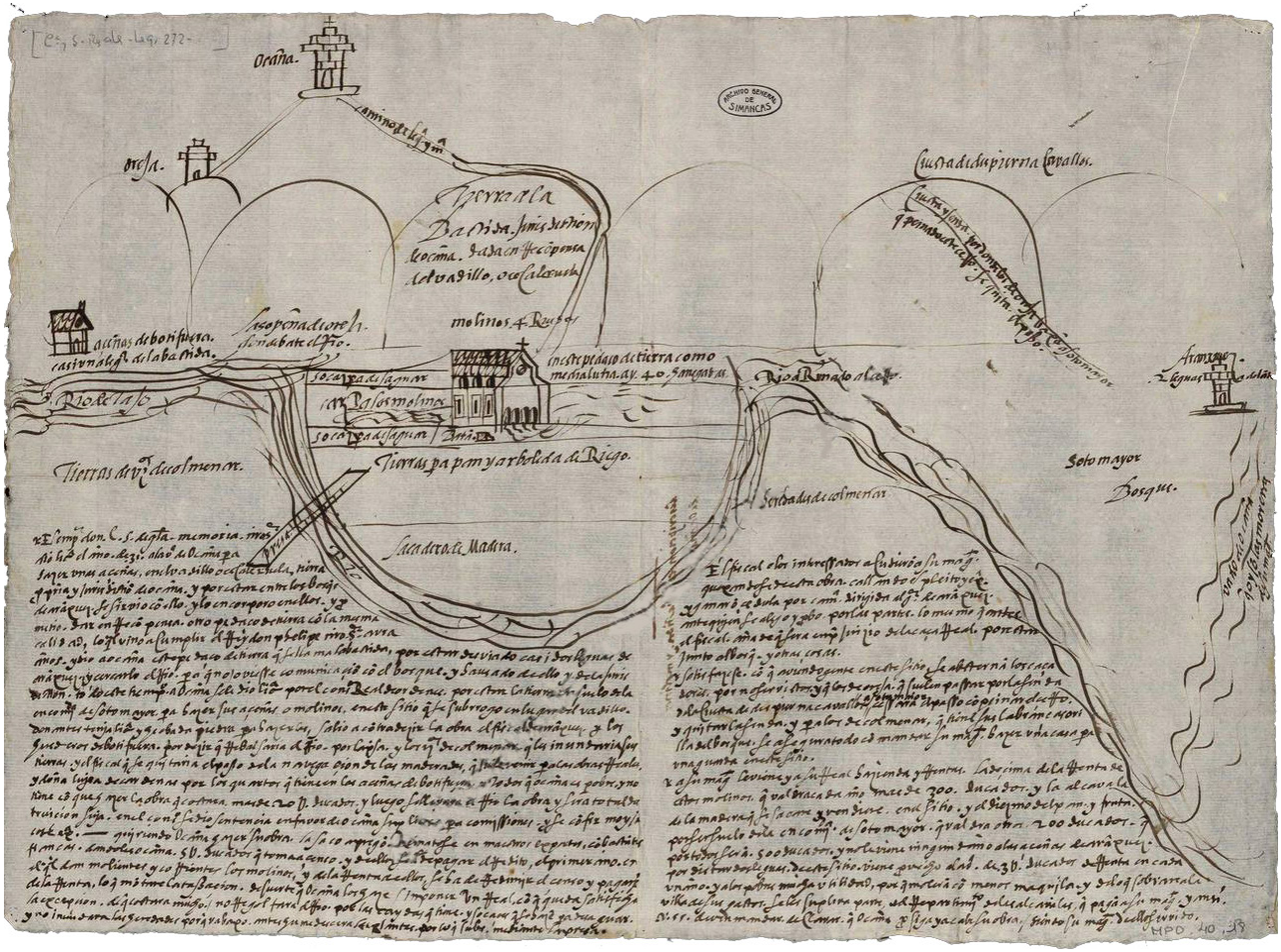


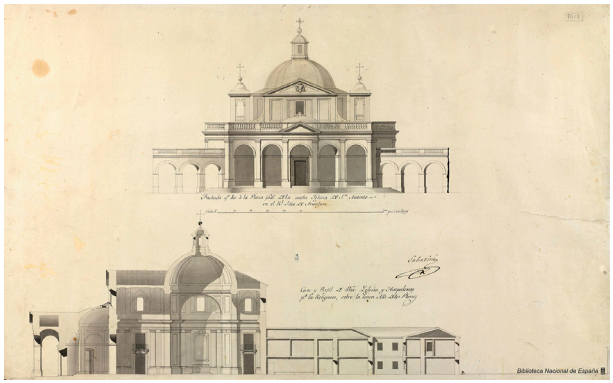
Fig. 11. Topografía Catastral de España, Aranjuez, Hoja Kilométrica 31L. Instituto Geográfico Nacional, Madrid.

and the environment, but also the activities performed in daily life.
Only fifty years later, Pier Maria Baldi provided a set of illustration of the journey of Cosme the Medicis through Spain and Portugal [10]. He made a stop at Aranjuez, and drew the unfinished Royal Palace built by King Philip II beside the old Casa Maestral.
Two anonymous oil paintings preserved respectively in the Prado Museum and in the Monastery of El Escorial, show two bird's eye views of the Royal Site as it was built by King Philip II, and an ideal perspective of the project by Juan Bautista de Toledo. But while the first one depicts the building embedded into a fascinating countryside, the second one focuses in the Palace.
The perspectives painted throughout the 18th century show essentially the splendor of the court at the Royal Site, that was transformed into an huge theatrical scenery for the display of the powerful Spanish Monarchy. They were painted mostly by Italian artists like Carlo Broschi Farinelli, Francesco Battaglioli, and Antonio Joli, but also by important Spanish painters like Luis Paret, Isidro González Velázquez and Domingo de Aguirre, and outstanding engravers like Manuel Salvador Carmona, Juan Minguet, Manuel Alegre, Joaquín Ballester, Francisco Muntaner and Fernando Selma among other, at the dawn of the 19th century. These artists produced the interesting collection of etchings that show Aranjuez from the point of view of a walker by 1775.
The paintings by Michel-Ange Houasse are specially interesting among the eighteenth century perspectives, because of his color palette that is «full of qualities and rich in suggestions», [Luna 1974] according to Luna and because they show the everyday environment that enabled the life in the Palace.
Another essential collection of charming views of the Royal Sites was painted by Fernando Brambilla between 1821 and 1833, that shortly thereafter was lithographed and widely diffused. Although his main purpose was to enhance the image of the vile absolutist King Ferdinand VII, his points of view were usually unrealistic and the perspectives lack of a rigorous structure, according to his communicative intent.
More recently, the views of the gardens of Aranjuez by Santiago Rusiñol (fig. 8) provide the solitary vision of a nature submitted to the man's will by means of a rigorous symmetric composition, in contrast with a wild background [Martín Bourgon 2019].

Conclusions

Re-construct the development of a place means to identify the natural landmarks, to know how, when and why men built his artifices and buildings, the way he took profit of the available resources, and how the landscapes were conformed.
To this end it become essential to develop an exhaustive documentary search where the graphic documents proved to be particularly useful due to their ability to describe the geographic features, but also to their capacity to express and suggest the qualities of environments and atmospheres.
The indispensable fieldwork must be developed focusing at various scales, and allows us to verify or correct what images and texts convey. In essence, these researches allow us to recover the memory of the territory and the landscape of an «enchanted place», according to the experience of Mme. D'Aulnoy in 1668.

Fig. 12. F. Sabatini, Project of the new Church of San Antonio, 1772. Biblioteca Nacional de España, Madrid.



Notes

[1] The right border has a gentler slope than the left one, due to the general incline of the Central Plateau to the South.

[2] Bonavia's plan faces south.

[3] Among the collection of maps and drawings that is still preserved, there are oil paintings and drawings produced using many different techniques, but also engravings, that were particularly abundant from the 18th century onwards.

[4] There are some copies in the Biblioteca Nacional de España and the Centro Cartográfico y de Estudios Geográficos del Ministerio de Defensa, both in Madrid.

[5] Archivo General de Simancas, MPD y D47,059, *Sketch of a fountain for the garden in Aranjuez*.

[6] There is a collection in the Biblioteca Nacional de España dated 1636, and another one in the Vatican Library that is a manuscript copy of the original 16th century plans.

[7] Plans are preserved at the Centro Cartográfico y de Estudios Geográficos del Ministerio de Defensa in Madrid.

[8] Archivo del Palacio Real de Madrid, nr. 1187 y 1188.

[9] Jehan Lhermite (1602-1622), *Le Passetemps*. Bibliothèque royale de Belgique, Bruxelles, *Manuscripti historici* n. 17.

[10] Biblioteca Laurenziana, Firenze, Med. Pal. 123.

Authors

Pilar Chías, Escuela de Arquitectura, Universidad de Alcalá, pilar.chias@uah.es.
Tomás Abad, Escuela de Arquitectura, Universidad de Alcalá, tomas.abad@uah.es.

Reference List

Almazán y Duque, J. (1870). *Informe sobre la enajenación del patrimonio de Aranjuez*. Madrid: Imprenta de Rojas.

Álvarez de Quindós, J. (1804). *Descripción histórica del Real Bosque y Casa de Aranjuez*. Madrid: en la Imprenta Real.

Bonet Correa, A. (1987). Cronología del Real Sitio de Aranjuez. En A. Bonet (coord.) *El Real Sitio de Aranjuez y el arte cortesano del siglo XVIII*, pp. 137-140. Madrid: Comunidad de Madrid-Patrimonio Nacional.

Cardone,V. (1999). *Modelli grafici dell'architettura e del territorio.* Napoli: Cuen.

Chías, P. (2015). Cuelgamuros: Territorio y paisaje con figuras. In *Academia*, n. 11 (2), pp. 161-178.

Chías, P. (2018). Pictures of the Territory and the Lansdcape: Cartography and Drawings of the Mountains of Guadarrama. In E. Castaño, E. Echeverría (eds.). *Architectural Draughmanship*, pp. 427-438. Cham: Springer International Publishing, vol. 1.

Chías, P., Abad, T. (2012). Open Source Tools and Cartography: Studies on the Cultural Heritage at a Territorial Scale. In C. Baterira (ed.). *Cartography. A Tool for Spatial Analysis*, pp. 277-294. Rijeka: IntechOpen.

Chías, P., Abad, T. (2014). La construcción del entorno del Monasterio de San Lorenzo de El Escorial. Agua, territorio y paisaje. En *Informes de la Construcción*, vol. 66, n. 536, pp. 1-12.

Chueca Goitia, F. (1958). *Madrid y Sitios Reales*. Barcelona: Seix Barral.

D'Aulnoy, Marie-Catherine Le Jumel de Barneville (1668). *Relation d'un voyage en Espagne*. À Paris, Chez Thomas Lolly, vol. III, pp. 259-269.

Luna, J.J. (1974). Michel-Ange Houasse. En *Reales Sitios*, n. 42-45.

Martín Bourgon, M.T. (2019). Rusiñol y Prats, Santiago. En *Museo del Prado, 200 años*. <https://www.museodelprado.es/aprende/enciclopedia/voz/rusiol-y-prats-santiago/4aac09d8-4e6b-4464-a532-7d0facd9c32a> (accessed 26 January 2019).

Ortega Cantero, N. (2004). La imagen literaria del paisaje en España. En R. Mata y C. Sanz (eds.) *Atlas de los paisajes de España*, pp. 30-52. Madrid: Ministerio de Medio Ambiente-Universidad Autónoma.

Sancho, J.L. (1995). La arquitectura de los Sitios Reales. Catálogo histórico de los palacios, jardines y patronatos reales del Patrimonio Nacional. Madrid: Patrimonio Nacional – Fundación Tabacalera, pp. 284-290.

Terán, M. de (1949). Huertas y jardines de Aranjuez. En *Revista de la Biblioteca, Archivo y Museo (Ayuntamiento de Madrid)* n. 58, pp. 261-296.

Urteaga, L., Camarero, C. (2015). Los planos de lso Sitios Reales españoles formados por la Junta General de Estadística (1861-1869). En *Scripta Nova*, vol. XVIII, n. 482.

Considerations about Old Maps in the Digital Era

Lia M. Papa

Abstract

Old maps often corroborate the studies performed in many fields of design, but they also provide a wealth of precious data which, in an increasingly interdisciplinary manner, can retrace transformations in parts of a territory or urban context; these changes are often radical, made either by man or triggered by natural events.
Although maps are sometimes poorly appreciated the interaction between their signs creates and transmits significations that depend on their historical and social context as well as on their interpretation, i.e., the way in which the user intends to use the cartographic drawing, quite apart from the reason why it was produced.
This article focuses primarily on nineteenth-century maps; during this century extensive progress was achieved in the fields of science, technique and organisation; this had not only a fallout on map making, but also led to the emergence of several important figures in the fields of education and technique.

Keywords: iconic/symbolic, cartographic culture, transformations.

Introduction

Transformations of territories and urban centres, coupled with environmental and safety problems, underscore the importance of a multiscalar analytical and design approach involving all drawing disciplines, influenced as they are by considerations about changes in culture and technology.
In this context, cartographic representation is again an interesting research topic, not least due to the increasingly pressing need to enhance cultural and landscape resources, govern urban transformations, and manage the latest technologies since the latter make it possible to compare and georeference outputs produced in different eras and inspired by different cultures.
In a recent issue of this journal Vito Cardone wrote: "after the shift in the frontiers of infographics, graphic representation has broadened its borders; new fields have been sown and produced important, novel fruits, but yet more are in the offing. Nevertheless, fertility has slowly waned; the 'light' that initially imbued the entire scientific community is becoming dimmer and we are starting to see more and more routine work, without any truly innovative ideas. […] Sometimes however –as in certain studies about territorial and urban representation submitted above all by Argentine, Brazilian and Spanish congress participants– the authors have travelled to the frontiers of representation, beyond which we can glimpse endless prairies with the tracks of the possible, long-awaited paths towards future developments in our scientific and disciplinary fields" [Cardone 2018, pp. 5-7].

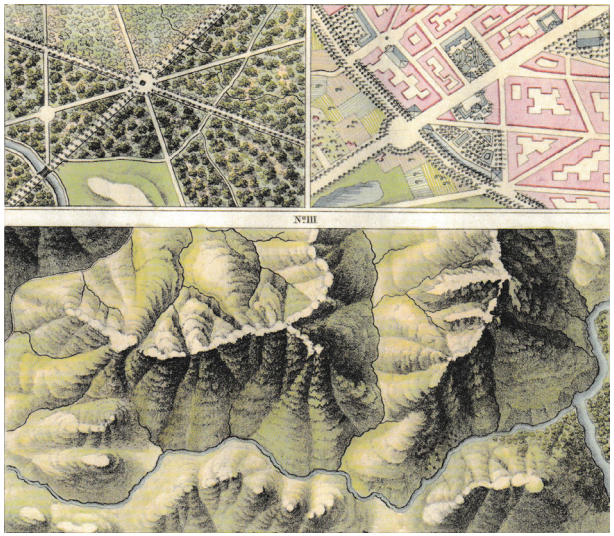


Fig. 1. Topographic models drawn and watercoloured by A.M. Perrot, Table IV. Florence: P. Fumagalli, 1819-1829.

The specialisation that has typified the world in which we live, above all since the late eighteenth century, has led to different, well-defined languages; this is why in the era of interoperability we need to ask ourselves whether drawing can take on the responsibility of triggering a renewed impulse towards comparative knowledge and conveying interest in the description of places – in the broadest sense of the term. This interest should consider the material and immaterial dimension which are not rigidly defined but require multiple viewpoints and hybridised languages since specialisation has facilitated expressive modes and stricter dedicated codes.

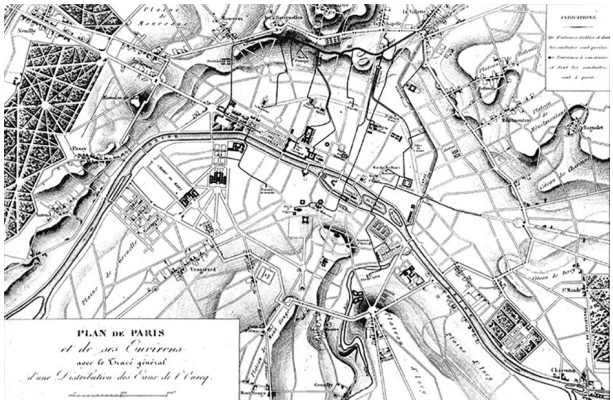
Technical-scientific developments and visual innovations in the nineteenth century

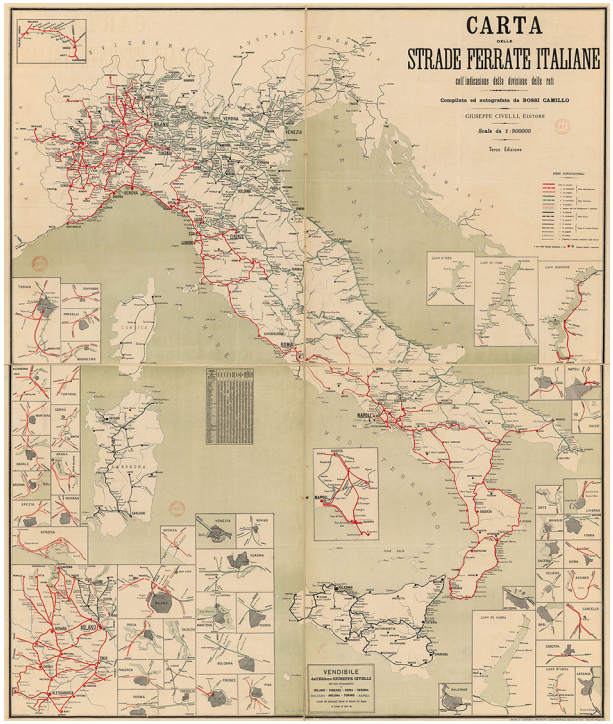
In the eighteenth century the cartographic representation processes that began primarily in European countries were consolidated, disseminated and diversified.
Medium- and large-scale survey became a key factor in the broader issue of objective representation, as did the grammatical rules used to describe places. The lack of a uniform expressive method depended on the fact that often the method was influenced not only by the expertise which operators had acquired either while training or on the job, but also by their personal drawing skills [Rossi 2018]. A systematic reorganisation of topographic styles began when a commission was set up by the *Directoire* in Paris in the early nineteenth century (1802); their work has been the focus of numerous studies.
Amongst other tasks, commission members were mandated to "discuter les moyens de simplifier et de rendre uniformes les signes variés qui, sur les cartes et les autres projections, servent à exprime les accidents du terrain" [Mémorial topographique et militaire 1803, p. 2]. According to the rules of the *Mémorial Topographique*, every draughtsman working in this field had to reproduce "le même effet que fait un relief parfait du terrain, ou plutôt la nature elle même revêtue de ses formes et des couleurs, mais redoute aux dimensions de l'échelle" [Mémorial topographique et militaire 1803, p. 2].
Three-dimensional representation was also a priority issue. In one of François de Dainville's papers he retraced the main steps which led, as he himself writes, "de la profondeur à l'altitude", in other words, from probes –which inspired opisometers– to the introduction of contours in maps [De Dainville 1958]. For many years mapping offices avoided the issue of the geometric representation of the morphology of the terrain and continued to use the eighteenth-century tradition of merging geometric and pictorial methods. It's not surprising that in Naples, in the year 1807 – with a reference to the *Mémorial*– oblique hatching was used in the *Atlante Geografico*, the invaluable, comprehensive map completed in 1812 by Giovanni Rizzi Zannoni [Valerio 2014] [1].
The typical categories of eighteenth-century topography were revived, strongly influenced not only by the aforementioned concepts of imitation of nature, but also geometric representation based on the projections with numerical quotas [Papa 2003, pp 303-323].
Since the overall objective was to shape the image of modern countries and territories, there was a tendency to establish which tools were best suited to specific political and military requirements.
The crucial visual changes that occurred in the nineteenth century also benefited from the close relationship which developed between photography and

cartography thanks to the critical analysis of the photo-topographical method developed by Aimé Laussedat (1819-1907) [2]. This triggered a trend that was consolidated in the following century due to the increased number of details a camera can record compared to what can be visually retained by the human mind in the short time it takes to reconnoitre an area (we are now familiar with the physiological selection mechanisms of the human mind).
At the same time, map production increased steadily not least due to the invention of lithography, initially developed in the late eighteenth century by Aleis Senefelder and perfected throughout the nineteenth century. It allowed cartographers to gradually introduce colour and photography into their works, despite the fact that traditional etching techniques continued to be used in many maps [Brotton 2018, p. 363].
These technical developments allow us to identify two kinds of approaches in nineteenth-century maps: a more strictly codified technical approach, using zenithal projection, used to control the territory, and another approach focusing on production and design in order to broaden communication. These two approaches are objectively different in their appearance and features, but interconnected as regards spatial appropriation.
Which fundamental categories and which signs have to be used to satisfy these increasingly stringent requirements regarding representation?
Since the early decades of the nineteenth century, the business world understood the importance of strict codified cartographic representation, but at the same time had different communication requirements influenced by multiple economic and expansionistic situations.
In 1823 Carl Ritter, founder of the Geographical Society in Berlin, used the term *Kartograph*; its meaning was challenged in 1839 by Manuel Francisco de Barros e Sousa Santarém who maintained he had coined the term *Cartographia*. Whatever the case may be, the two terms were extensively used in the 1880s [Brotton 2018, p. 364].
The most recent definition of Cartography by the International Cartographic Association (ICA) states that "it is the studies and scientific, artistic and technical operations performed based on the outcome of either direct observations or the use of documentation to elaborate and prepare maps, plans, and other modes of expression, in order to revive the exact image of reality" [AA.VV. 2006, p. 5].

Fig.2. Plan of Paris and its suburbs showing the water distribution network of the river Ourcq. From: Génieys 1829.

Fig.3. Map of the Italian railway system, 1885. Bibliothèque Nationale de France.



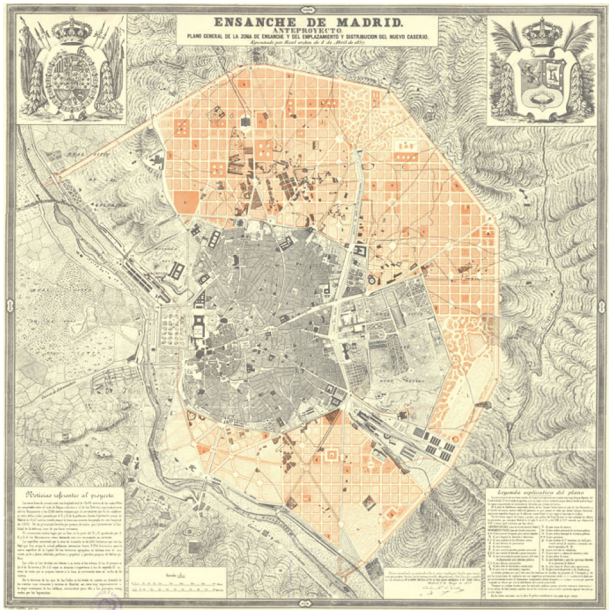


Cartography for urban expansion projects implemented internationally

The descriptive methods required to convey aspects of nineteenth-century urban expansion, construction of territorial infrastructures, and socio-economic patterns, needed to be coupled with the objective representation of places. So Europe began to move in this direction.
The images shown here reveal that cartouches, elaborate frames, and their aulic corollary all disappeared, replaced by more streamlined representation; the objective was to enhance communication which is often the synthesis of images, on different scales, explanatory legends, or statistical data. Whoever reads a map can turn a graphic image into a verbal image thanks to the legend, the point of contact between two expressive mediums.
New forms of hypertext were tested; often they simultaneously turned the maps into an image and a language, merged in a network of multilevel relationships. The following is a very appropriate definition of these complex relationships: "The map is a highly complex supersign, a sign composed of lesser signs, or, more accurately, a synthesis of signs" [Wood, Fels 1986, p. 88].
The construction of infrastructures and, more specifically, the creation of transport networks, coupled with the hygienic-sanitary problems of bigger urban centres and the development of agriculture and industry, contributed to the dissemination of new drawing types, i.e., maps that quantitatively tackled specific topics such as expertises, land and water issues, and connections between human beings and goods.
Figures 2 and 3 illustrate the different modes of expression and synthesis regarding the size of the geographical area in question.
France was the first European country to have a national topographic map with a transverse Mercador projection on a 1:86,400 scale developed under the supervision of C.F. Cassini de Thury. Territorial representation was given a new boost under Napoleon Bonaparte as part of his military control and expansion project in which men and resources were to achieve the infrastructuralization and safety of French overseas territories.
Up until the nineteenth century the most common maps in England were tithe maps, i.e., landed estate maps with differing representation scales not in line with the standardisation required by the Ordinance Survey which, from the late eighteenth century onwards, drafted the country's

Fig. 4. D.A. Donnet, Planos de población, 1857. Instituto Geográfico National de España.

Fig.5. Plano de Madrid y sus contornos, 1896. From: Chías, Abad 2016.



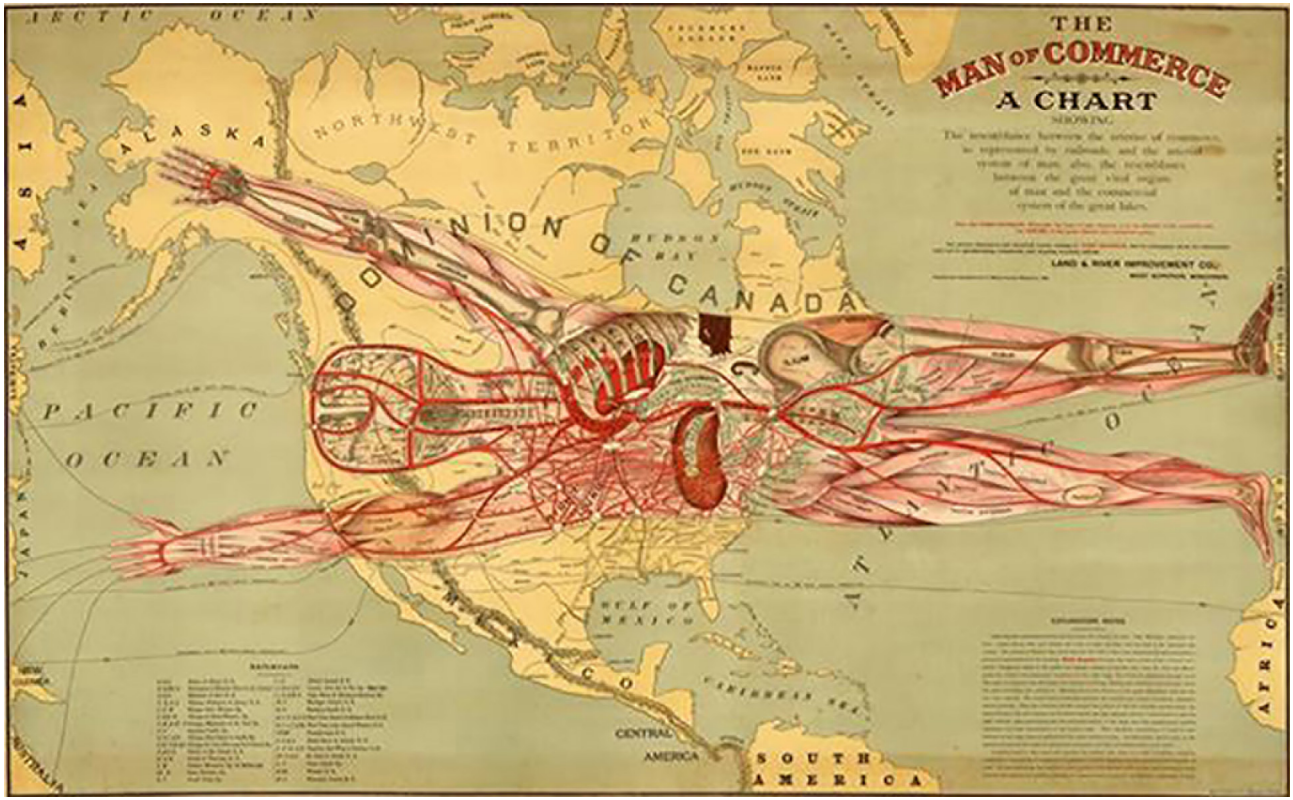


Fig.6. The Man of Commerce, 1889. University of Wisconsin Milwaukee Libraries. The outline map of North America is superimposed, with metaphorical objectives, by a cutaway diagram of the human body. <https://www.wdl.org/en/search/?collection=american-geographical-society-library-digital-map-collection#15658> (accessed 2019, August 8).

maps. Between 1842 and 1895, roughly 400 cities were mapped in various representation scales using inches and feet as their units of measurement.
During that period commercial requirements appeared to be a priority in the colonies, so while the Ordinance Survey used a complex, well-established system of land ownership and management, in the late eighteenth century the West India Company launched a systematic survey culminating in the Great Trigonometrical Survey. The undertaking was considered complete in 1843, but work continued for decades and, like Cassini's, never came to a well-defined end.

In Spain work on the compilation and publication of the Topographical Map of Spain was performed by a civil rather than military mapping organisation that based its work on the surveys performed in 1809 by Joseph Charles Marie Bentabole [Chias, Abad 2016, p. 279].
Unlike other western countries, this map was initially intended to be part of a much bigger mapping project that involved drafting a topographical map and general cadastre of Spain. The first sheet, number 599, corresponds to the city of Madrid and was published in 1875.
In the early nineteenth century Madrid had roughly 220,000 inhabitants; by the end of the century the figure

Fig. 7. Giovanni Amenduni 1884. General plan of the beach along the coast including the reclaimable districts of Ostia, Isola Sacra, the harbour, Camposalino, Maccarese and Pagliete. <http://www.luniversoeluomo.org/storia/maps-storiaRM.htm> (accessed 2019, September 4).

Fig.8. Carta topografica ed idrografica dei contorni di Napoli levata per ordine di S.M. Ferdinando 1°. Re del Regno delle Due Sicilie dagli ufficiali dello Stato Maggiore e dagl'ingegneri topografi negli anni 1817.1818.1819. Ministry of Public works, Reclamation, I series, f. 75.

had risen to 300,000. Since urban expansion was physically limited by the city walls, an enlargement project was drafted in 1860 and entrusted to architect Carlos Maria de Castro.
Based on the plan of Barcelona, the one for Madrid increased the surface area of the city from 800 to 2,300 hectares and envisaged the addition of an area around the original nucleus. This area was zoned according to its use: residential, industrial, military, recreational, and agricultural. The conventional colours used in the graphic image were then consolidated to highlight the pre-existing parts of the project.
During the second half of the nineteenth century modernisation speeded up in the Atlantic world and reached the apex of its ideological, cultural and political expansion. The divergent elements now intertwined with centuries-old elements of integration created a solid union between different communities and continents. The countries that still had enduring remains of the old regime borrowed strategies from former imperial establishments and, albeit with different rhythms and intentions, embarked on a policy of power, one which also exploited cartography [Leonhard, von Hirschhausen 2014].
The long cycle of Italian emigration to the New Continent ended in the late nineteenth century [Devoto 2007, p. 88]. In South America, and especially in Argentina, we can consider the knowledge-gathering process to have ended at the dawn of the twentieth century after long exploratory missions and scientific expeditions performed by several technical professionals who collected data and drew maps. At that time the Jesuits were also working on gathering data in less well-known areas of Latin America.
When the war of independence ended in Spain the Argentine government sponsored several exploratory missions in order to improve their knowledge of the nature and morphology of the country.
This project was further promoted in roughly 1870 when the National Academy of Sciences was founded in Córdoba; one of its objectives was to systematically explore and represent the country [Tognetti 2005, pp. 91-95]. Many Italians worked on this project, for example the en-

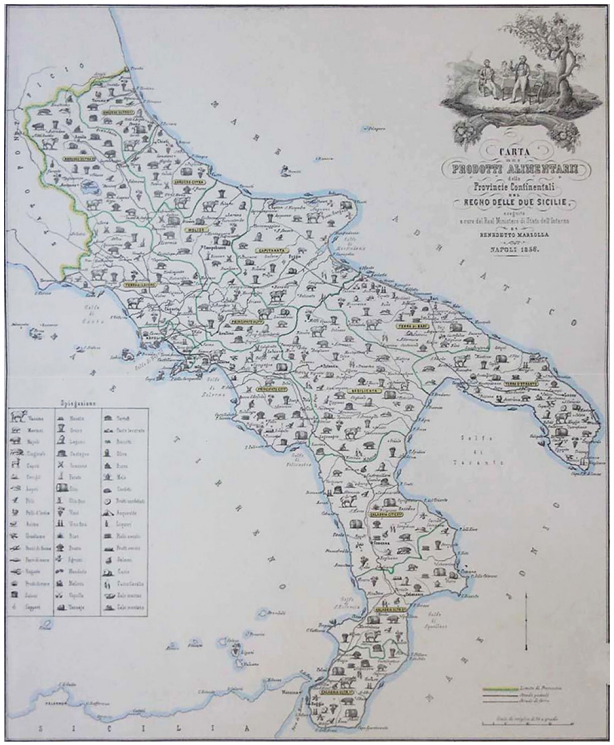


Fig. 9. Benedetto Marzolla. Map of the Food Products in the Continental Provinces of the Kingdom of the Two Sicilies, 1856. Naples, State Archive.

gineer Nicola Descalzi who was entrusted by the dictator Rosas to explore, amongst other things, the Colorado river along the border between Patagonia and the Pampas, an area where the Argentine army was fighting the Indios [Nocco 2014].
To integrate and subjugate men and places you first have to understand them, and to do so requires the use of statistical studies to test new descriptive methods.
The production of maps in Italy increasingly focused more specifically on the country's environmental problems: the flow of internal waterways and the associated problem of the formation of swamps in vast areas of the country. Reclamation was deemed to be the most important project to not only jumpstart agricultural and industrial economic growth, but also revive agriculture in what were considered unproductive areas, as well as clear land for potential urban expansion.
Given the importance of reclamation, in 1865 the Ministry of Agriculture commissioned the engineer Raffaele Pareto [3] to prepare a comprehensive report about the state of the country's agriculture prior to drafting ad hoc land drying projects. The study was to census and represent wetlands and swamps considered unproductive and harmful to public health (estimated at roughly one million hectares) [Pareto 1855, p. 57]. The study led to the promulgation of the Baccarini Law (1882) entitled *Regulations for the reclamation of wetlands and swamps* to which numerous thematic maps were attached.
The Map of productive resources drafted by Benedetto Marzolla was also dictated by the need to produce a description of food products. Marzolla was one of the most committed figures of that period, although very few studies have focused on his works. He exemplifies the dynamic activities performed throughout the nineteenth century in which men and machines were employed to not only tackle the new need for topographical or thematic information about places, but also draft design projects to improve people's living conditions, including experiments involving linguistic hybridisation and visualisation methods [Cardone 1993].
Benedetto Marzolla (1801-1858) was also a member of the Statistics Commission of the Kingdom of Naples set up by the Ministry of the Interior. This gave him access to an enormous amount of geographical data and territorial, economic and administrative information which he used to draft maps of the province of the Kingdom of Naples and elsewhere [Conti 2008]. The Map in figure 9 shows a very detailed view of the "natural" resources of the Kingdom using figurative symbols that were rather unusual for that period; they include realistic images of animals and food products, almost an anticipation of the descriptive, tourist-informative method that was to become widespread in the twentieth century.
The map provides an important instructive contribution, indicating crops no longer present in some areas of the country.
In the mid-nineteenth century maps of archaeological finds also became popular; their interesting expressive modes combined geometric rigour with attention to the landscape and variations of scale. In many cases this method produced effective, concise, thematic images, as in figures 10 and 11.

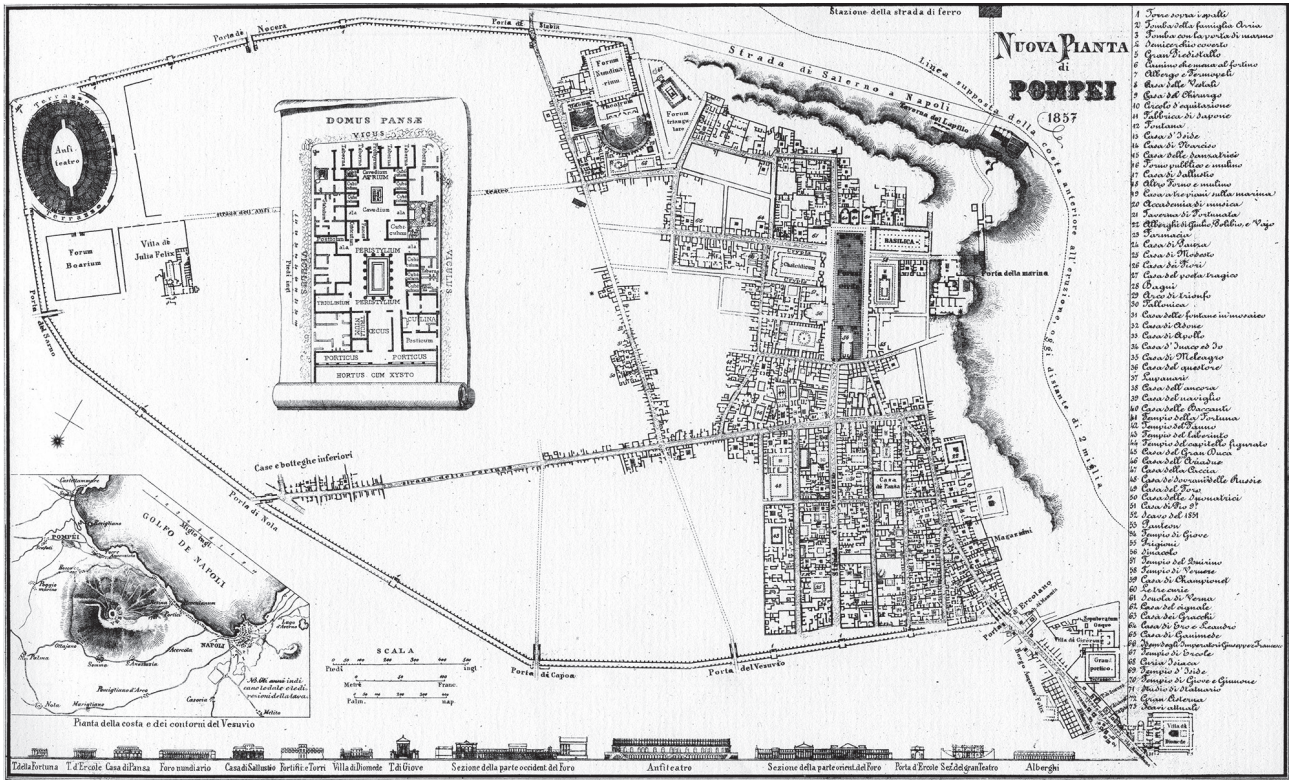


Fig. 10. New plan of Pompeii, 1857. In Atlante della Storia dei monumenti di Napoli e degli architetti che li edificavano, dal 1801 al 1851, by Camillo Napoleone Sas:so, Naples, 1858. Tab. XXII.

The future of memory

Of all the studies on old maps recently performed in various disciplinary fields, I find the ones illustrated in the book *The New Nature of Maps* by John Brian Harley [Harley 2001] to be particularly inspiring. In his book Harley also outlines what could be considered a new way of interpreting and deconstructing maps. He starts by criticising the concept of cartography as the expression of gradual technical abstraction; instead he states it is the product of social history and discusses the problem of power as an explanation for the map and its internal logic.
Cartography is undoubtedly a field in which the links between theories and the transmission of knowledge are expressed in forms that help describe the space of man and its transformations; this is achieved by using previously unexpressed communicative methods and by exploring the possibilities to coordinate, systemise and manage the different forms of data gleaned from the analysis and knowledge of places – the indispensable imperative basis behind a project.
In the last few decades the approach to urban and territorial representation has gradually evolved; it is currently possible to access families of data for every requirement and express functions exposed by the interactive potential of digital technologies and the web, so much so that a user can autonomously create an interactive map using a cartographic database. By interacting with the latter a user becomes part creator/inventor/designer. [Mingucci et al. 2013]

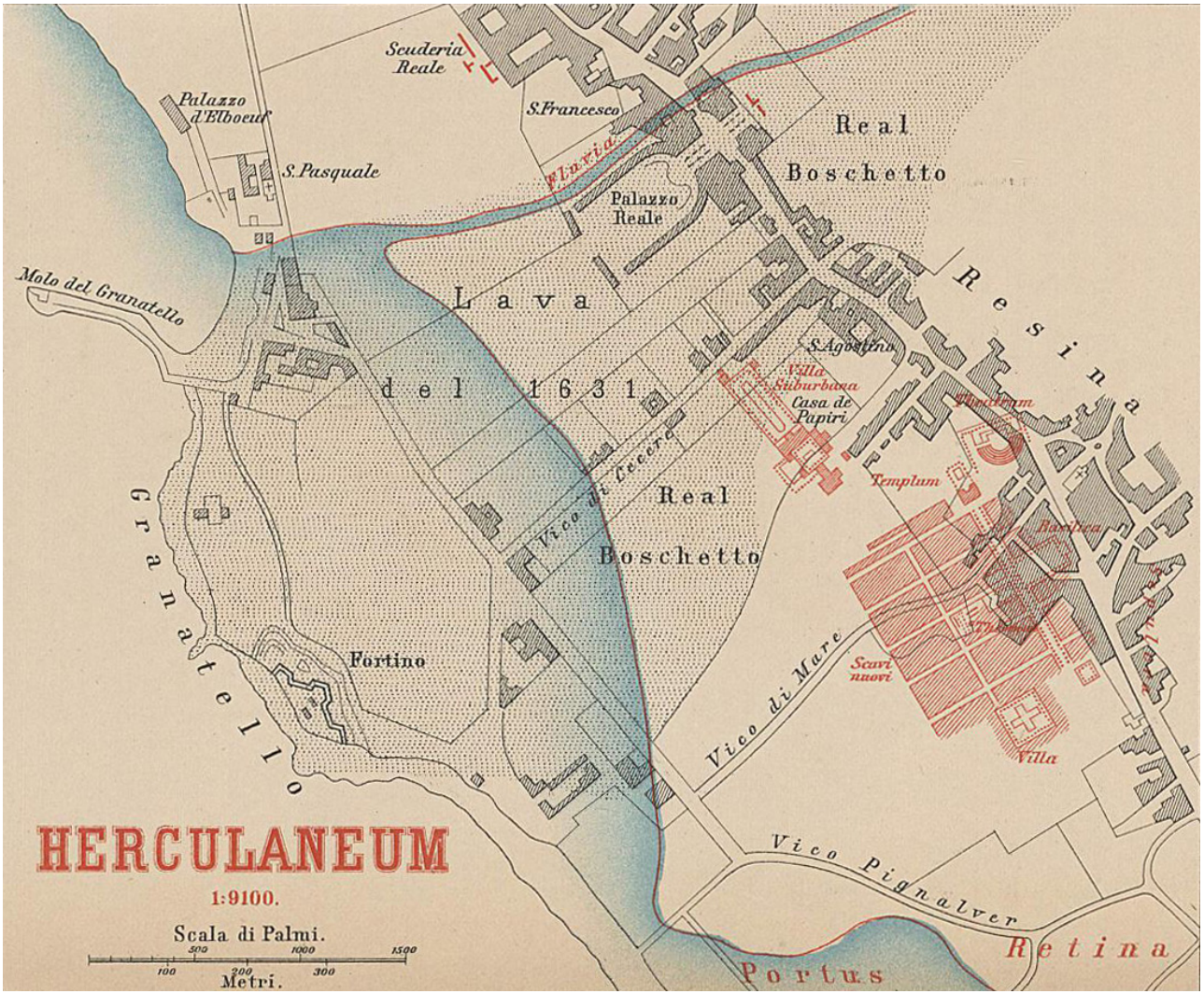


Fig. 11. Plan of Herculaneum. From: Beloch 1879.

This dynamic and interactive process is very different to past practices; it creates a clear-cut division between the person who produces the map and the person who reads it.
Relational multiform databases and geographical information systems –GIS– play a key role in this process: they can be used to file material, relate and analyse alphanumeric data, maps and images, as well as design and develop open access instruments that can be used to retrace the memory of places [Chias, Abad 2008].
This is the potential of geo-referencing which, associated with an analysis of the features of territories or, better still, of landscapes, exploits the representation of material and immaterial connotations.
Nevertheless, we should not ignore the construction of the data system that corroborates and substantiates not only the scientific validity of the whole process, but also the output drawings that have to transmit a coherent picture between what is physical and the cultural values that make up and define the represented contexts (fig. 12).
This is a stimulating operational and conceptual process if and when representation achieves the levels of expressivity required to spatially outline environmental and identity values which in turn delineate unexpected fields of action, also the result of certain nineteenth-century experiments.
Moreover the online dissemination of modern or old maps requires that a standard be adopted to establish these processes ranging from digitalisation to web sharing and copyright management and protection.

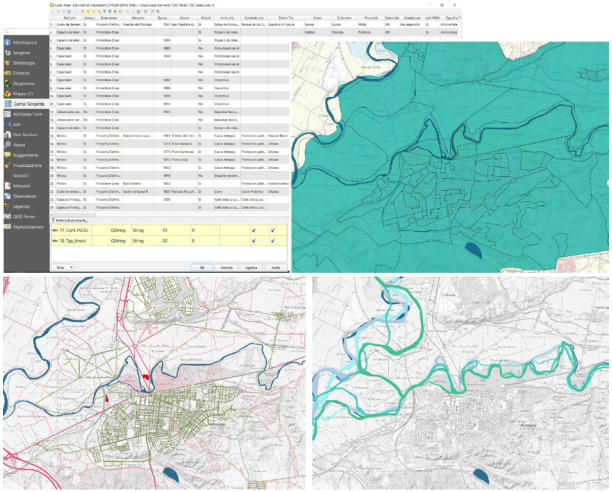


Fig. 12. Graphic output from the GIS comparing maps of the royal site of Aranjues created during different epochs. From: Fernandes 2019.

Conclusions

In this short and far from exhaustive article I have tried to show what old maps, especially nineteenth-century maps, can provide in terms of knowledge and how they can be used in in-depth disciplinary studies focused not only on cartographic analysis, the semiotics of representation and graphic signs, but also the interpretation-reinterpretation of the role of maps and their power of communication and persuasion.

These descriptive forms undoubtedly represent a cultural reservoir which remains almost untapped and waits patiently to be understandably analysed, interpreted, compared and disseminated. The studies performed in this disciplinary area have provided systematic and internationally-acknowledged results, i.e., with more episodic, but nevertheless inspiring goals, due also to innovative management information and communication technologies that can sustain and facilitate processes and searches that concentrate on connecting man and different places, eras, and expressive forms.
These studies also constitute a consistent heritage of knowledge which deserves to be disseminated more systematically so that as the studies progress, they produce new results and original inputs.

Notes

[1] The minutes of the meeting were published in issue n. 5 of the *Mémorial topographique et militaire* [Mémorial topographique et militaire 1803], the department of the *Dépôt de la Guerre*; the attached tables of conventional signs increased the number of signs previously used in topographical manuals.

[2] The report submitted by the captain of the military engineers, Laussedat, to the *Académie des Sciences* in Paris in 1860, implied that there was a desire to turn the photograph into a map; this should be considered as part of the trend involving technological changes that took place during that period. [Gemignani 2018]

[3] In 1877 the engineer Pareto became a 1st Class inspector of the civil engineering division and in 1882 was named member of the Permanent Committee of the Civil Engineering Division. He was also confirmed as a member of the National Council of Public Works.

Author

Lia M. Papa, Department of Civil, Building and Environmental Engineering, University of Naples "Federico II", lmpapa@unina.it

Reference List

AA.VV. (2006). *Linee guida per la digitalizzazione del materiale cartografico*. A cura del Gruppo di lavoro per la digitalizzazione del materiale cartografico. Roma: ICCU, Istituto Centrale per il Catalogo Unico delle Biblioteche Italiane e per Informazioni Bibliografiche.

Beloch, J. (1879). *Campanien: Topographie, Geschichte Und Leben der Umgeburg Neapels in Alterthum*. Berlin: S. Calvary & C.

Brotton, J. (2018). *La storia del mondo in dodici mappe*. Milano: Feltrinelli.

Cardone, V. (2018). Editoriale. In *diségno*, No. 2, pp. 5-8.

Cardone, V. (1993). Un rilievo giovanile di Benedetto Marzolla. In *Disegnare. Idee, immagini*, No. 6, pp. 17-24.

Conti, S. (2008). L'agroalimentare nel Regno delle Due Sicilie in una carta di Benedetto Marzolla. In N. Castiello (a cura di). *Scritti in onore di Carmelo Formica*, pp. 349-258. Napoli: Università degli Studi di Napoli "Federico II".

Chías, P., Abad, T. (2008). The GIS in an ancient cartography: A New Methodology for the online accessibility in the Cartographie Digital Librerie. In M. Ioannides, et al. (eds.). *VSMM 2008. Digital Heritage. Proceeding of the 14th International conference of Virtual Systems and Multimedia*, pp 125-130. Limassol, Ciprus: VSMM/CIPA/ICOMOS.

Chías, P., Abad, T. (2016). The Peninsular War 1808-1814: French and Spanish Cartography of the Guadarrama Pass and El Escorial. In E. Liebenberg, I.J. Demhardt, S. Vervust (eds.). *History of Military Cartography*. Cham: Springer.

De Dainville, F. (1959). De la profondeur à l'altitude. Des origines marines de l'expression cartographique du relief Terrestre par cotes et courbes de niveaux. In M. Mollat (éd.). *Le navire et l'économie maritime du Moyen Age au XVIIIe siècle*, pp.195-209. Paris: Sevpen.

Devoto, F.J. (2007). *Storia degli italiani in Argentina*. Roma: Donzelli.

Fernandes, V. (2019). *Siti storici e paesaggi fluviali. Strategie e strumenti per un progetto di valorizzazione: El Real sitio de Aranjuez*. Tesi di laurea magistrale in Ingegneria Edile-Architettura, relatori proff. L.M. Papa e P. Chías Navarro. Università degli Studi di Napoli "Federico II".

Gemignani, C.A. (2018). Dalla foto alla mappa: innovazioni tecnico-scientifiche, continuità e rivoluzioni visive nel secondo Ottocento. Spunti preliminari. In A. Guarducci, M. Rossi, (a cura di), *Storia della cartografia e cartografia storica*, pp. 88-94. Bologna: Patron.

Génieys, M. (1829). *Essai sur le moyens de conduire, d'elever et de distribuer les eaux*. Parigi: Carilian-Goeury.

Harley, B. (2001). *The New Nature of Maps*. Baltimore and London: The Johns Hopkins University Press.

Leonhard, J., von Hirschhausen, U. (2014). *Imperi e stati nazionali nell'Ottocento*. Bologna: Il Mulino.

Mémorial topographique et militaire (1803), *5. Topographie*. Parigi: Imprimerie de la République, pp. 1-64.

Mingucci, R. et al. (2013). Modellazione e progetto urbano: applicazioni e prospettive per i GIS. In *Disegnarecon*, Vol. 6, No. 11, pp. 11-20.

Nocco, S. (2014). Conoscenza e rappresentazione del territorio argentino tra il XVI e i XIX secolo: missionari, cartografi, esploratori. In *RiMe, Rivista dell'Istituto di Storia dell'Europa mediterranea*, No.12, pp. 181-183.

Papa, L.M. (2003). La cultura del disegno nella formazione dell'ingegnere. In A. Buccaro, S. D'Agostino (a cura di). *Dalla Scuola di Applicazione alla Facoltà di Ingegneria*, vol. I, pp. 303-327. Benevento: Hevelius.

Pareto, R. (1855). *Irrigazione e bonificazione dei terreni*. Milano: Stabilimento Saldini editore.

Rossi, L. (2018). Ancora sulla rappresentazione del rilievo. La centralità francese e un precoce caso italiano (sec. XIX). In A. Guarducci, M. Rossi, (a cura di), *Storia della cartografia e cartografia storica*, pp. 70-79. Bologna: Patron.

Tognetti, L. (2005). *Explorar, buscar, descubrir. Los Naturalistas en la Argentina de fines del siglo XIX*. Córdoba: Universidad Nacional de Córdoba.

Valerio, V. (2014). La rappresentazione della montagna nel XIX secolo tra scienza e imitazione della natura. In E. Dai Pra' (a cura di). *Approcci geo-storici e governo del territorio*, vol. 2, *Scenari nazionali e internazionali*, pp. 75-92. Milano: Franco Angeli.

Valerio, V. (1993). *Società, uomini e istituzioni cartografiche nel Mezzogiorno d'Italia*. Firenze: Istituto Geografico Militare.

Wood, D., Fels, J. (1986). Designs on signs/myth and meaning in maps. In *Cartographica. The International Journal for Geographic Information and Geovisualization*, Vol. 23, No. 3, pp. 54-103.

Town

From the Historic City to the Historicized City: Reflections on Several Studies on Urban Form Conducted in the Last Century

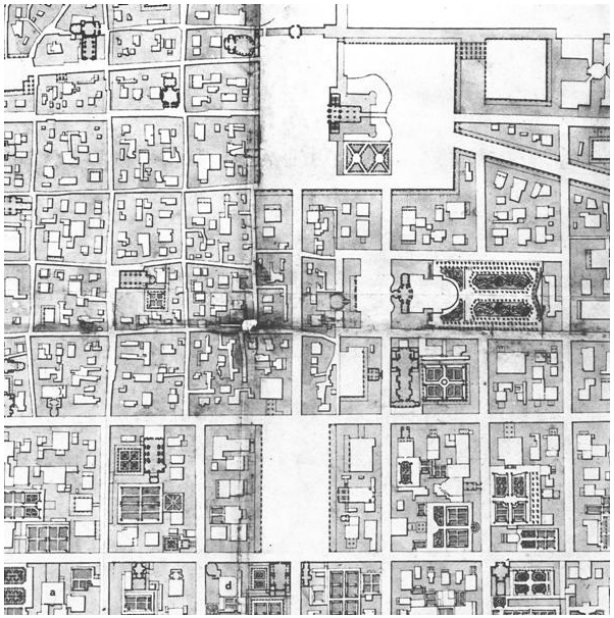
Dino Coppo

The following reflections refer to a few studies on the urban form of Turin whose research methodology was based on the identification of a hierarchy of values characterizing the investigated reality and on the definition of a graphic language suitable for the representation/communication of the results achieved.

The historic city

The concept of the historic city, in the 1960s, was linked to the size of the pre-industrial city that had developed within fortified walls as a product of an urban planning/architectural culture that had operated with continuity of intent within a system of morphological and structural invariants while entailing, within itself, a set of variants tied to the succession of architectural styles, construction techniques and technologies, and functional and political motivations.
In an essay written in 1993, Cesare Macchi Cassia stated that the formal value recognized to the historic city can be grasped at three fundamental levels: "at the level of the fundamental structure of the city, of its ground plan, at the typological level as well as the stylistic level, that is, at the level of the language with which the pieces of the city express themselves. The form at the urban level has the purpose of rigidly identifying the structure on which every other aspect of the image of the city rests, allowing the successive formal levels, both typological and stylistic, all the variety, diversity and flexibility that has always been one of the fundamental arms for the quality of the city of the past. A strong differentiation of the pieces, of the image of the pieces within a strong order, a strong significance of the fundamental system" [Macchi Cassia 1994, p. 75].

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.



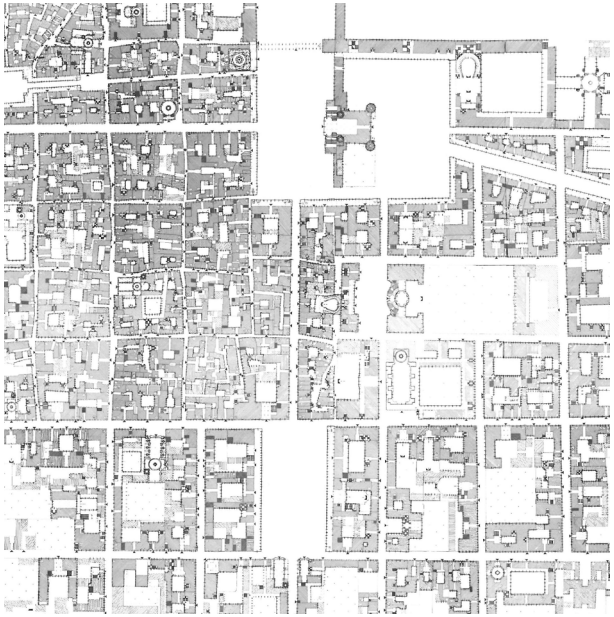


Fig. 1. Excerpt from the Copia della Carta dell'Interiore della Città di Torino, drawn up around 1763. AST, Maps for A and B. The map represents the state of construction of the urban fabric showing the public buildings, porticoed passageways and gardens as elements characterizing the image of the city.

Fig. 2. Excerpt from the map of the conjectural philological survey in the last quarter of the eighteenth century of Baroque Turin, from AA. VV. 1968. The map bearing the UNI 7310 standard number was constructed through the direct survey of the existing building fabric and the reconstruction on archival documentation of what was demolished and replaced in the last two centuries. The specially developed graphics shows the spaces and buildings for public use on the volumetric consistency of the urban fabric, the profile of the skyline and the morphological conformation of the individual blocks.

The cultural attention devoted to the history of cities in the 1960s was very strong. Saverio Muratori, in Rome, conducted research on the urban form of the capital, Paolo Maretto in Venice had begun a major work of urban survey taking in the entire historic center, Luigi Vagnetti worked on the historic center of Genoa. Along with them, other scholars in Italy focused their interests on the morphological structure of cities in order to identify regulatory aspects for their recovery. Augusto Cavallari Murat had set up a research group within the Istituto di Architettura Tecnica of the Politecnico di Torino with the aim of developing research and studies on the urban form of the Savoy capital, comprehensive of a survey campaign of what was then identified as the historic center, namely, the city that had been formed within the perimeter of the Baroque-period walls before their dismantling in the Napoleonic era. The research group in Turin, of which I was a member, was in constant contact with a celebrated historian of urban planning, the French Pierre Lavedan, with whom interesting confrontations were woven on the values characterizing the urban planning of the city in the Baroque period and on their hierarchy, in order to identify the methods of investigation, as well as methods for the graphic restitution of the results obtained. In addition, the aim was to point out the methods and timing of the entire construction period, selecting the main stages of implementation from within it. "It is wrong to consider the living city formed over the centuries as being similar to a geological stratification, because every age erases the pre-existing one, sometimes reusing its materials and construction elements. However, by making a conjectural note of the building consistencies on various pieces of paper and superimposing them, the living city virtually becomes a city stratified in stages, at different times… Architectural survey is no longer that im-

mediate, traditional work with maps and paper; rather, it thus becomes painstaking lab work: the work of subsequent scrupulous transfers and meticulous elaborations, controls, conjectures and experiments" [Cavallari Murat 1968b, p. 114].
It was therefore necessary to develop a research method capable of constructing, through a series of investigations (direct survey, archival research of historical documentation, both illustrated and not, historical-bibliographical research), a reality that today is no longer totally present, since the aim was to represent, with the means available at the time, the urban form that characterized Turin at the end of the 18th century, considered, as mentioned above, a completed form of a city that starting from its Roman origins in Imperial times had assumed the dignity of national capital through the coordinated work of urban planners/architects active between the second half of the sixteenth century and the end of the eighteenth century (Vitozzi, Carlo and Amedeo di Castellamonte, Guarini, Juvarra, Planterj, Alfieri, Vittone…) with a precise strategic and cultural vision. The main difficulty was also that of finding a set of graphic works capable of visually recreating the characteristics of the urban form object of the research. A first important reference was undoubtedly the historical cartography elaborated in the Baroque period. Substantially, however, this cartography was constructed on a hierarchy of pre-established values: in practice, the ground floor plans of what were considered architectural emergencies of particular artistic interest or representative of the different powers (political, religious, welfare, military) present in the city on the undifferentiated basis of the built context were represented through precise graphic simplifications. Some of the research being carried out in the 1960s, on the other hand, was directed towards the recreation of the ground floor plan of all the building "cells" making up the urban fabric, through a laborious assembly of the relative cadastral maps verified –I hope– on site and redrawn with the usual methods of architectural drawing. Cavallari Murat thought otherwise. "Urban planning is one of those arts that require an adequate conventional schematization: it is easy to recognize, at the current state of development of concepts about the historic districts and their characterization, how necessary it is to outline a scheme of the urban scene. The drawing of monumental urban survey must increasingly aim at simplification, normalization and economic reproducibility. It is therefore not only drawing, but also an annotation of the most varied research involving every manner of extrinsic expression of an elementary critical thought […] Where the intervention of the art critic is necessary, a conventional symbolic schematization of reality is required, leading it back to its immaterial essence. Moreover, this means that a conventional remodeling is necessary whenever an interpretation of thought as a scientist and not as an executor intervenes […] The surveyor of the historic district will be able to dominate his own ambition by knowing how to limit, in the graphic dictation, those means of representation that are most useful

Fig. 3. Excerpt from the Conjectural Philological Survey map from AA. VV. 1968. The map represents the morphological structuring of the urban fabric of the so-called Città Vecchia before the major urban restructuring interventions by the royal architects (A. Vitozzi, C. and A. di Castellamonte, G. Guarini, F. Juvarra, B. Alfieri, G. Planterj…) for the purpose of giving Turin the magnitude of a national capital.

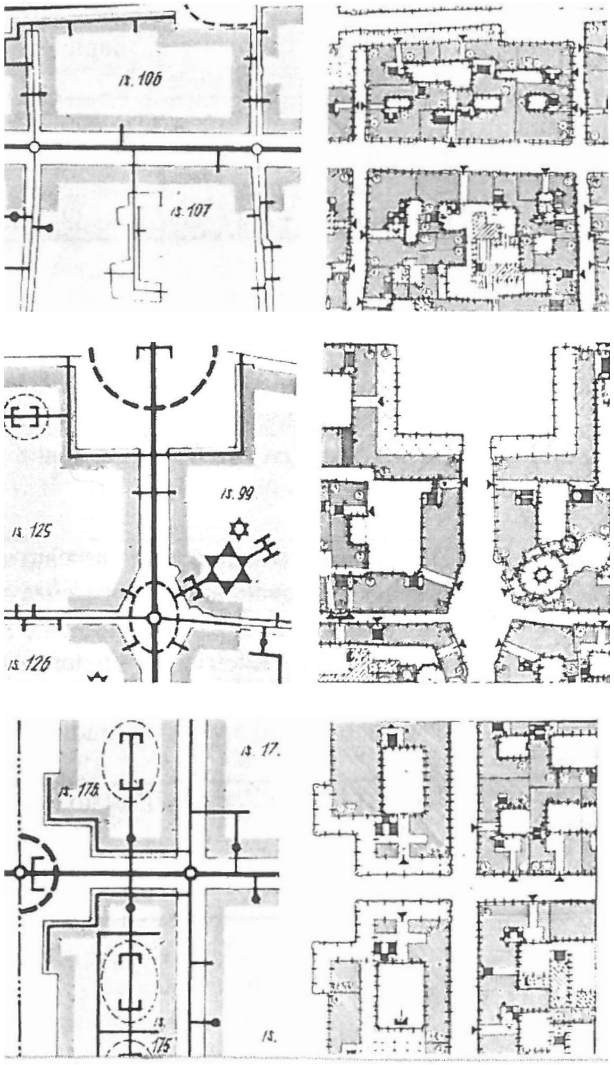


Fig. 4. Conventions and symbols of the maps illustrating the urban and architectural connections in the environmental complexes characteristic of Baroque Turin.

in the urbanistic aim proposed, having no scruples about referring further surveys with more precise goals to future users" [Cavallari Murat 1968b, p. 115].
With these theoretical premises, a campaign of research regarding different disciplinary fields (history, urban planning, survey) was conducted, which led to the construction of the urban reality investigated with a conventional graphic language constructed on iconographic and symbolic elements and which was then accepted as a method of reading and interpretation of urban realities of other historic centers. The so-called "conjectural philological survey" had, as already mentioned, the purpose of recreating, with a series of maps drawn up on a scale of 1:1000, an urban reality at a precise historical moment taken as a hypothesis of its greater stylistic and formal completeness. This experience, which lasted about four years, was the first indispensable moment of theoretical research, an essential basis on which it was possible to construct subsequent experiences of applied research, with different operational goals related to a conception of the project as an interrelated process between cognitive and decision-making moments. The whole of the graphic conventions elaborated were structured in a *corpus* in accordance with the UNI 7310 standard, *Convenzioni e simboli del rilievo urbanistico congetturale di rioni storici* (figs. 1-5).
It should be noted that the survey campaign was not originally based on operations of metric survey of a specific instrumental accuracy. The ground plan of the individual building cells making up the urban fabric was constructed, based on the topographical map of the Municipality of Turin compared with that of the Turin Land Registry of 1823. The survey on an urban scale was limited to the description of the public portion of all the building cells: from this point of view, the representation of the spaces for free circulation of public, private and service buildings was differentiated. In this way, a building cell was deconstructed into two parts: the spaces intended for circulation and for the performance of activities relating to the sphere of public life, and the spaces intended for private activities, the latter being filled in with a grid pattern. It should also be noted that over time, in the various experiences of studying the urban form of other Italian and European historic centers, the *corpus* of the graphic language adopted assumed the role of a method of reading/interpreting the various activities investigated. But in line with the concept that "a drawing that intends to be a critical schematization must be constantly renewed, born from a terrain fertilized by a tradition but at the same time a revival and surpassing of that graphic tradition" [Cav-

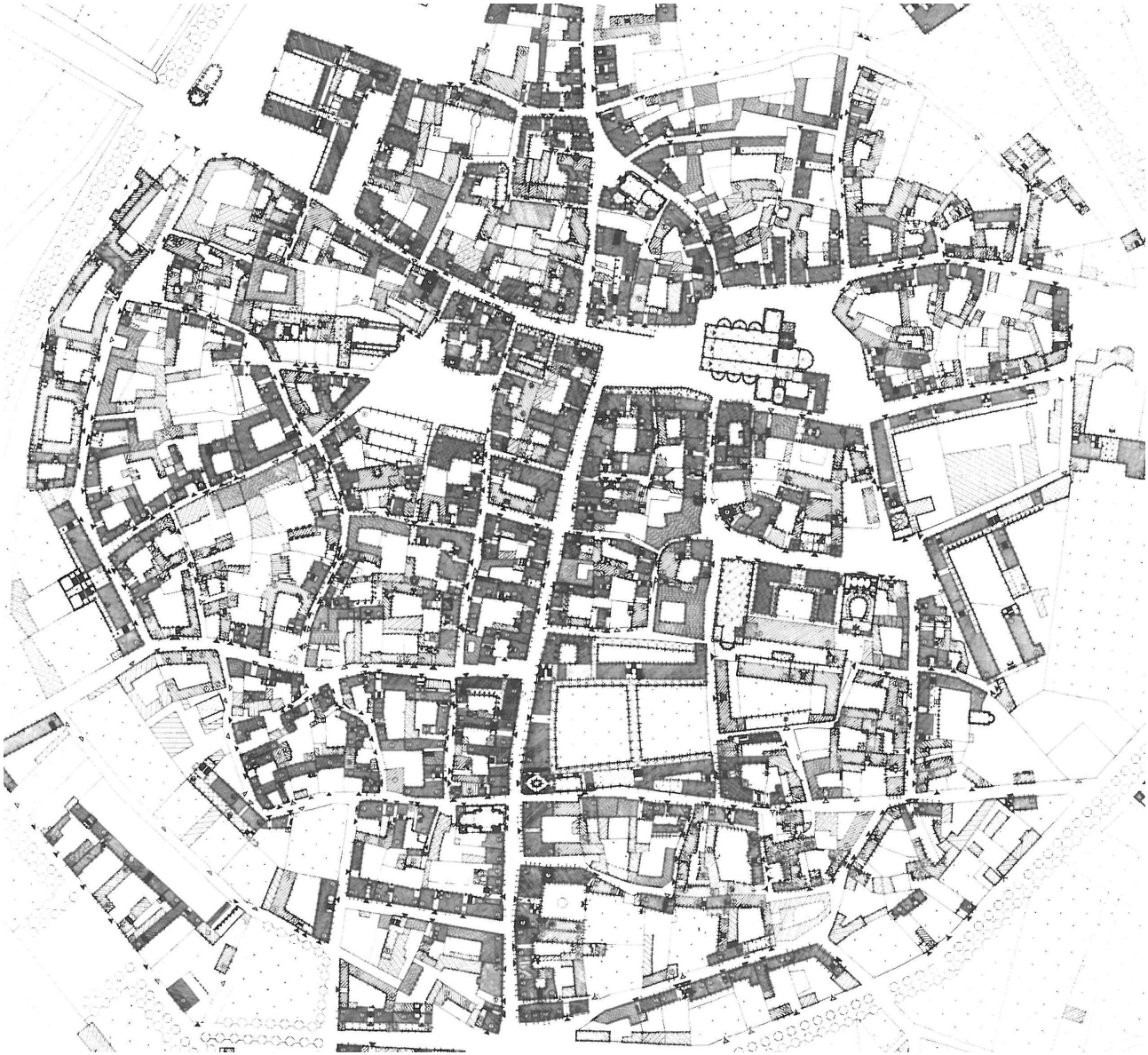


Fig. 5. Map of the city of Alba at the beginning of the 20th century drawn up on the basis of the UNI 7310 standard with the necessary variations developed according to the particular morphology of the urban fabric examined, with densely built-up areas along street fronts, but with a more porous structure, of rural derivation, in the suburban blocks.

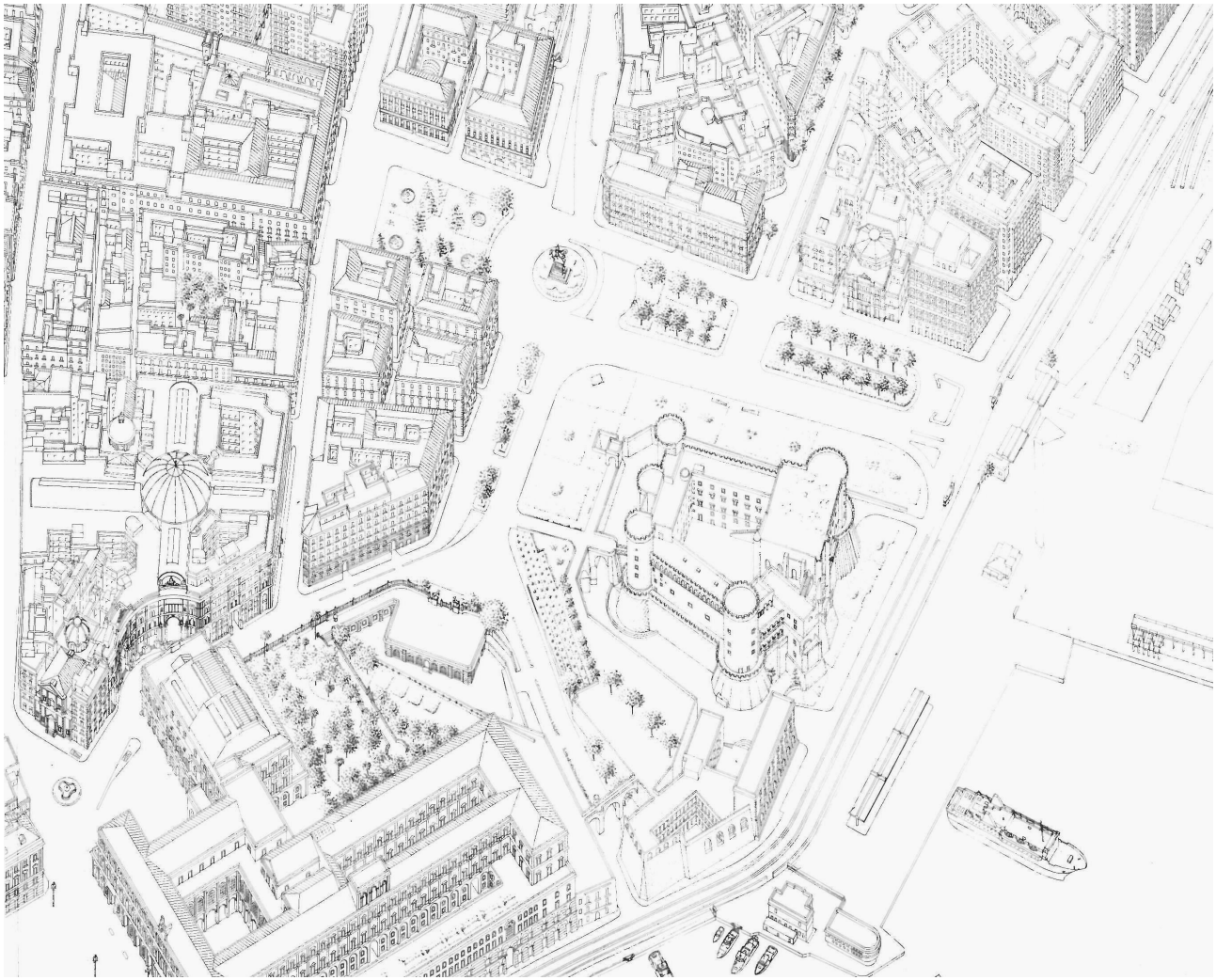


Fig. 6. Excerpt from the axonometric representation of the historic centre of Naples, from Baculo Giusti 1996. The representation of the architecture of the street fronts has been elaborated with special graphic conventions regarding the presence of decorative elements and building components.

allari Murat 1968c, p. 97], the body of conventions has been expanded and increased in relation to the formal consistencies of the individual urban realities investigated [Coppo 2010]. I would like to mention that an analogous, but different schematization of graphic conventions was elaborated in the 1990s by the research group coordinated by Adriana Baculo for the description of the formal structure of the street fronts in "*Napoli al 4000*," cornerstone and essential

cultural reference for all the three-dimensional models that have later been realized (fig. 6).
"The drafting of the abacus of signs derived from the categorical imperative dictated by the need to translate architecture into graphic signs, passing from the real life scale of 1:1 to the 1:1000 scale of the drawing, i.e. operating a reduction […], which in analytical-graphic terms allowed drawing each and every building with a few paradigmatic marks playing an explicit symbolic role capable of referring to a more complex reality. In order to complete a drawing of the city, it was necessary to oblige oneself to make a selection of the suggestions that the urban reality proposed and that the symbolic-graphic program demanded to neglect" [Baculo Giusti 1996, p. 10].

The historicized city

The image of the contemporary metropolitan city can be considered as the product of various operations of planning, construction and restructuring conducted over several centuries, very difficult to "block" in a specific historical moment, apart from cases of urban aggregates built from an urban plan and realized in the context of a society enjoying a happy socio-economic-cultural situation within formal unifying parameters, unchanged over time and still today recognizable despite an unavoidable level of obsolescence. The problem of the recognizability of the image of the contemporary city therefore acquires importance because today's cultural attention is strongly focused on issues of urban restoration and sustainability in terms of functional energy of the historical urban fabrics, with the consequent need to draw up regulations aimed at a form of protection that cannot be limited to bringing pseudo-ideal situations to a standstill, but must be oriented towards solutions consistent with the characterization of the individual urban fabrics. Proceeding in the study of the urban form of the contemporary city therefore implies the identification of individual fragments present each with its own historical, morphological and formal characterization, retracing the process of design and implementation in individual historical moments in which different cultures and motivations have left their mark on spaces and environments of life.
Another experience of research dating back to the 1990s, in Turin, is linked to the drafting of a series of thematic maps functional to the drawing up of the PRG, conducted by research groups of the Politecnico di Torino in collaboration with the design group led by architects Gregotti and Cagnardi [Cagnardi 1994]. This experience of applied research could only have been born from the previous pure research of the 1960s: in fact, in our field, we can speak of applied research only if we have previously operated in a line of research that imposes the problems to be addressed at the methodological level [Coppo 1994].
In this perspective, in fact, it is necessary to consider the results of the individual experiences proposed not as models that can be exported to other historical and territorial realities, but as terms of reference on which to construct, case by case, specific operational methods and choices.
In the case of Turin, the construction of a map relating to the formal structuring of the contemporary city has been studied in order to highlight fragments of urban fabrics in relation to the single process of historical generation so as to be able to set up a normative discipline functional to the protection of the single building cells within the relative historical and environmental context. For the present purposes, a historical environmental context can be defined as a set of urban spaces and reciprocally related buildings that together make up an environmental image characterized by stylistic, structural and historical components that are still evident and recognizable. In most of Turin's historical-environmental contexts, including the so-called historic center, these spaces now appear to be linked to each other and to the overall image of the "consolidated city," since each of them was intentionally studied and created in relation to the design and stylistic and formal characteristics, as well as to the functional, economic and political motivations of the individual design/construction period. These areas have also, of course, undergone subsequent interventions, renovations and renovations that may have partly changed the characteristics of the original plan. In addition, some of these interventions, also present in the historic city, are partially incomplete in comparison to the original project, but still testify to the character of process and continuous evolution present in most of our cities. Within each event, however, individual ideal moments can be identified which are always, and in any case, interrelated:
- phase of conception and planning of the intervention of urban expansion or restructuring from which the environmental context originated;
- phase of modification of the urbanistic project under construction;
- phase of realization of the urbanistic plan;

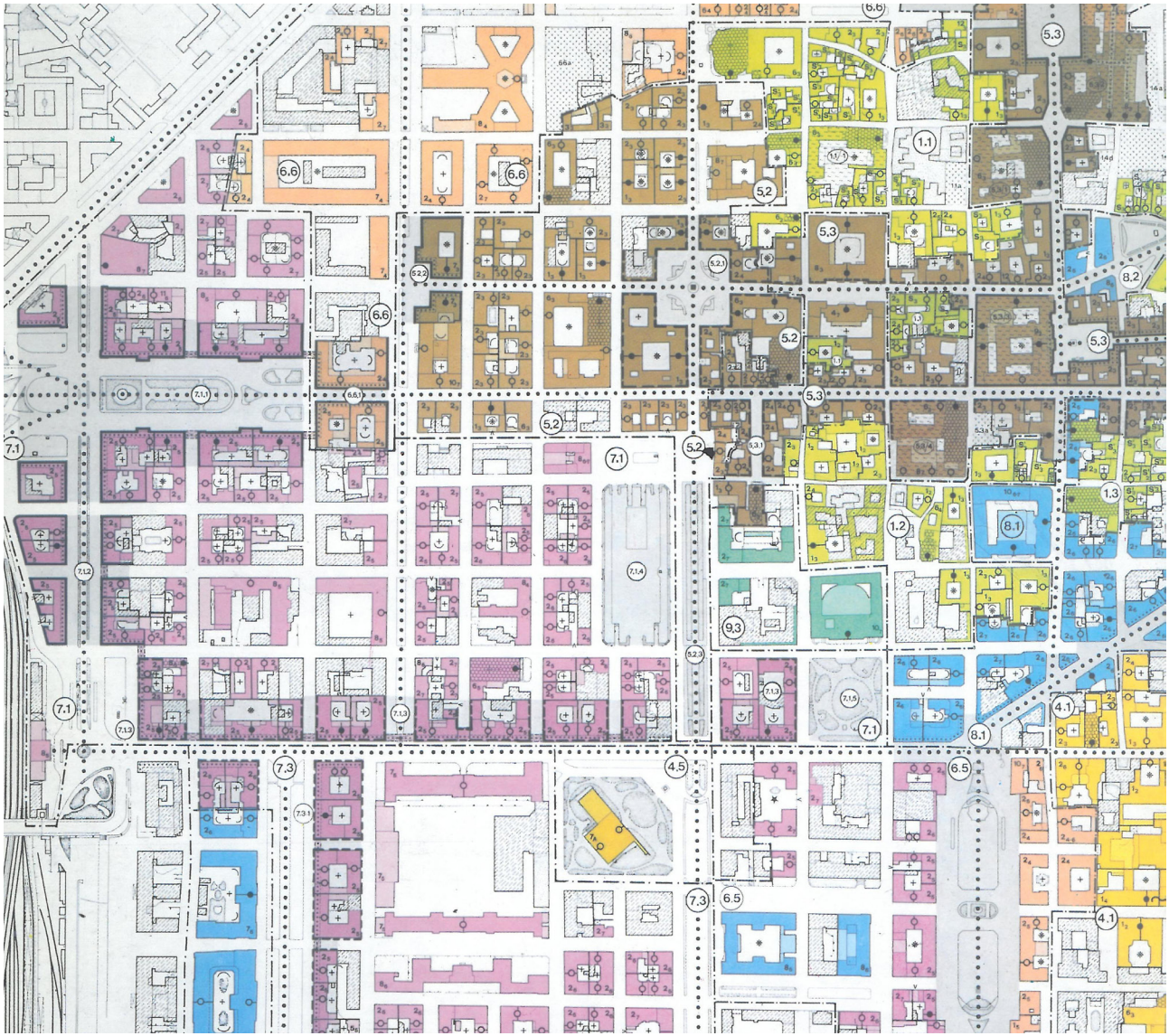


Fig. 7. Excerpt from the map drawn up by DISET for the Municipality of Turin, for the purpose of drawing up the 1994 General Regulatory Plan. The urban fabric of cultural and environmental interest is highlighted by the areas filled in with colors or patterns representing the period of the expansion or transformation plan; the black borders identify the fronts of streets or squares of uniform architecture or realized according to specific regulations. Seen inside the buildings, there are spaces (hallways, stairs, courtyards…) of particular architectural value or used as connections in the morphological and formal structure of the blocks.

- phase of rehabilitation and modification of buildings and urban spaces up to the current physical consistency.
Within the areas of the individual environmental complexes identified a number of annotations were reported, including:
- Identifications referring to the volumetric conformation of the urban fabric highlighted with the color related to the aforementioned context;
- indications referring to the nature and the construction events of the individual building cells;
- indications referring to the presence of detailed plans;
- indications relating to the presence of the principal routes constituting links between public and private space;
- indications relating to the organization of courtyard and garden spaces;
- indications relating to elements characterizing public spaces and pathways: main axes of the urban form, covered porticoed walkways, façades overlooking public spaces of unitary architecture or that meet specific urbanistic regulations.
The maps showing the complexes thus identified were drawn up on a scale of 1:2000 on the basis of the representation of the building volumes within the boundaries of the individual lots (fig. 7). The modes of representation were studied in function of the immediate visual restitution of the different categories of complexity investigated, on an iconographic basis so as to be used as a support for the study of regulatory hypotheses.

On the subject of urban survey

The experiences presented, dating back to the last half century, were characterized by the invention of a graphic language constructed in relation to knowledge projects, strongly characterized but united by a homogeneous research methodology. Today the technical and technological

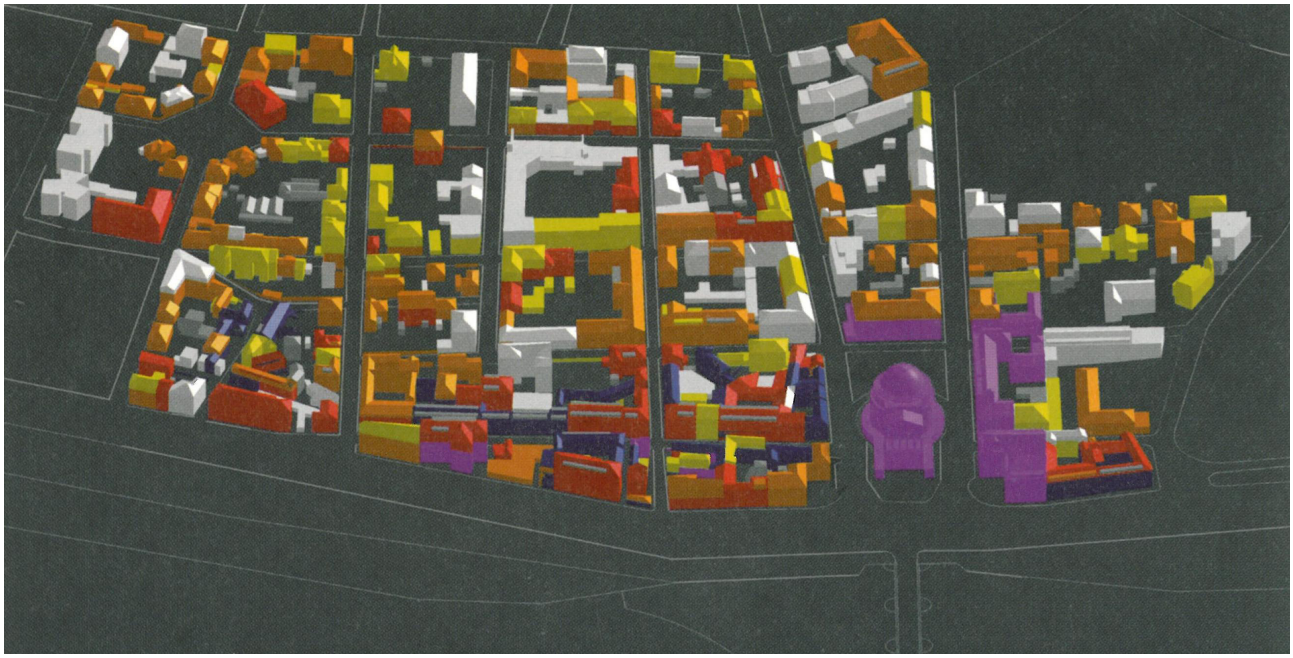


Fig. 8. Axonometric view of the 3D model of the current building consistency of the Borgo Po district in Turin, with identification of the individual periods of urban development in AA. VV. 1999.

Fig. 9. Excerpt from graphic documents related to the presence of the open-air market in the historic center of Cuneo. The data collected and represented are intended to permit the understanding of the spatial relationships between the components of the street market and fixed shops, the architectural conformation of the porticoed space and the identification of the pavements. In Coppo, Osello 2007.

landscape in the field of both survey and graphic language has substantially changed and the different digital techniques and technologies in use are constantly evolving. It seems to me substantially useless to retrace the different experiments carried out in specific studies on many urban areas based on the use of three-dimensional models and the construction of databases, linked to the methodologies of GIS systems. Such experiences not only translate into territorial information systems or urban information systems sets of data that are not only spatial, but that also informatically integrate data that are typologically dissimilar, becoming the main portal for sharing and exchanging information, also for decision-making purposes [Boido 2010]. As I have already mentioned, a fundamental experience in this context is represented by Adriana Baculo's *Napoli nel database*, dating back to the early 1990s, grafted onto the three-dimensional view of the city, but still constructed with the traditional techniques of manual drawing. Today, the three-dimensional models created with the use of "out-of-scale" computer tools are exquisitely iconographic in nature and the transition between the scale of architectural knowledge and the urbanistic scale often takes place only with a scalar reduction, without a rethinking or a definition of the contents of the different disciplinary fields. So, if the contents of our now ancient research can still be at least partially a subject of interest, what added values can the renewal of IT techniques provide? The first and main one is that of dimensional precision connected with the construction of a three-dimensional model of the volumetric consistency of the urban fabric in its current situation. On this basis, the representation of the transformations undergone over time, constructed backwards in accordance with historical research and archival documentation, requires only the need to adapt information of "qualitative" and not quantitative level to the basic three-dimensional model. The various experiments carried out in some thematic studies (*Il disegno dei portici a Torino*, *Il disegno di luoghi e mercati a Torino e in Piemonte*) have, on the whole, produced quite satisfactory results (figs. 8, 9).
More interesting, instead, would be an experiment aimed at translating into three-dimensional terms the hierarchies of values on which the UNI 7310 standard was constructed. The work of translating the geometric conformation of architectural spaces into three-dimensional models (covered walkways, hallways, staircases, vaulted systems of churches and public buildings…) would, however, not only require geometric schematizations of the buildings characterizing these spaces, but –I believe– also the invention of a special graphic language that could lead to a critical re-reading of the spatial conformation of the buildings being studied. And on the control of the informatic weight of this body of readings we could set up a different way of connecting the single bits of information.
Today, the construction of database systems, I believe, is no longer a problem: the difficulty, if anything, is that of choosing the type of information to be taken into consideration, since it relates to the system of knowledge linked to the regulatory system of reference [Novello Massai 2002].
The state of the art of many of the topics dealt with, especially in the field of three-dimensional modelling and construction of databases, has been extensively investigated in the proceedings of the 37th International Conference of Teachers of the Disciplines of Representation, *Drawing & City*, of 2015. In particular, with regard to the built city, the presentation by Pina Novello and Anna Marotta reiterates the need to "identify and build stratifications, transformations, changes with integrated, traditional and innovative methodologies. It also means recognizing the connections

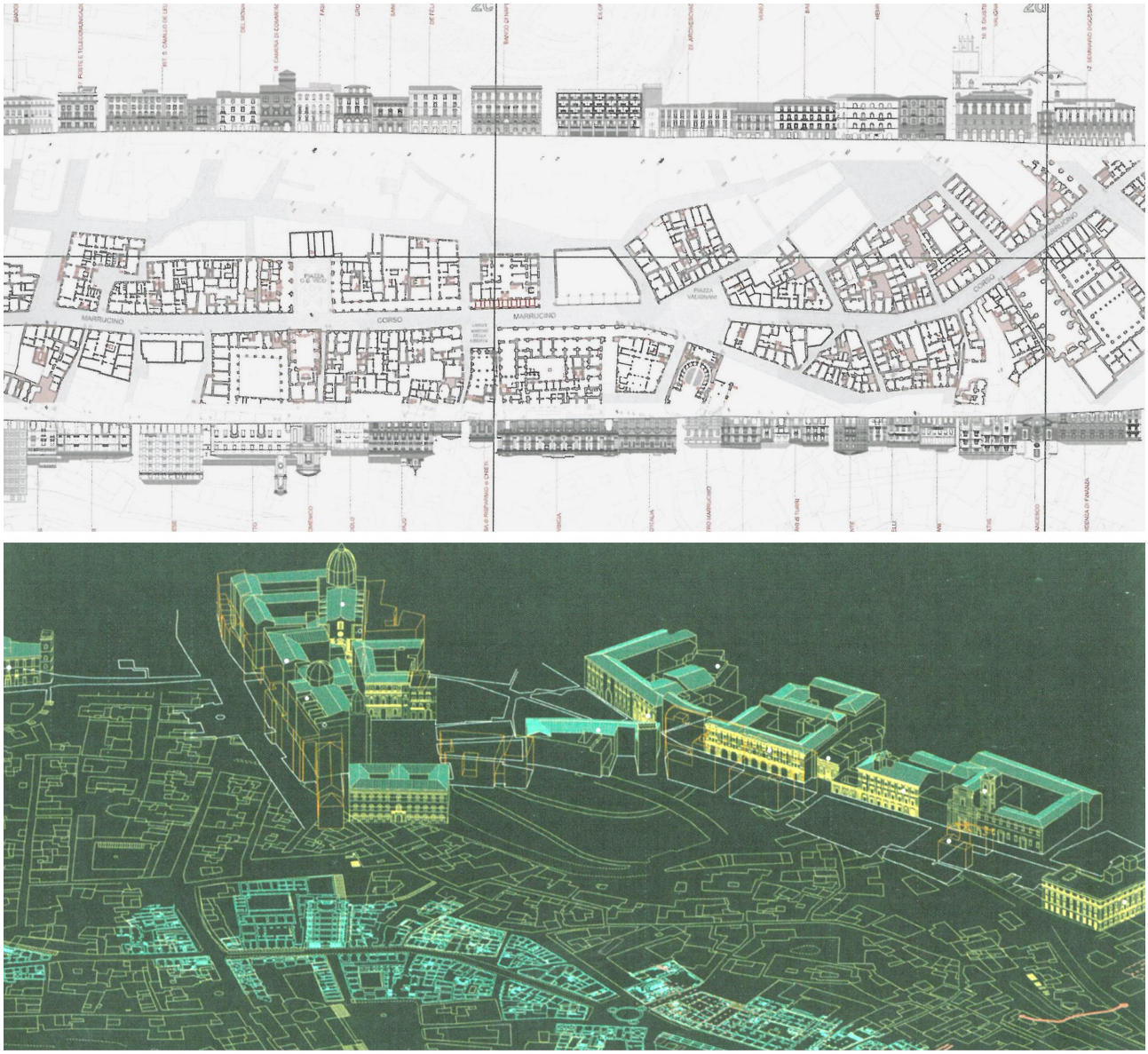


Fig. 10. Representation of a portion of the urban fabric of the city of Chieti, comprehensive of ground-level plans, street front elevations, axonometric model., in Bizzotto, Mezzetti, Sardo 2009.

characterizing the relationship between urban components –fabrics, artifacts, materials and their environmental context– to highlight old and new strategies aimed at the sustainability of feasible interventions, with attention also paid to natural components" [Novello, Marotta 2015, p. 1]. Once again, attention is focused on the definition of the contents that research in the field of urban form must have as a first hypothesis for the definition of the line of research; the great and varied means provided today by computer systems and the now generalized mastery of three-dimensional modeling systems for the construction of virtual realities and dynamic readings can only prefigure goals once unimaginable. The research of the last century had produced as a final result maps drawn up with manual representations, logical and necessary translation into graphic language conceived as a result of a methodology of investigation based on the identification of a set of values characterizing, in a hierarchical order, the urban form examined. We have repeated it several times. The consequent symbolic schematization was necessarily linked to the scale of representation and left room for the necessary in-depth investigation of the building fabric at the level of specific urban contexts (squares, streets, infrastructure systems) to other levels of knowledge related to other scales of representation (fig. 10).
In my opinion, however, the work of correlating at a theoretical level the innovations related to the use of the most innovative IT tools to the specific interdisciplinary contents of urban survey still presents ample room for study.
Research in this field requires dedication, practice, and – why not?– financial commitment.

Author

Dino Coppo, Department of Building Engineering and Territorial Systems, Polytechnic University of Turin, dino.coppo@studiokb.it

Reference List

AA.VV. (1968). *Forma urbana e architettura nella Torino Barocca*, Torino: UTET.

AA.VV. (1994). *Idee e città incontri di urbanistica*. Parma: Finhaus s.r.l.

AA.VV. (1999). *Borgo Po, 1999. Un'esperienza di rilievo della trasformazione*. Torino: Editrice Levrotto e Bella.

Baculo Giusti, A. (1996). *Napoli al 4000*. Napoli: Electa.

Bizzotto, R., Mezzetti, C., Sardo N. (eds.). (2009). *Rappresentazione dalla formazione alla professione*. Roma: Edizioni Kappa.

Boido, C. (2010). Processi conoscitivi per la città e supporti di base dati multirelazionali. In Coppo, Boido 2010, pp. 188-194.

Cagnardi, A. (1994). Il Piano Regolatore di Torino. In AA.VV. 1994, pp. 93-106.

Cavallari Murat, A. (1968a) Evoluzione della cartografia urbana ed extraurbana. In AA.VV. 1968, pp. 97-141.

Cavallari Murat, A. (1968b). Simboli nelle mappe congetturali di rilievo nei tessuti cittadini. In AA.VV. 1968, pp. 115-141.

Cavallari Murat, A. (1968c). Problemi scientifici del disegno descrittivo. In AA.VV. 1968, pp. 97-99.

Coppo, D. (1994). Le problematiche di rappresentazione nei piani di recupero dei centri storici. L'esempio di Torino. In AA.VV. 1994, pp. 107-122.

Coppo, D. (2010). Iconografia e simbologia del linguaggio grafico nella rappresentazione della città. In Coppo, Boido 2010, pp. 30-46.

Coppo, D., Boido, C. (ed.). (2010). *Rilievo urbano. Conoscenza e rappresentazione della città consolidata*. Firenze: Alinea.

Coppo, D., Osello, A. (ed.). (2007). *Il disegno di luoghi e mercati in Piemonte*. Torino: Umberto Allemandi.

Macchi Cassia, C. (1994). La qualità del progetto urbanistico. In AA.VV. 1994, pp. 65-86.

Novello Massai, G. (2002). Verso un'evoluzione della rappresentazione. Media e non solo strumenti del rilievo urbano e territoriale per luoghi in trasformazione. In R. De Rubertis (ed.). *La città rimossa*. Roma: Officina Edizioni, pp. 205-215.

Novello Massai, G., Marotta A. (2015). Disegno&Città. In S. Bertocci, M. Bini (a cura di). *Disegno&Città. Cultura Arte Scienza Informazione*. Atti del 37° Convegno internazionale dei docenti della Rappresentazione. Torino, 17-19 settembre 2015. Roma: Gangemi Editore, pp. 23-24.

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

Chiara Vernizzi, Andrea Zerbi

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 imagery, 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

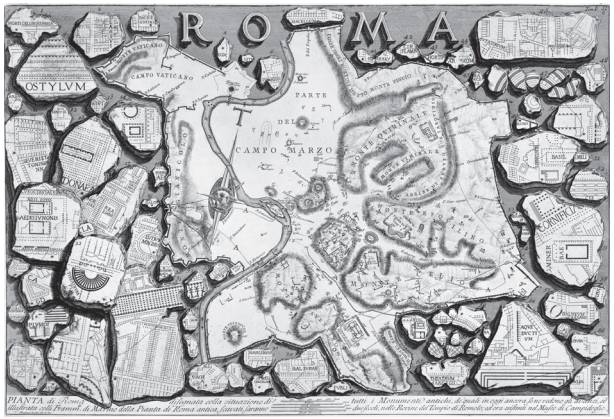


Fig. 1. G.B. Piranesi, 1756. "Pianta di Roma disegnata colla situazione di tutti i Monumenti antichi…" (Le antichità Romane, Tomo I, tav. II).

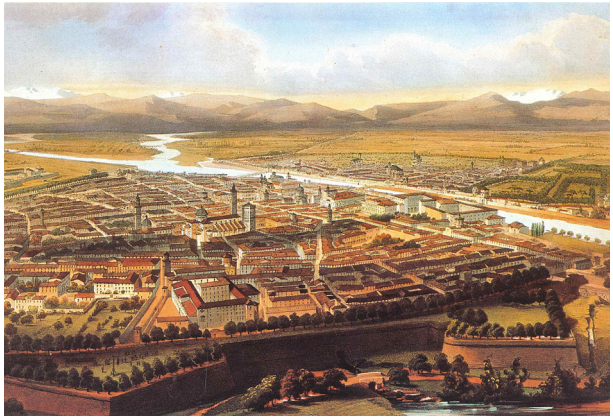


Fig. 2. A. Guesdon, 1850 ca. Lithograph of the city of Parma seen from the bastion of San Francesco (Parma, Collection of the Cassa di Risparmio Foundation).

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).

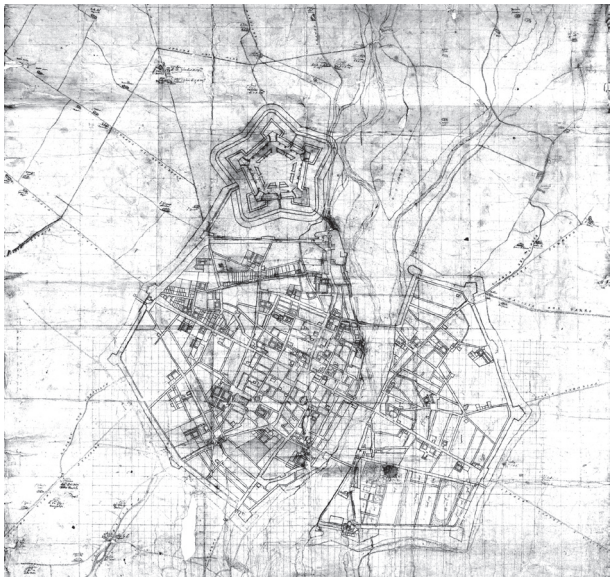


Fig. 3. S. Smeraldi, late Sixteenth century. Map of the city of Parma and surroundings (Archivio di Stato di Parma, Miscellanea).

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-

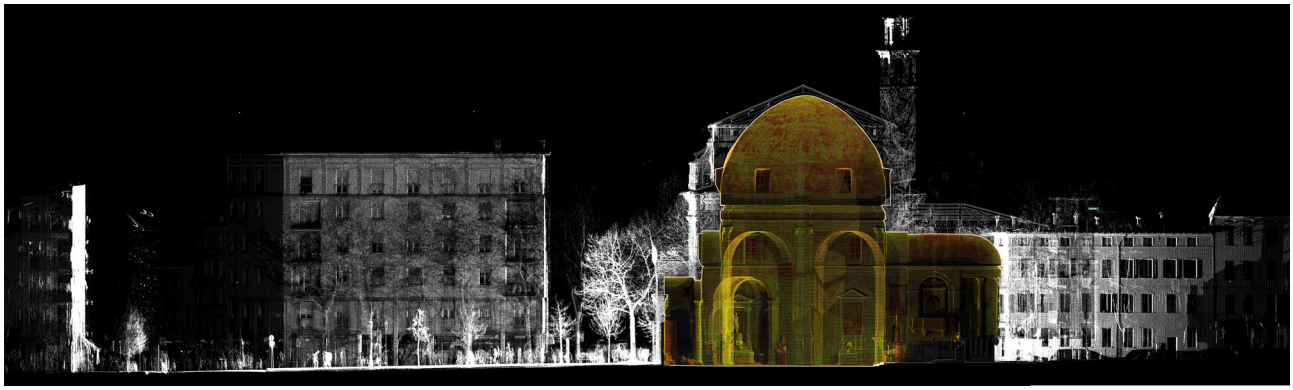


Fig. 5. The laser-scanner survey of the urban area of Piazzale Picelli in Parma, used for the analysis of the relationship between the church of Santa Maria del Quartiere and its surrounding area.

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-

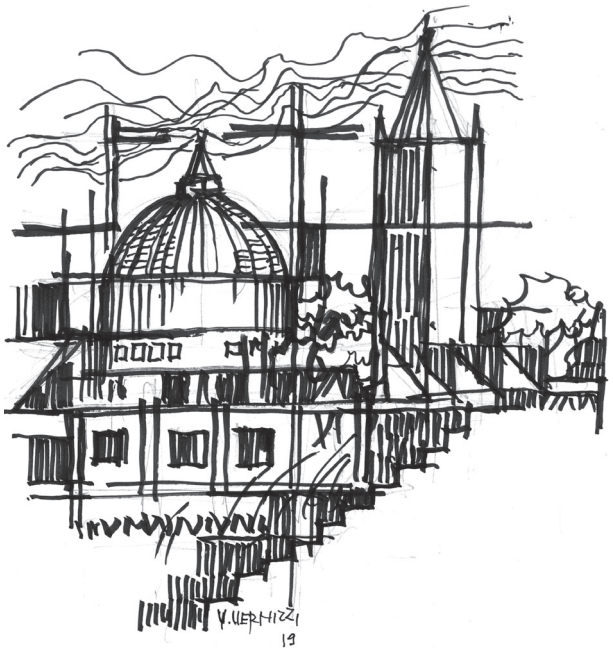
Fig. 6. Drawing Architecture Studio, 2014. "Nao Luo Gu Xang", isometric axonometry of one of the best preserved nutong zones in Beijing. (http://www.d-a-s.cn/en/projectdetail.php?currcategory=drawing&page=12)

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 communication, 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).



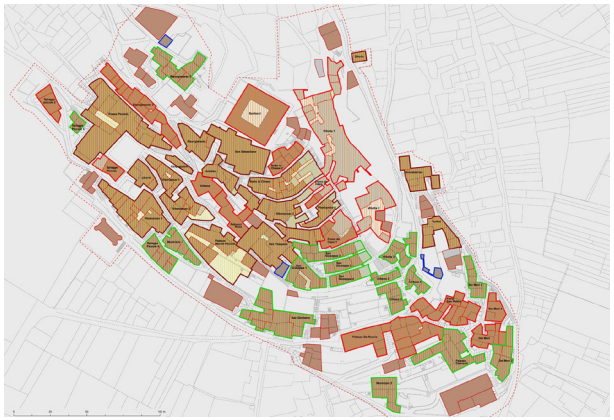


Fig. 8. Identification of the building aggregates of the historical centre of Navelli (graphic work by M. Carra).

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".

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 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).

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).

Authors

Chiara Vernizzi, Department of Engineering and Architecture, University of Parma, chiara.vernizzi@unipr.it
Andrea Zerbi, Department of Engineering and Architecture, University of Parma, andrea.zerbi@unipr.it

Reference List

Burgio, V., Moretti, M. (2017). Infographics as images: Meaningfulness beyond Information. In *Proceedings of International and Interdisciplinary Conference "IMMAGINI? Image and Imagination between Representation, Communication, Education and Psychology"*. Vol 1. MDPI.

Coppo, D., Boido, C. (a cura di). (2010). *Rilievo urbano. Conoscenza e rappresentazione della città consolidata*. Firenze: Alinea Editrice.

Cardone, V. (2015). *Modelli grafici dell'architettura e del territorio*. Santarcangelo di Romagna (RN): Maggioli Editore.

Casale, A. (2018). *Forme della percezione. Dal pensiero all'immagine*. Milano: FrancoAngeli.

Cennamo, G.M. (a cura di). (2016). *Processi di analisi per strategie di valorizzazione dei paesaggi urbani*. Ariccia (RM): Ermes.

Cullen, G. (1976). *Il paesaggio urbano: morfologia e progettazione*. Bologna: Calderini.

De Carlo, L. (a cura di). (2015a). *Metamorfosi dell'immagine urbana. Rappresentazione documentazione interpretazione comunicazione*. Roma: Gangemi Editore.

De Carlo, L. (2015b). Documentare e comunicare le trasformazioni dello spazio urbano. In [De Carlo 2015a].

Eco, U. (1968). *La struttura assente*. Milano: Bompiani.

Empler, T., Quici, F., Valenti, G.M. (2015). L'esplorazione urbana come forma di conoscenza dell'ambiente costruito: dalla *flânerie* analogica a quella digitale. In [Marotta, Novello 2015], pp. 991-1000.

Lynch, K. (1964). *L'immagine della città*. Venezia: Marsilio Editori.

Luigini, A., Moretti, M. (2018). Visual journalism come strumento per la narrazione della città altra. In F. Capano, M.I. Pascariello, M. Visone, (a cura di). *"La Città Altra / The Other City". Proceedings of VIII International Conference CIRICE*, doi 10.6093/978-88-99930-03-5, pp. 1113-1122.

Marotta, A., Novello, G. (a cura di). (2015). *Disegno & Città. Cultura Arte Scienza Informazione*. Atti del 37° Convegno internazionale dei docenti della Rappresentazione. Torino, 17-19 settembre 2015, Roma: Gangemi editore.

Massari, G., Pellegatta, C, Bonaria, E. (2006). *Rilievo urbano e ambientale*. Milano: Libreria CLUP.

Merleau-Ponty, M. (1969). *Il visibile e l'invisibile*. Milano: Bompiani.

Mezzetti, C. (a cura di). (2005). *Dalle città ideali alla città virtuale*. Roma: Edizioni Kappa. See in particular the essays by Maurizio Unali; Giovanni Caffio; Fabio Mazzeo.

Munari, B. (2018). *Design e comunicazione visiva*. Bari: GLF Editori Laterza. [Prima ed. Laterza 1968].

Osello, A. (2010). Le rappresentazioni tridimensionali tra tradizione e innovazione. Contenuti, metodi e scale di rappresentazione. In Coppo, Boido 2010, pp. 138-143.

Panofsky, E. (1961). *La prospettiva come "forma simbolica"*. Milano: Feltrinelli.

Parrinello, S. (2013). *Disegnare il paesaggio. Esperienze di analisi e letture grafiche di luoghi*. Firenze: Edifir Edizioni Firenze.

Quaroni, L. (1977). *Progettare un edificio. Otto lezioni di architettura*. Milano: Gabriele Mazzotta Editore.

Ratti, C., Claudel, M., (2017). *La città di domani. Come le reti stanno cambiando il futuro urbano*. Torino: Giulio Einaudi editore.

Schianchi, P. (2018). *#visual journalist. L'immagine è la notizia*. Milano: Franco Angeli.

Unali, M. (a cura di). (2008). *Abitare virtuale significa rappresentare*. Roma: Edizioni Kappa.

Ventura, P., Montepara, A., Zazzi, M. (a cura di). (2019). *La Città Storica post-sisma. Memorie, piani e prassi della ricostruzione di Navelli e Civitaretenga*. Parma: Grafiche STEP.

Venturi, R., Scott-Brown, D., Izenour, S. (1972). *Learning from Las Vegas*. Boston: MIT Press.

Vernizzi, C., Bontempi, D. (in press). Can a map save city shops? Applications of data visualization to represent the material and immaterial urban survey. In Luigini, A. (ed). *-Gràfiche/-Graphics. Proceedings of International and interdisciplinary conference on images and imagination*. Cham: Springer.

Graphic Readings on Bressanone: Models and Schemes

Starlight Vattano

Abstract

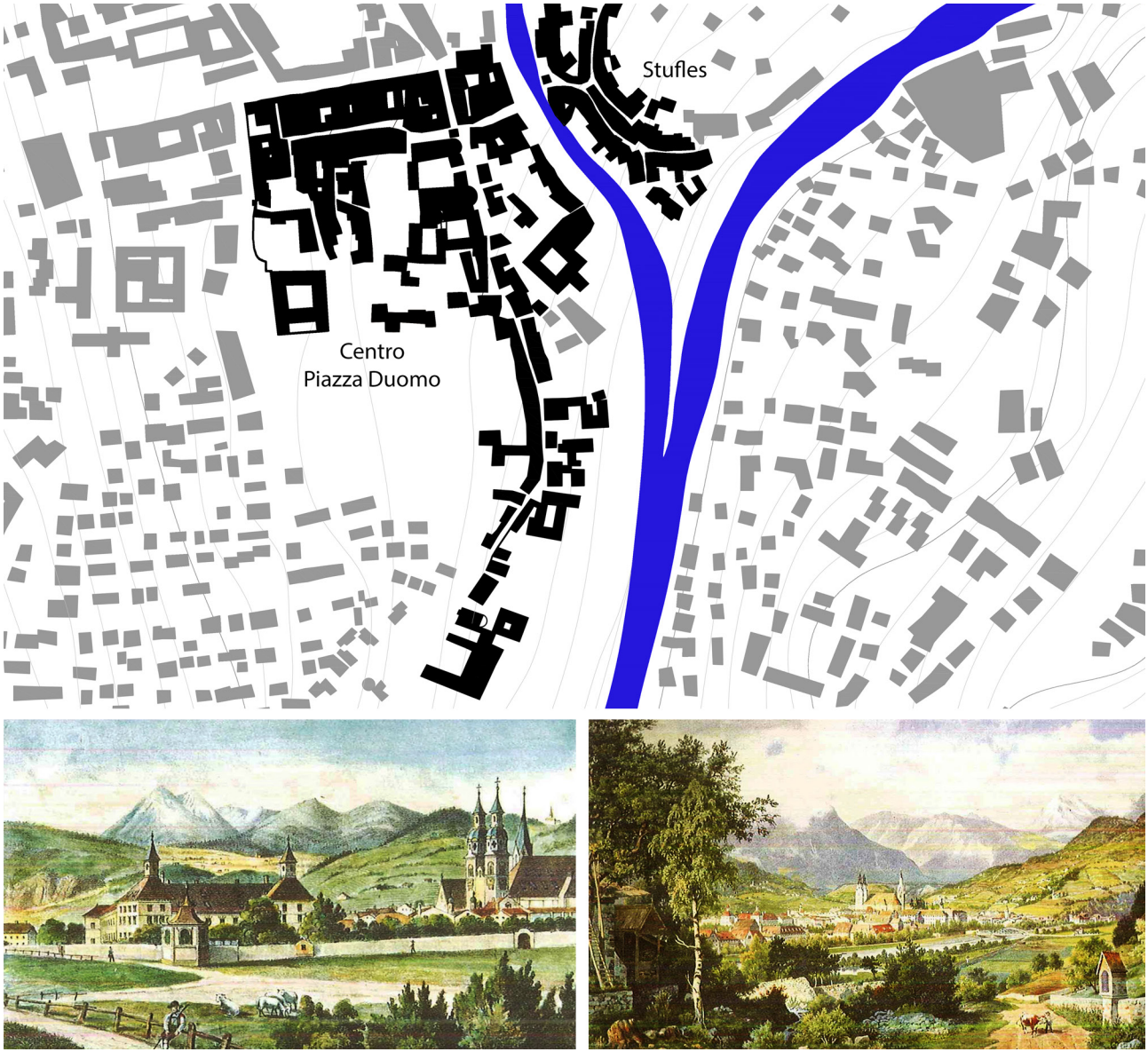
The paper deals with the morphologic and urban analysis of Bressanone through the digital modeling of the territory and the building layout with the aim of defining a mode of observation from the landscape to the city, able to provide the tools for the knowledge of the historical and architectural heritage of Bressanone, through the elaboration of new images. The symbolic values, given back by the images produced, decline the orographic and urban complexity in the language of representation, which translates the analytical process into a digital iconographic apparatus. The views realised from the 16th century onwards are integrated with the new graphic elaborations, tracing the spatial relationships of the territorial and building fabric.

Keywords: graphic analysis, digital modeling, Bressanone, digital iconography, historic-urban reconstruction.

Introduction

The essay deals with a graphic study on the urban evolution of Bressanone through a transversal reading between historical and iconographic sources, with the aim of providing a story by images of the urban events that have determined its current configuration together with the perception that many travelers had of the city centre.
The topographical elements that characterize the city of Bressanone, on the one hand the river that surrounds the urban expansion and on the other the mountains, constitute the values of identity of the bishopric city. A *locus asperrimus* [Flachenecker, Heiss, Obermair 2000, p. 115] whose urbanization process is significantly intertwined with the social and religious history of the South Tyrolean region and with a urbanistic connotation geographically defined by the expansionist-political tendencies of the bishopric principality, which also owned the cities of Brunico and Chiusa. The characterization of the urban context can be considered as the result of a process of oscillation between the municipal social control and the strategies of the ecclesiastical power that determined the socio-cultural consolidation of the building stratification. The presence of the convents of the Poor Clares and Franciscans within the pilgrimage routes that crossed Bressanone, the cathedral, the market square, the Bishop's Palace, are only some of the focal points of the *civitas* memory, whose first settlements are placed around the twelfth century [Flachenecker, Heiss, Obermair 2000, p. 13]. Cartography and travel drawings synthesize the process of evolution of the

Fig. 1. Above, the urban centre of Bressanone with the identification of the two original nuclei of Piazza Duomo and Stufles; below left, the Bishop's Palace with the Chinese pavilion in a view of Kravogl (1850 ca.); right, view of Bressanone made by Gatt around 1895.



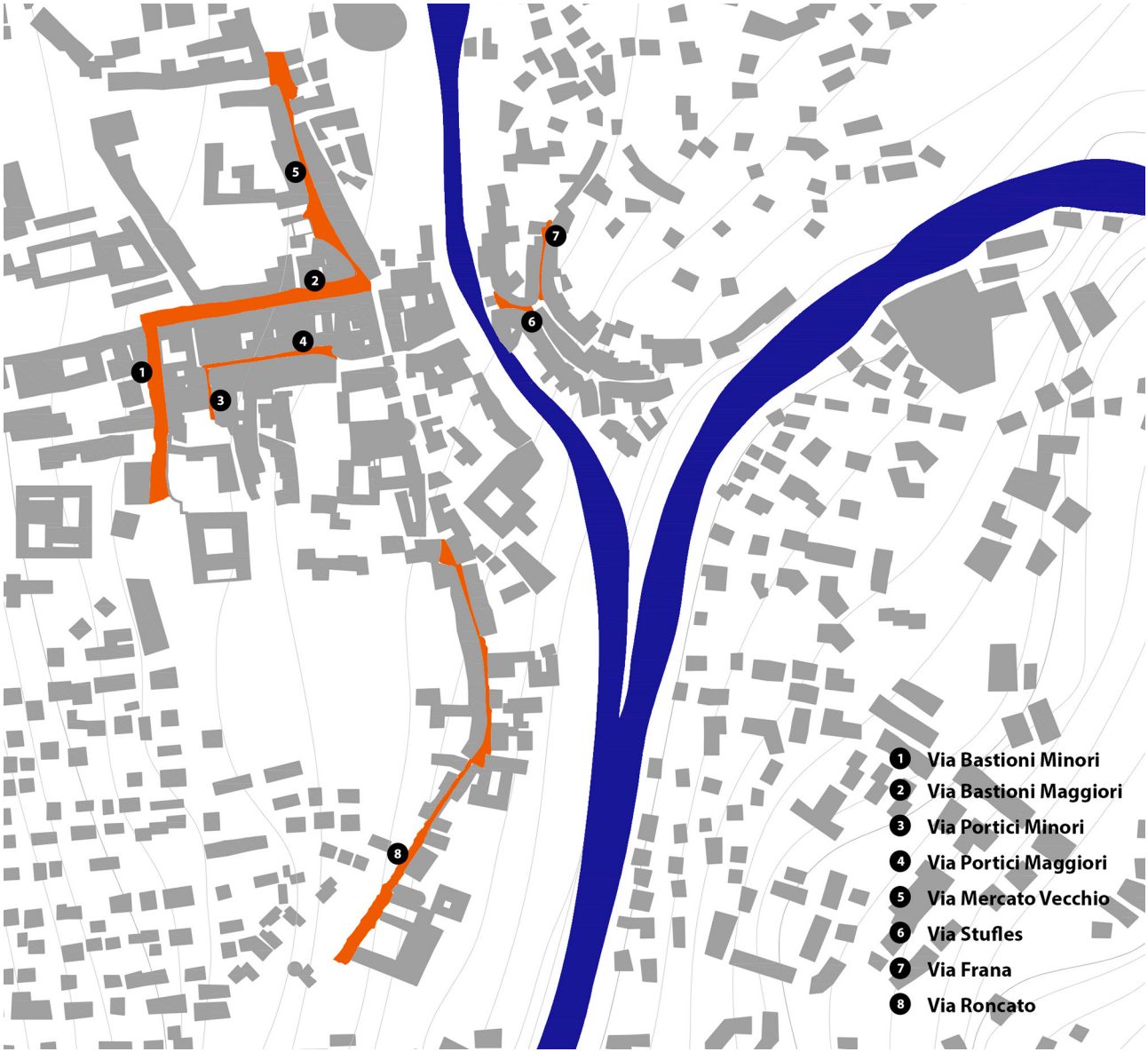
city starting from the architectural and urban characteristics: the river, on the one hand, the mountains, on the other. These two elements, narrated in the landscape representations of Braun and Hogenberg, Marian, Burglechner and Gatt, together with the buildings of the original nucleus, constitute the physical margins of the urban layout.

Methodological approach

With the aim of reconstructing the urban development of Bressanone, the graphic elaboration involved, in the first phase, the retrieval of the iconographic sources of the city. The modeling of the territory was followed by the digitization of the urban layout, on the basis of the cartography retrieved from the GeoPortal Alto Adige [1]. The synthetic model of the city has been used to cross-reference data with historical sources related to urban evolution. In this sense, graphic studies have been produced that allow the identification and chromatic isolation of the original nuclei (fig. 1). The two-dimensional representations are followed by the three-dimensional ones in which the buildings of the clergy and of the major convent complexes that have assumed a decisive role in the subsequent expansion of the city have been inserted (fig. 2). These readings have been integrated with the graphic isolation of the main axes that shape the urban fabric of Bressanone (fig. 3), taking into account the construction of the Cathedral, the Major Seminary, the Bishop's Palace and the convents of the Franciscans and Poor Clares along the pilgrims routes of the thirteenth century, which configured the image of the city over time (fig. 4).
A second phase of graphic interpretation concerned the integration of several drawings made by travellers betwe-

Fig. 2. Digital model of the orography and urban texture of Bressanone with the identification, in yellow, of the first two nuclei of the city and, in red, of the buildings of the clergy.

Fig. 3. Identification of the main axes of Bressanone starting to which the first two nuclei of the city were developed.

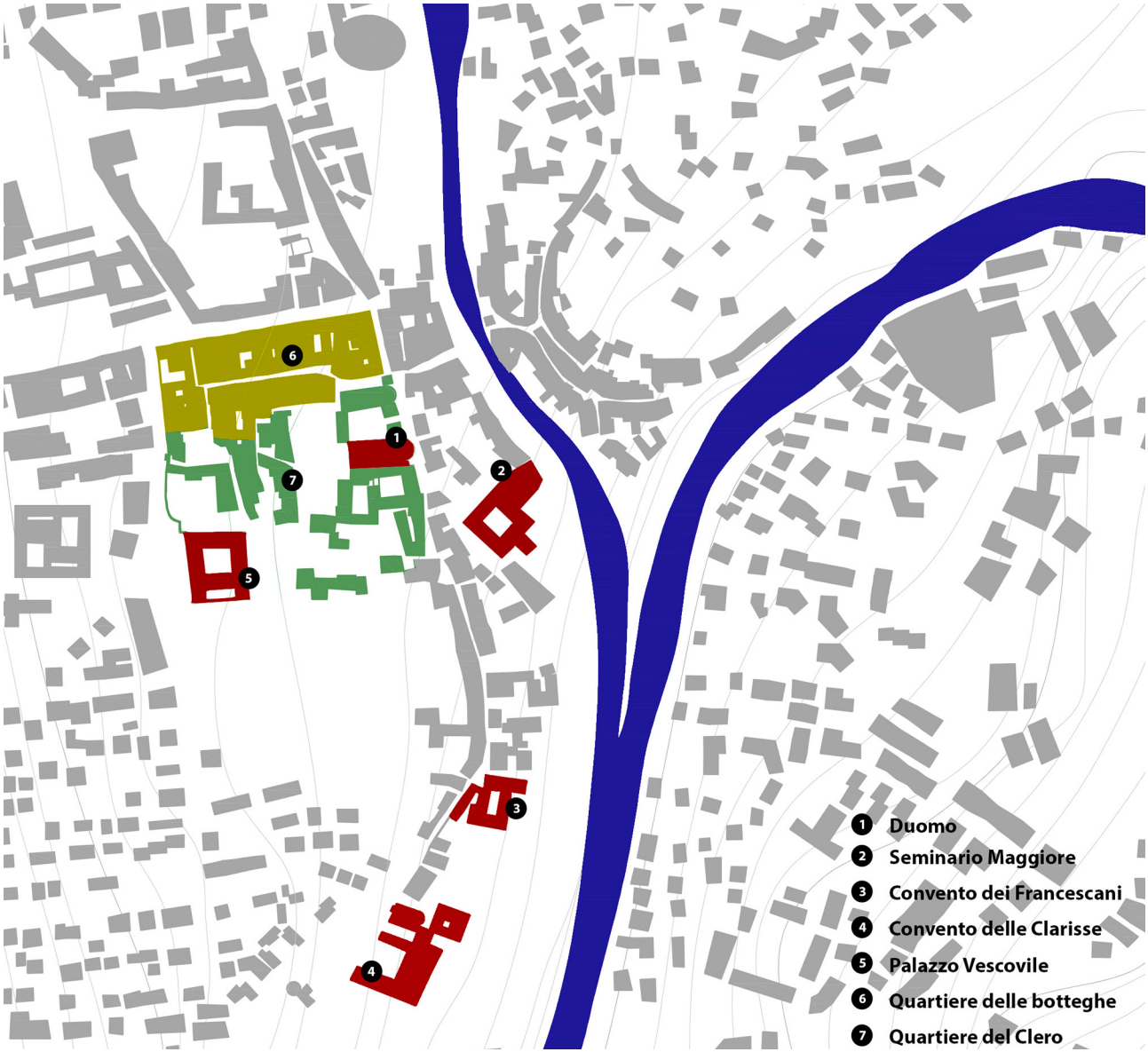


en the 16th and 20th centuries into the digital model. In this way it was possible to establish a series of immediate relationships between the historical cartography and the digital model of the current urban layout through the identification of the same architectural elements in the two representations (fig. 6). By observing the cartography and the model in a single representation, it is possible to gather the urban transformations that the city has undergone, the expansions of the blocks and the relationship between the buildings in the views and their landscape context (figs. 7, 8).
The elaboration of schematic drawings together with the digital reconstruction of the urban settlement of Bressanone provide categories of observation through which to read, recognize and arrange the elements of the city that from the textual narration of historical sources are transferred to the graphic plan of the drawing and then, in the other quality of digital objects, to observe within the model space.
The axonometric representations provide information on the layout of the urban system, the two-dimensional layout organizes a road taxonomy that defines a reading order for the recognition of city sections: the aligned buildings make visible the main routes and the large urban voids establish relations between parts.
Digital documentation and historical iconography intersect each others in the operation of observing and restoring, building a new physiognomy of memory aimed at understanding the change in configuration. It is a critical classification that during the visual analysis of the architectural and urban apparatus formulates visual judgments, verifying each time the traces on the plan and formulating a real design action.

A reading on the historical-urbanistic evolution of Bressanone

The name *Pressena* probably referred to Bressanone appears in 828, the Germanization of the name *Brixina* of pre-Roman origin in *Prishna*, in ancient German "place of loud noise", occurred in 901 alluding to the confluence of the two rivers, Isarco and Rienza. Probably it was a large area, where there were some buildings belonging to the Royal Farm, property and rights attached to the church of Sabiona (now Chiusa), which occupied today's Via Roncato and extended to the upper part of Stufles [2].
Other sources derive the name *Brixen* from the Indo-Germanic root *bergh*, i.e. "settlement in a high place" and just in Stufles, the oldest part of the city situated between the two rivers, there is the first urban settlement, in the highest part at the edge of the basin (fig. 1). Historical sources identify in the period called *La Tène* (400 BC) evident traces of Celtic tribes and later also Roman.
In 1909 the remains of some settlements dating back to the Iron Age were found; subsequent excavations brought to light traces of a Christian settlement dating back to the fourth century and other Rhaetian settlements in the current Piazza Duomo, dating back to the fourth and fifth centuries AD. It was probably in the second half of the tenth century, following the transfer from the diocesan seat of Sabiona to Bressanone, that the cathedral, the cloister and the adjoining buildings were built, even if the historical sources date back, in addition to the buildings of the clergy, the existence of the district of Stufles and the buildings outside the walls as early as the eleventh century.
These first buildings were protected by the walls built around the cathedral complex, extended in the late Middle Ages to include the current via Bastioni Maggiori and via Bastioni Minori. A differentiation between the city and the old market took place when in 1050 Bressanone was defined for the first time *urbs* in an official document. Starting from the 12th century, as was happening in many other cities included in the pilgrimage routes to reach the Holy Land, the hospital of Santa Croce was established, strategically located along the Brennero road to welcome pilgrims and built on an island between the course of the Isarco and an artificial canal. Only later, in 1764, in the place where the hospital stood, the Seminario Maggiore was built. Following the pilgrims route, around 1229 Bressanone became the seat of a convent of Franciscan nuns of San Damiano who had built a small church. A few decades later, in 1268, the Prince-Bishop's residence was transferred from the fortified castle attached to the cathedral to the *castrum novum*, in the south-west of the city, where today is the Bishop's Palace and was surrounded by a moat with a canal with three drawbridges, walls and defensive towers (fig. 2).
Historical sources do not report any trace of a single urban project with respect to which the building fabric has developed, while it is believed that as regards the complex of the cathedral, consisting of the episcopal basilica, the bishop's palace and the canons, the baptistery and the cathedral school, all grouped around the cloister once used as a cemetery by the clergy, we can refer to a single project. The expansion of the city took on a quadrangular shape over time, delimited by the thickening of the buildings between the Bastioni Maggiori and the Bastioni

Fig. 4. Identification of the cathedral, the Bishop's Palace and two Franciscan and Poor Clares convents on the axis of Via Roncato, in red, and of the two clergy quarters and commercial activities, in green.



Minori, towards outside and by the axis formed by the Via Portici Minori and Via Portici Maggiori, towards inside. In fact, only from the fourteenth century were included in the defensive complex of the city also Via Mercato Vecchio and Via Roncato, along which articulated the convents of the Franciscan and Poor Clares and the streets Stufles and Frana, on the other side of Isarco in the ancient settlement located on the upper part of the city (fig. 3).
In 1570, the city was divided into two parts, the northern part where the citizens' houses were located and the district of the shops built by the wealthy citizens between the sixteenth and seventeenth centuries, whose main axis were the streets Portici Minori and Maggiori, and the southern part that included the Cathedral Square, the Bishop's Palace and the streets Bruno and Hartwig, along with the streets Roncato and Gries, where the clergy resided. Within this building fabric, the Piazza Duomo, where the main buildings of the city were located, was to constitute a real urban and social hinge.
Soon it was necessary to build new neighborhoods outside the city center, in fact, developed an area used for the market, which later took the name of Via del Mercato Vecchio moved in 1273 in the current Piazza Duomo, while further south along Via Roncato rose the convents of the Poor Clares and Franciscans with the adjoining cultivated fields. The configuration of the new *Prishna* at the beginning of the fifteenth century was defined by six districts: the center, Gries, Stufles, Mercato Vecchio, Tratten and Roncato (fig. 4). The bishop's castle and another castle that belonged to the lords of Rodengo, later razed to the ground, were two of the fortified buildings built in the early Middle Ages. The residence of the Lords of Sabiona dates back to the same period, to which was attached a Gothic tower, the Porta Sabiona, also known as Porta Fienili, which served as access to the Hospital of the Holy Spirit. The Sun Gate, formerly known as the Erardo gate and even before the Cross gate, was the other gate of the city and represented the access for those arriving from Bolzano to the center of social and commercial activities in Bressanone [Gelmi 2004]. Around 1260 the city walls were moved further south to obtain even more space for the construction of houses for the clergy together with large gardens and the square in front of the bishop's palace. Another gate, Mercato Vecchio, stood at Via Torre Bianca, but was demolished in 1779, following the collapse of the Mercato Vecchio tower, also to facilitate the road network to and from Brennero and the connections between southern Germany and Italy.

Fig. 5. Above, the Elephant Hotel in 1879; in the centre, the Hotel alla Mara, in a view of Gatt; below, the Elephant Hotel in 1830.

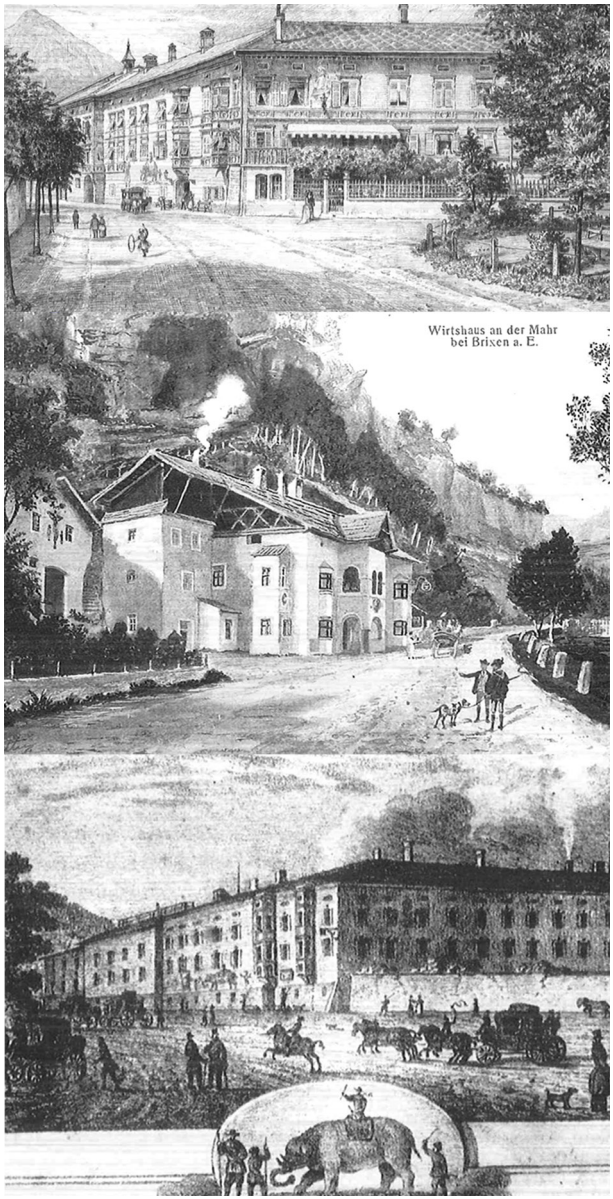
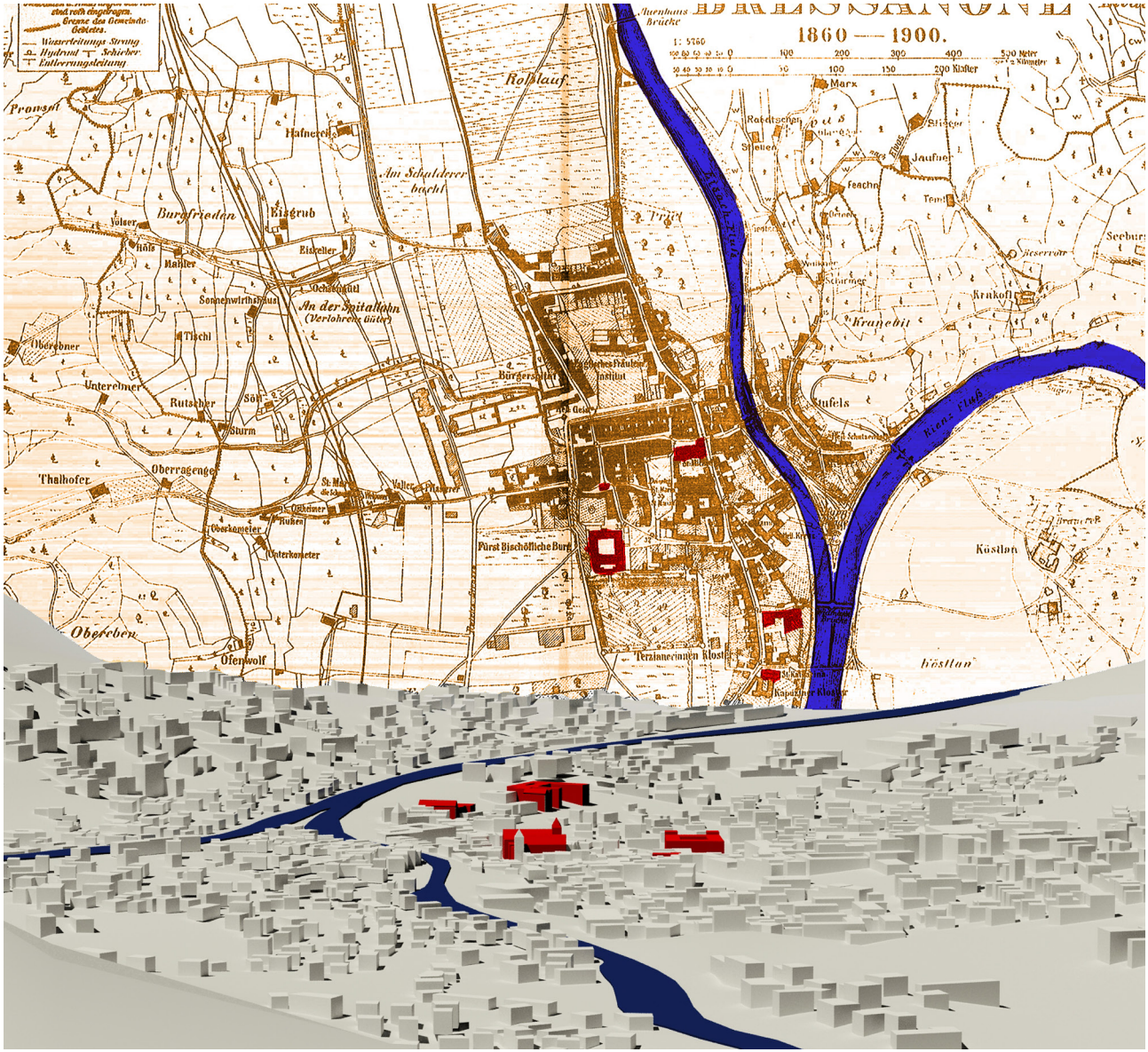


Fig. 6 . Planimetry of Bressanone realized in 1860 ca. inserted in the digital model in which the Cathedral, the Episcopal palace, the church of Sant'Erardo and the two convents of the Franciscans and the Poor Clares have been identified.



Bressanone became a place of passage during the conflicts in which the Emperor Charles V was involved. At the end of the 18th century there were about 30 hotels in the city, but already in 1640 the new road built to cross the area of Rosslauf Tiniga, in the direction of Novacella, allowed to lighten the traffic to the Val Pusteria, also providing a significant advantage for trade (fig. 5).
However, when the construction of the Brennero railway began in 1867, the choice of Fortezza as the central junction between the railway lines from Germany, Italy and Carinthia, caused a period of recession for the city, once a place of transit for travelers and merchants.
A few years later, the river regulation completed in 1896, allowed Bressanone an efficient modernization of the urban system and infrastructure. From the early years of the 20th century, work was carried out to improve public gardens and public building activity also encouraged an increase in private building: between 1900 and 1910 about fifty villas were built on Fallmerayer Street, including the so-called *Kienerhäuser*, i.e. the oldest tall houses in Brixen.
Later, the city would also extend beyond Isarco; in fact, between 1927 and 1941, with the advent of the fascist regime, the rural municipalities of Monteponente, Millan-Sarnes, Albes, Elvas, Sant'Andrea and Eores were annexed to Bressanone.

Bressanone told through travel iconography

Because of its geographical position, a junction between the main roads of communication between Germany and Italy, the city of Bressanone was affected by numerous historical events that led craftsmen, emperors, merchants and crusaders to stay within its walls.
From a morphological point of view, the urban settlement develops among mountain ranges that, precisely in the deployment of the city, give life to the course of the Isarco, between the mountain of Fortezza and Chiusa. The urban layout is entirely crossed by the Isarco, a natural barrier in the old town centre, together with the system of buildings that thickened compactly on the Via Bastioni Maggiori, defining the other walled border of Bressanone. These are the urban and landscape elements that are identified at a first level of reading in the travel iconography.
The original urban fabric, in the historical maps, is traced within a quadrangular area bordered on the north side by the stream Scaleres, corresponding to the Via Bastioni Maggiori, to the west by the Via Bastioni Minori, to the south by the garden of the Bishop's Palace and to the east by the Via della Torre bianca (fig. 6).
The travel stories retrace the ancient axes of the medieval city, via Portici Minori and Maggiori, which were accessed from the Porta Croce, now known as Porta Sole and Sabiona, both characterized by massive watchtowers, as often reported in the views (figs. 7, 8).
The first representations of Bressanone date back to the sixteenth century, in a view of Braun in 1578 the massive White Tower, the bell tower of the cathedral and the tower of the Porta Croce mark the space through a decreasing verticality from left to right, contrasting with the horizontality of the buildings that are arranged compact almost to become one with the vegetation. In a wider view of Burglechner from 1590, it is the vegetation that fills the scene. The architecture alternates with the careful graphic story characterized by the close relationship between the course of the river Isarco, which laps the city, and the morphology of the soil with the identification of the land properties and the main routes. It is possible to perceive a hint of differentiation between the building fabric of the buildings attested on the northern part of the city, that of the commercial activities and residences of the citizens and that to the south characterized by ecclesiastical architecture whose fulcrum can be immediately read by the urban void in correspondence with the Piazza Duomo.
More detail in the treatment of the relationship between nature and architecture is provided in the view created by Braun and Hogenberg in 1599, which arrange on the left side the natural furrow of Isarco and Rienza beyond which the morphological complexity of the soil is the element of characterization of the landscape and on the right side the clear break obtained by the terraced buildings that define the trace of the Via Bastioni Maggiori, one of the boundaries of the original quadrangular core of the urban settlement. In the central part, once again, the high bodies of the towers in correspondence with the urban gates, the White Tower and the bell towers of the cathedral, bring the gaze back to the architecture of the city.
On the basis of a view of Bressanone's Castle (*Hofburg*) already built in 1649, Matthias Merian described the urban core of the *castrum novum* in a 1656 representation by identifying the most important building and urban elements of the city: the legend written by the author lists the clergy buildings, churches, towers, the castle, the convents of the Poor Clares and Franciscan, and finally the bridges. Compared

Fig. 7. Digital model of Bressanone with the insertion of three views identified in the plan at the bottom. From the left, the Poor Clares church around 1900; the Piazza Duomo in a view from 1830; the Stufles district in a watercolour by Gatt around 1890.

Fig. 8. Digital model of Bressanone with three views identified in the plan at the bottom. From the left, the Guggenberg house in the Stufles district, portrayed in 1908; view of Brixen by J. Erler 19th century; view of the Fornai alley by Gatt around 1900.

to the previous views, more graphic space is dedicated to the oldest part of the city beyond the Isarco, the Stufles district, which is detailed access via the Aquila bridge (fig. 7). From 1800 the iconography of the city shifted the attention from landscape views to descriptions of urban pieces: the Cathedral Square, the main seat of ecclesiastical power; the intersections between the districts, as junctions often characterized by wells or fountains; the arcades, places of commerce in the city; the most important buildings in Bressanone, such as the Bishop's Palace and the *Hofburg*; the hotels Aquila and Elephant; the city gates (fig. 8).

Conclusions

The spatial relationships revealed through the observation of urban transformations return images of cities that establish a further relational dimension between the physicality of the architectural-urban object and the incorporeality of the image produced by looking-perceive-process. The relevant operation that implements the gaze in the categorization of the elements and their arrangement within the grid of the plane accumulates, recognizes, orders and graphicizes the historical process of urban evolution, focusing on the coding of signs for the rendering of the digital model. Taking into account those historical-documentary and synthetic-legal values that, as Vittorio Ugo states, denote the meaning of "representation", the graphic elaborations produced assume the sense of "model", in its autonomous dimension with respect to the represented object and of "scheme", in the hermeneutic relationship established between the drawing and its object [Ugo 1994, p. 12].

Notes

[1]<http://geocatalogo.retecivica.bz.it/geokatalog/#!home&layer=p_z%3A344039a4-cb12-4dd9-abb0-0c0e771d8635> (consultato il 19 ottobre 2019).

[2] For further information on the historical-urbanistic evolution of the city of Bressanone, please refer to the text: Gufler 1976.

Author

Starlight Vattano, Faculty of Education, Free University of Bozen, starlight.vattano@unibz.it

Reference List

Cigola, M. (2015). Integrazione di tecniche informatiche per il rilievo e la rappresentazione del patrimonio architettonico-urbano. Il gruppo di ricerca, le attività, il caso studio. In M. Centofanti, S. Brusaporci (a cura di). *Modelli complessi per il patrimonio architettonico-urbano/Complex models for architectural and urban heritage*, pp. 84-88. Roma: Gangemi Editore.

Flachenecker, H., Heiss, H., Obermair, H. (2000). *Città e Principato. Bressanone, Brunico e Chiusa fino alla secolarizzazione 1803*. Bolzano: Athesia.

Gelmi, J. (1984). *Die Brixner Bischöfe in der Geschichte Tirols*. Bolzano: Athesia.

Gelmi, J. (2004). *Storia della città di Bressanone*. Bressanone: Weger.

Gelmi, J. (2012). Das Brixner Domkapitel in seiner persönlichen Zusammensetzung: 1826-2012. Bolzano: Weger.

Gufler, L. (1976). Bressanone e dintorni. Bolzano: Athesia.

Heiss, H., Gummerer, H. (1994). *Brixen 1867-1882: die Aufzeichnungen des Färbermeisters Franz Schwaighofer*. Bolzano: Folio.

Kaufmann, G., et al. (2001). *Bressanone prima del 901: Momenti dell'archeologia. Bressanone:* Museo Diocesano.

Mock, H., Heiss, H. (2011). *Il municipio di Bressanone: viaggio in un secolo di storia. Bressanone:* Weger.

Nuti, G. (1986). Figure tecniche del rappresentare ed ambiente urbano. In *XY. Dimensioni del disegno*, n. 2, pp. 35, 36.

Rossi, A. (2018). *L'architettura della città*. Milano: Il Saggiatore.

Salerno, R. (2019). Drawing, Map, Maquette. Plan-relief Landscape Depiction. In *Disegnarecon*, vol. 12, n. 22, pp. 22.1-9.

Sender Contell, M., Iñarra Abad, S. (2019). Graphic styles for the representation of the landscape. In *Disegnarecon*, vol. 12, n. 22, pp. 26.1-10.

Ugo, V. (1989). Rappresentare/costruire. In *XY. Dimensioni del disegno*, n. 10. pp. 77-86.

Ugo, V. (1994). Fondamenti della rappresentazione architettonica. Bologna: Progetto Leonardo.

Wolfsgruber, K. (2010). *Duomo e Chiostro di Bressanone*. Bolzano: Amministrazione del Duomo.

Territory

Mapping (in) the New Time. New Analytical-Synthetic Representations for the New n-City and its Multi-Territories

Manuel Gausa

Cities between centuries: territorializing (and synthesizing) information

Our cities –as translations of our societies themselves– are the most complex dynamic and informational systems that exist: they are space-time (as well as sensorial) systems constantly exchanging information among the elements that comprise them, and between the latter and the surrounding environment, mutating and fluctuating in an evolutionary manner [Gausa 2015; 2016].
As their capacity for movement, processing, transformation and transfer –and the degree of connectivity– among "conditions," "situations," "solicitations," "fluctuations" and, ultimately, "information," has grown, so has their capability for "simultaneity" between levels and processes of exchange and thus the complexity –diversity, heterogeneity, plurality and irregularity– of their most explicit manifestations.
In this new, definitively heterogeneous, dynamic and interactive understanding of our collective environments (a condition they have always had, but which has become more pronounced in recent decades, moving beyond the old stable and gradually progressive conceptions of their development processes) lies, in fact, the true "information" revolution of our time and the basis of a shift in logic and thought more open to a new holistic capacity for "interaction of information" happening now in all that relates to the conception of space and the definition of our environments of existence and relations [McHug 2014].
The setting of this new open, dynamic and "informational" condition of the city is no longer built on the basis of more or less substantive formal criteria, but is defined and re-

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editor-in-chief's responsability.

defined dynamically, continuously, relationally, by the interactive combination of different –and simultaneous– levels of information (geographical, biological, economic, cultural, environmental, socio-political, etc.) which characterize it and the (infra)structural networks of exchange (of transport, energy, diffusion, communication, demographic or financial movements, etc.) which (inter)connect it, materializing the variations proper to a complex and plural "system of systems," definitively "in process" [Gausa 2010].
The main characteristic of this complex space, where the variables are multiplied, would be, as in the whole "non-linear" system, that of multiplicity –or "multipli-City"– of variability and uncertainty [Batty 1997, p. 6; Kleyn, Taverne 1997, p. 44].
The approach to this new type of multiple ("metapolitan") [Asher 1995] spatiality (and/or territoriality) and the movements and evolutions that would define and/or delineate it, thus requires, for its effective recognition, the development of new analytical instruments and perspectives of recording, representation and projection, as well as the definition of possible qualitative (and adaptive) vectors associated with them.
Representation and projection have always been terms closely linked to the notion of "project"; and it seems important today to understand, in this time of new socio-cultural and urban paradigms [Ricci 2012] which are the new approaches to the traditional polynomial "representation/projection/planning," once the old models (and certainties) of the city-form, composed, figurative, planned or drawn have given way to the new tools of recognition, analysis and approach.
From an architecture and an urban planning understood as disciplines destined to trace, design or draw "linear" and stable forms in space, today we are moving towards an architecture and an urban planning understood as trans-disciplines –or disciplines among and across other disciplines– called upon to combine, synthesize and express dynamic, complex processes and variable, interconnected relationships, in possible formulating, more than formalized, gambles. This shift entails the replacement of a certain idea of urban-architectural space as an "a(bs)tractive object" (that is, as a formal-figurative event) and its new conception as an "interactive system" (that is, as a relational process, implicitly "con-figurative"); and therefore, the emergence of a "new logic" called upon to replace the old classical compositional order or the new modern "intrusive" order (and the post-modern "expositive" order) for a more "organizational" order –fluctuating and flexible– called upon to react with the environment and among environments, by "info-strategic" criteria open to different tensions, stimuli and solicitations [Gausa 2010].
The advent of this new "advanced approach" –urban and architectural– associated with the digital and informational revolution itself, has been that of a whole generation of ideas, explorations and research mobilized by the innovative vocation, in which transversal strategies have been combined with new holistic approaches in the search for an effective mapping and for a new type of (intentional/informational) perspective and/or a new type of "hyper-urban" settings, more complex (multi-level and multi-scale), more dynamic and n-dimensional [Fargas, Papazian 1992, p. 90; Barahonda, Ballesteros 1997; Bijlsma, Garritzmann, Deen 1998].
We can speak, therefore, of the necessity of proposing new "operational (and operating) maps" for cities. These are new synthetic scenarios of approach: of diagnosis, responses and gambles, all at the same time.
The progressive capability for innovative combination generated in the last three decades, between the "3IN" terms, Information, Interaction and Integration (to be understood in all their dimensions: spatial, environmental, social, technological and cultural) shows the digital possibility of managing complex programs and simultaneous solicitations, trend parameters and environmental indicators, creative movements and social dynamics through the increasing computational ability to process, measure and optimize data in new open, systemic (but also, integral and integrative, multi-typological and anti-typological) approaches associated with this new "Information Logic" [Gausa et al. 2001; 2003].
These dynamics build a new global framework for a new projective interpretation of cities "in and of" the territory: that of an "n-city," "multi-city" or "pluri-city" (*poly-polis*) given to a multiple network of infrastructures and intra-structures, landscapes and intra-landscapes, density nodes and exchange hubs, road and fabric networks [Gausa, Guallart, Müller 2003].
Developments locally oriented to the urban scale and developments globally articulated to the large scale (regional, trans-regional, territorial) in which the city-system would no longer be interpreted as a single expansive movement around a large unitary center but as a large polyhedral, polycentric, polymorphic and definitively multidimensional structure [Gausa 2001].

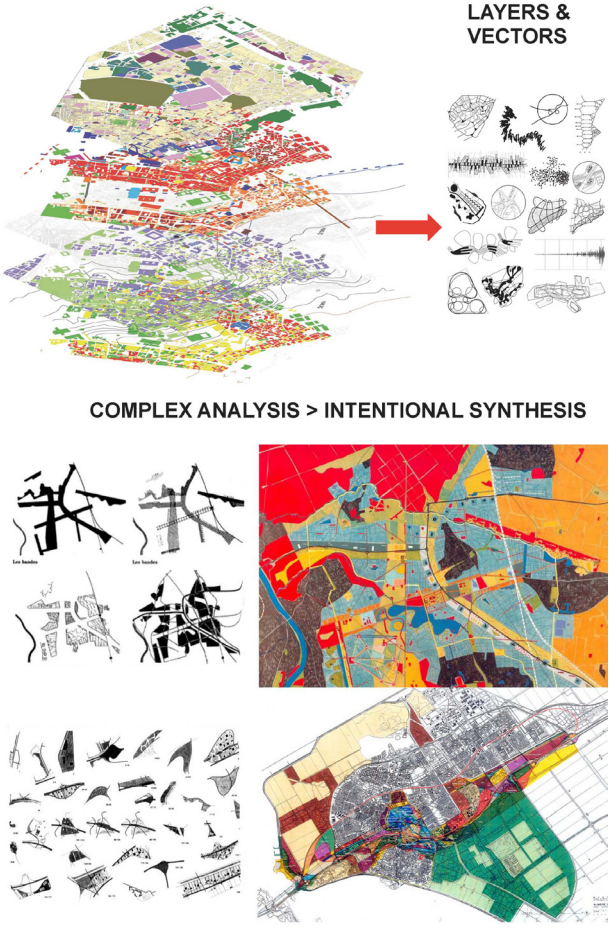
Maps for a new time

"Multinter" strategies
The definition of possible "Mult-inter" (multi-urban and inter-territorial, multi-level and inter-networks, multi-scale and inter-systems...) strategies for the great challenges that present themselves today in this complex scenario of exchange, obliges us to consider some of the great transversal themes associated with the new urban-territorial agendas of this early twenty-first century, raising different strategic issues regarding representation, cities, architecture, infrastructure and landscape [Gausa 2009].
Today it is a question of rethinking the possible propositive quality implicit in the dynamic potential of this new multi-urban, poly-urban and "geo-urban" scale of the current metropolitan structures, where nature and artifice, eco-systems and anthro-systems (re-naturalization and urban recycling) would be articulated; favoring a positive and at the same time critical action, attentive to those conflicts, tensions and deficits generated by new socio-environmental phenomena and dynamics [1] which require new, resilient and intelligent, integrated approaches for our life and relation scenarios; new operational scenarios of recognition, diagnosis, formulation and (inter)action. Systems "in" and "of" networks (info, infra, intra, eco and socio-structural) that would constitute a new instrumentation made up of different models of representation (multilayer cartographies, scanner sequences, development schemes, compression diagrams and/or conceptual ideograms or dynamic simulations), combining analytical analogue approaches and new synthetic digital and even plastic expressive logics [Gausa, Guallart, Müller 1998].
Lines of action associated with research anxiety related to the development of new digital technologies but, also, to a new contemporary thought, and that respond to explorations and trials (more or less intense over time), generated in the different phases that the digital/information revolution itself has experienced in the last thirty years. Approaches that are not mere "trends" (they are not closed in themselves) but that are combined, as potential models and innovative methodologies, still currently being verified.

1990-2000: Battle maps (intertwined strategies)
(Formulations and/or configurations: networked integrated systems and multi-level models)
The first shift in urban and architectural paradigms, generated in the last decade of the 20th century with the initial emergence of a new instrumentation and of a new digital information logic, was the transition from traditional occupational planning to a new type of relational strategies for cities. GIS analysis and the first manifestations of Internet 2.0 have favored the ability to combine complex systems and synthetic models, interwoven, integrating, in compatible and differential meshes, multilevel programs and grids; new models of organizational (topological and matrix) geometries, more irregular but interlaced, intended to form the basis of a new advanced approach particularly interested in favoring multiple directives (or guidelines) –in the network and in networks– conceptual, strategic and operational at the same time.
The sale of the first PCs and portable computers, that is, laptops (with a personal access to computing) as well as the launch of the first Hubble Space Telescope in 1990 –the first "processor" of geo-referenced information– favored a new approach to this multi-register condition (multi-level and multi-layer, real and virtual, material and immaterial, formal and informational) of a system –the urban one– referred to processes of exchange –and mapping– in which diversity and simultaneity, multi-scalar complexity and inter-scalar transversality, could be addressed with the new GIS systems (launched in 1991) and the first sequential scanner readings (marketed in 1993). The factors of access, portability, speed, adaptability or simultaneity, typical of a systemic, complex, multiple, precise and flexible approach to context, were combined to facilitate a real change in the management and perception of our realities and environments [2].
The first generalized network connections –associated with the first popularized developments of the Internet (Web. 2.0. Internet of People), globalized at the end of the 1990s– contributed to strengthen this idea of a diversity/heterogeneity connected on the network… and in networks (networks understood not only as physical service and transport networks, but as virtual connections and, also, as eco-sustainable systems; flexible, landscape, social, identity, cultural and, evidently, environmental matrixes) favoring a concept that is programmatically intersected and intertwined, integrated and interconnected, aimed at combating the patchwork city or the sprawl city [Neutelings 1992; 1994] with potentially organized and diversified (*agencès et diversifiés*) schemes and systems [3].
We have used, on several occasions, the terms "LAND-LINKS" [Gausa 2003], "LAND-GRIDS" [Gausa 2001], or "RECYTING" [Gausa, Ricci 2012] associated with the

Fig. 1. Data-Layers & Diagram-cities, Territorial diagrams and Ideograms. From: Gausa, Ricci 2013.

Fig. 2. OMA: Mélun Sénart, 1987 (with the expressive images by Yves Brunier) and MVRDV: Antwerpen, 1997.



new dynamics of the n-CITIES [Gausa, Ricci 2013], to define these possible integrated, flexible and interdependent strategies, designed to ensure local and global, combined and qualitative developments on a large (territorial) and an intermediate (urban) scale: developments in which the city would no longer be interpreted as a large area of "urban sprawl" tied to a single mono-central and mono-referential reality, but as a possible multicentric and interlaced structure; strategically adjusted, appropriately recycled, environmentally re-naturalized, sensibly "re-equipped" and intelligently "re-informed," rather than just "reformed."

Neither "mono-compact" nor "poly-diffused" models, but possible "(in)twined" (polycentric, networked); articulated or focused, extensive and intensive systems; with the potential to simultaneously combine –within new matrixes and territorial mosaics– systoles and diastoles, concentrations, dilations and interconnections; density structures (urban fabrics), connecting structures (connective meshes) and structures for expansion and relations (active landscapes) capable of establishing new urban geographies or "geo-urbanity" [4].

Intertwining, in eco- and infra-structural networks, the different nuclei of life, exchange and relation, to strengthen, recycle and qualitatively re-naturalize cities, to trim (or shape) the margins (outlines, perimeters and confines of differential density or substance) or re-articulate (or re-urbanize) scattered proximity areas or peripheries, would constitute operations associated with possible equations of "city/city" continuity, "city/landscape" contrast or transition, or a qualitative fusion of "city/landscape/infrastructure."

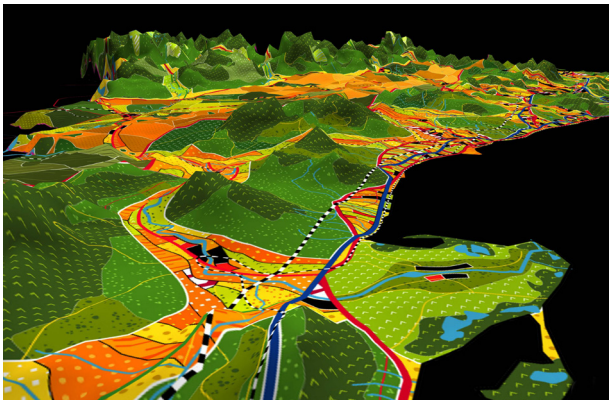
During much of the 1990s, the exploration of a new type of urban architectural organization and configuration, but also of a new type of geometry (elastic, irregular, topological, intwined) that was more open, varied and irregular (and its links with schematic diagram potential, such as "information compression, induction and vectorization") went further in these lines of action (fig. 1).

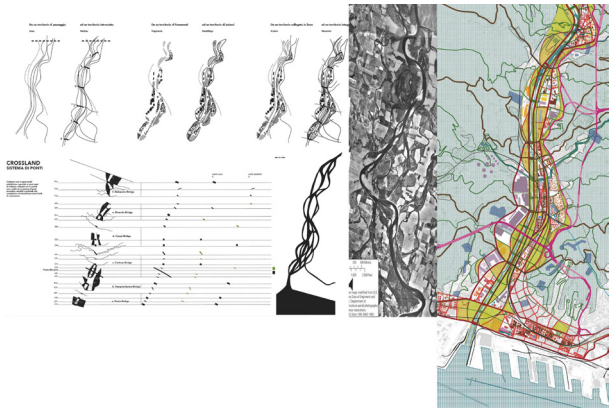
A pioneering project like that of OMA's for Mélun-Sénart (1990), with its infrastructural mix of city and landscape (suggested by the interlocking expressive matrixes in "K" by the unfortunate Yves Brunier), had a decisive influence on many subsequent proposals more intentionally linked to the notion of networked cities, in particular many of the interesting research studies by "ex-OMA" figures (Kees Kristiansee, Willem Jan Neutelings, Max, MVRDV etc.) (fig. 2) [5].

Fig. 3. Catalunya Land Grid. Barcelona/Catalunya, an integrated model of urban-territorial development (Hicat-Actar Arquitectura, 2003). Mastering and 3D viewing. (Source: author)

Fig. 4. Barcelona Eixample – New Multistring Green Centrality. Green cord basic band grid: data and flow management model and diagrammatic plan (Actar Aquitectura, Gic-Lab-UNIGE, Massi di Roma 2010).

Fig. 5. Genova - Val Polcevera 2019 (Gic-Lab UNIGE, Diagrams and mastering / general mastering).





Mélun-Sénart was one of the first projects to formulate a project using voids (vacant land) as an active instrument: research studies such as that of MVRDV (South Almere, 1997-1998) in the Netherlands, Actar Arquitectura (Barcelona Land-Grid, 1998 or Catalunya Land-Grid, 2003 or GOA Val-Polcevera, 2018) (figs. 3-5) in Spain and Italy, by Mosé Ricci (Genoa PIC City, 2010, UniverCity, 2012) or Maurizio Carta (as the expression of the entire Italian Villard network) or other actors in France such as Fin Geypel, Obras, TVK etc., went on to explicitly investigate this type of potential by examining this possibility of proposing adaptable, flexible and changing (but articulated) virtual mosaics, associated with a new type of strategic-tactical-diagrammatic, multiple "territorial filigree" (dentelle urbaine), also expressive in its projectual representation.
Many important contributions generated at the end of the last century would go on to explore the instrumental and dispositive, a-scalar and multi-scalar capability of the scheme diagram as an (expressive and dynamic) cartographic synthetic device for a city, strategically reinterpreted [Gausa 2018, Ch. 7 (Diagrams); Allen 2001; Lynn 1995]. In any case, the interaction between "data and processes + potentials and objectives + structures and lines of force + gambles and strategies + narrations and expressions + operations and concrete propositions" - that is, between "Recognition + Diagnosis + Strategy + Formulation + Communication + Approach" – did not turn to a necessarily linear nor complete path but would have progressed by detours, back and forth, stylizations and redefinitions, from plan (thematic, selective cartography) to scheme (structural model), from scheme to diagram (organizational criterion), from diagram to ideogram (strategic concept of orientation and/or generation), from ideogram to logogram (expressive, communicative message), and its new multi-level relaunch towards a possible simulated vision of the whole ("masterizations" intended as "proto-master-plans" or "diagram-maps") compatible with possible projections and digital and/or visual images of syn-

thesis –collages or new-generation photomontages, with a high degree of heterotopic realis – interpreted as possible "strategic scenarios," suggested and defined at the same time, rather than as mere illustrations; these masterized simulations (well beyond the old master-plan) proposed an interpretative, expressive and plastic reformulation, at the same time, of the geo-urban city, where its broad lines of force would combine with particular and precise details of reality in an intense and explicit narrative of its potentials which, however, would contribute to vectorize the basic organizational concepts of its future conceptualized developments: "strategic-formulative" organizational (rather than formulating) criteria, to which the infinity of urban, evolutionary and changing, particular and general, autonomous and systemic processes relating to it openly refer [Gausa 2015; 2016; 2018, Ch. 7 (*Diagrams*); Allen 2001; Lynn 1995].
Integral (and integrating) models that would refer, in general, to differential and mesh structures, of a networked multi-city, (made of density points and attractor poles, flow (and articulation) lines and networks and surfaces and matrixes of landscapes (whether agricultural or natural, etc.); that is, of natural networks, occupational networks and infrastructure networks.
"Battle maps" that would refer to a "logic of decision," a "logic of education," a "logic of action" and a "logic of representation," combined together.
Maps capable of visualizing the new city as a systemic, complex, dynamic and varied (multi-layer) scenario, potentially arranged as a set of sites, sets and networks [Gausa 2011; 2012a; Krausse 1998, p. 3].
Confidence in an urban and territorial orientation, open, indeterminate and vectorized at the same time, gave priority, during the 1990s, to a "concept-strategy," flexibly articulator (networked) as a guideline (or line of action) and to the notion of "nuclear criterion" – whether large- or medium-scale [Kwinter 1998].

2000-2010. Flow maps (optimized data)
(Processes and/of management: eco-efficient data recording and processing in responsive scenarios)
The second paradigm shift, generated in the first decade of the 21st century, was the transition from open but "drawn" and/or fixed strategic representation to a new kind of parametric, dynamic or evolutionary mapping, with simulations of variable processes through algorithms (re) elaborated and synthesized in real, or almost real time.
The expansion of digital technologies and mobile telephony (Internet 2.0 and 3.0, open source software, drone recording and big data) and progressively more sophisticated applications –apps– as well as an "urban sensorization" obtained through responsive devices and precision digital programs, favored the ability to visualize space-time processes (and to simulate their diversified evolution) through increasingly optimized parameters and indicators.
The mobile phone revolution also accelerated access to the "network," emphasizing the new potential of a more ubiquitous and diffused connectivity: social, environmental and material. But also, the capacity for progressive data management.
The advances in the development of processing devices proposed, in fact, new interfaces that combined technological efficiency –and design– with new multi-level functionalities.
In this sense, the consolidation of the FAB-LABs, starting in 2000, as a consequence of the evolution of new virtual-material technologies (in particular 3D printing devices and the possibility of creating topographic-geographic models linked to the projected –or inversely-projected– processing of different, variable and dynamic data) was perfectly suited to this type of dynamics, in which conceptual (re) production and digital production assimilated more sophisticated open source devices and software (Arduino, Rhino, Grasshopper, etc.) [6].
The development, in the first decade of the new century, of the third and fourth generation (3G and 4G) mobile phones and the spectacular irruption of social networks or the authorization (on May 16, 2006) of flights with drones for civil purposes contributed to the advent of a new framework of relationships not only "virtual" in their operational definition, but "real" in their (socio-economic, productive, socio-cultural and environmental) operational effects [7] which accelerated the recording, compilation, archiving and management of data (Big Data), in a process closely linked to the appearance of the concept of Smart Cities.
The notion of Smart Cities, fundamental at the beginning of the 21st century, required a new type of urban management in which the city tended, increasingly, to be understood as a complex but potentially more efficient information system, designed to integrate and algorithmically process data, parameters and indicators in (theoretically and tendentially) safer, qualitative (and innovative) spaces in urban uses, services, structures and spaces (USSS) [Mitchell 1996], reducing costs and consumption of re-

sources and promoting new positive interactions between citizens, habitat(s) and local governments [Markopoulou, Gausa 2014; Markopoulou 2014].
A techno-efficient system that seemed to refer to a new potential for "sensorization" and real-time co-production (big data, real-time data, data optimization, ener-grids, fab labs and fab citizens, eco-agendas etc.) from which to explore new sustainable (responsible and responsive) agendas and possible self-sufficient models [Gausa 2012b].
The application of these new algorithmic processing capabilities, aimed not only at optimizing the management of an integrated techno-urban systematics, but also of a new, more complex and efficient environmental response (associated with a new "sensorized," implicit vocation), suggested a new "resili(g)ent" (resilient and intelligent) condition [Gausa, Andriani, Fagnoni 2017] open to evolutionary and adaptable scenarios, associated with a new "urbaneutics" (a term used to define this urbanism of data and sensors) but also with a new type of representation and of animated management capable of reacting to the evolution, networked, of the urban systems themselves.
The works and studies of Carlo Ratti at MIT or John Palmesino at ETH, Polero and Paschero at the Bartlett, but also of Vicente Guallart, Willy Müller, Tomás Diaz and Areti Markopoulou at IAAC in Barcelona, dealt with this type of research.
The old analogue "(re)presentation" has increasingly given way to a new type of "(pre)presentation" –or multiple, virtual, dynamic and visual "(proto)presentation"– as open and indeterminate as it is potentially "orientable" and "vectorizable" in its own procedural "indefinition" and (and "n-definition"); a "representation-simulation" definitely open to the projection of possible simulated and simultaneous, multiple and differentiated scenarios, according to its particular conditions and response capability.
This reactive (responsive, that is, informational and interactive) condition tends today, progressively, to qualitatively multiply the variables but also the solutions –in the form of logarithms and precise, recordable, searchable and re-editable statistics, in variable formats, trajectories, contexts and visualizations– combining different and diversified data and options, displaying them digitally (and dynamically) in different potentially qualitative scenarios (through multimedia projections, dynamic and evolutionary maps, reactive three-dimensional prototypes, etc.) without conceptually determined aesthetic/scenic gambles; progressively bringing the representation of the processes closer to a more

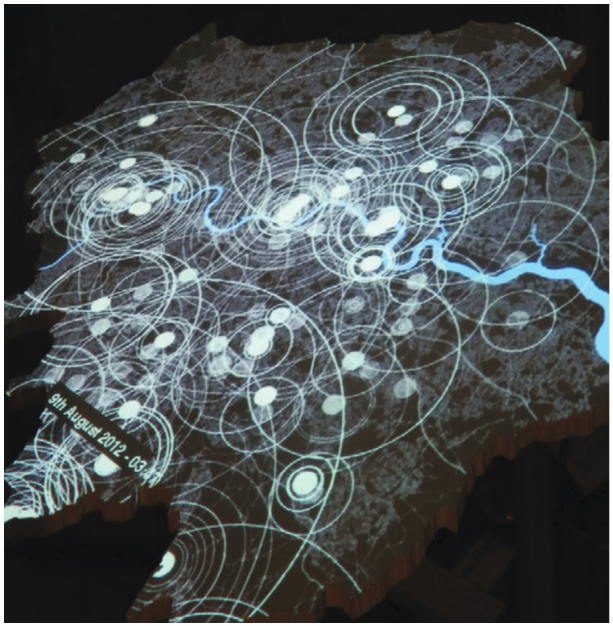


Fig. 6. London, Data Table 2017. From: Vivaldi 2014, p. 12.

diffused, varied and polyvalent condition, "virtual and real" at the same time, apparently indifferent to the final "form," or at least to a single traditional idea of form/object qualitatively "drawn" as a unique creative gamble [Ramsgard Thomsen 2014, p. 2].
The increasing capability to manage mutable information, through algorithms and parametric data (thanks to new software programs), allows the vision of a multiple set of optimized options, through a possibly (and/or virtually) three-dimensional representation (multimedia models, the first holograms, augmented reality, etc.) that facilitates the visualization of a wide range of diversified and evolutionary developments, combining advanced technological models, responsible ecological attitudes and social actions in spatial manifestations without dogmas or prejudices: rigorous, imaginative and sustainable at the same time; capable of combining "sensory" and "sensitive" logics, as translations of new technical and technological conditions, but also of new ethical, environmental and, above all, socio-cultural expectations (figs. 6, 7) [Gausa 2018].

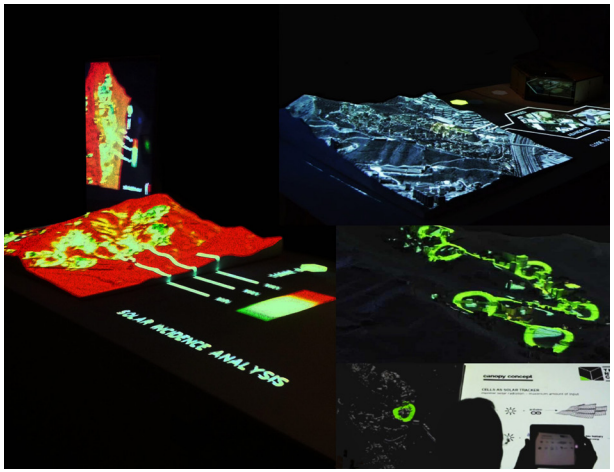


Fig. 7. Evolutionary and variable Data Maps in 3D projections of Energy, Barcelona Baró Tower. Interactive Plastic Model (IAAC Global Summer School, 2014).

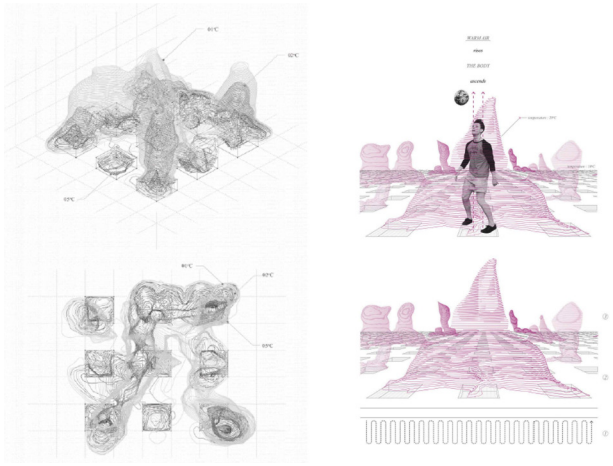


Fig. 8. Dynamic views of responsive elements in variable environments according to thermodynamic parameters, Barcellona (IAAC - From Craft to Research, Reactive Environments, IAAC-MAA1 2015-2016, Asya Guney).

Action maps (of movements and maneuvers)
(Programs and/in interaction: self-generating agents, collective intelligence and new social mediations in experiential spaces)
The third paradigm shift, generated in the second decade of the 21st century, was the transition from dynamic and evolutionary representation to "sup(ra)presentation" (super-presentation) in distributed networks of generation, conception, materialization and/or mobilization, interconnected, but also interactive and/or co-active (co-participating) (fig. 8).
The evolution of research on Artificial Intelligence applied to matter and to the environment, bio-genetics and bio-materials, the increase in portable or immersive (embedded) technologies today focus on dynamics not only of interaction but of interactivity, at all levels; particularly in the social field with the emergence of new collective (common) behaviors and a new, progressively bottom-up, "interactive collective intelligence" open to experiences and to co-creative (co-productive, co-incident, co-involved, co-active) spaces or programs (fig. 9).
New scenarios-interfaces between programs, materials, environments, citizens and a new reactive-activist logic (fig. 10).
The exponential development of algorithmic programs for the representation, modeling, design and the dynamic and parametric generation, and their combination with differential (and multidimensional) "generation/simulation/representation" devices –through new types of interfaces that combine technological efficiency and augmented vision (holograms, virtual simulations and more precise augmented reality, etc.) in "surroundings" that are more and more realistically simulated and (rep)presented each time– is contributing decisively to the improvement of production and visualization tools associated with a new, more precise real/virtual condition, but also to a new robotic (almost "bio-robotic") intelligence in the context of a possible association of space, architecture, artificial intelligence and automatous agents (2007-2010, *KUKA Robotic Knowledge & Technologies*, 2006, *Drones e Auto-drones*, 2018, *Self-Learning Devices & Matters*, etc.).
The next step, Web 5.0 –the sensory and emotive Web– must, in fact, aim to expand these capabilities in the field of sentiment, "datafied" emotions, in a "sensory" reality, elaborated in a more tangible development of artificial intelligence itself combined with a human-artificial (post-human?) intelligence associated with the quantum revolution, the growth of (ubiquitous, assimilated and integrated) nanotechnologies and an advanced bio-genetics, not strictly

deterministic but modifiable with new information from the environment [8].
The exponential diffusion of the Internet and of social and professional networks [9] and the spectacular growth, since 2009, of WhatsApp as well as Skype (decisive in promoting a direct –economic, productive, operational– interconnection between users) have been combined to contribute to the consolidation of a new framework designed to encourage shared exchanges and complicities between common positions, networked, with new socio-economic and cultural (but above all productive and co-productive) effects still in their initial phase.
Augmented Matters but also Common Behaviors speak of a new vocation, not only reactive but also co-creative, that aims to examine factors of interactivity and plural diversity: factors supported by multiple processes of exchange referred to synergistic mediation but also to new symbiotic operations associated with a new reality, not only "distributed" but also "augmented" in its conditions of hyper-connection and "sensorization"; an expansive and systemic reality, both collective and connective, associated with a progressive "info-technological" and "social-empathetic" definition as a capability for efficient interaction between systems.
In fact, today, a new type of "social-environmental-cultural" activism, more direct and spontaneous –OSBURT: Open Source, Bottom-Up, Real-Time– at times informal, fresh and casual, at times determined, committed and assertive, is combined (but not always, not necessarily) with a super-technology of open connectivity and exchange, of data, messages, experiences and information, as varied and multiple as it is mobilized and mobilizing.
In exploring this new logic of interaction, the pioneering advanced architecture of the 1990s, of the (diagrammatic, integrated and interwoven) "topological-strategic-synthetic formulation" opens to a space of operative immediacy; a space of the program and the immediate response; of the moment rather than the event (and the monument); a space that seems to intend to combine a new "(in) common logic" (active and activist, positivated or simply positive) called upon to make this potential of transversal interconnections exponentially extreme, translating it into responses, re-evaluative, direct and precise, at times elementary, beyond aesthetic prejudices or stylistic filters (fig. 11).
The development of new information or communication technologies brings us closer to a reality, that is recorded and elaborated in an increasingly precise, simultaneous and immediate manner, opening up an immense repertoire of possibilities in the field of the combination of materiality, spatiality, sociability and "inform(action)ality," through a reciprocal collaboration in (and with) the context; more "eco-" and "co-" qualitative (analysis and synthesis of data associated with urban mobility and accessibility, habitation and housing, energy efficiency, social economy, public spaces, collective self-organization, social-environmental responses, productive exchange, political action, etc.) [Markopoulou 2014; Brillembourg, Klumpner 2014].
It is clear that this strong sensitivity concerns a new combination of "information and interaction," not always techno-operative but conjugated in "performative-social" terms (not only technological processes but actions and/or social-collective movements, innovative, generated at times with the resources at hand), entails a new positive, imaginative and sensitive (empathic or eco-empathic) mediation capable of spontaneously addressing increasingly complex scenarios (possibly affluent but, above all, deficient) produced in situations of conflict, tension or threat: geopolitical (and geo-economic) crises, migrations due to war or simply for pure survival, but also, of course, climate change with its devastating effects on the most vulnerable populations (risks, environmental problems, housing defects, pollution, ghettoization, increase in poverty thresholds, etc.) [10].
The operational approach to a directly confronted reality, in almost real time (precise data and concrete facts,

Fig. 9. Map of operations related to urban re-naturalization through agro-urban spaces (Münich, Joerg Schroeder Research Group, 2011-2012).

Fig. 10. Workshop of collective actions in the ancient Caserna Gavoglio. Photographs and map of the basic structure of the actions on the main patio. (GicLab - UNIGE e collettivi urbani, 2017).

for possible "positivated" scenarios) favors experiences produced beyond aesthetics, by a certain ethics of action translated into the qualification and manipulation of matter, context, environment and inhabited space, without formalist or purist prejudices, in its manifestations and representations.
In fact, if the informational notion of "program and programming" has been one of the keys to this digital era, in this type of new approach, the planning of "programmatic" actions and operations such as fields and lines of temporal maneuvers proves to be as important as its own digital (software) programs for analysis, recording and processing.
The programming rather than the strategic formulation of the 1990s or the pure management of environmental data at the beginning of the century constitutes a new approach to a representation that defines sequences, instants or movements within a wide range of operations conducted over time through its possible phases and variations, according to possible stimuli and/or conditions.

Like our individual intelligence, a new collective intelligence generated through statistical parameters and majorities determined in (almost) real time, begins to be able to analyze, relate, connect, react, adapt and structure itself, changing our habits into a new kind of "instantaneous collective actions," co-generated and co-programmed (fig. 12) [11].
Time groupings, generally generated via wireless telecommunications and oriented towards common and contingent, concrete objectives and interests, of "involved and organized" individuals (*Impliqués, agencés et engagés*, to use "Deleuzian" and "Hesserlian" terms) indicate a new type of more open and interconnected techno-social organizations [12].
Young mediator groups such as the pioneer Recetas Urbanas (Santiago Cirugeda, Seville) Ecosistema Urbano (Madrid), La Col (Barcelona) Al Borde (Quito, Ecuador), Elemental (Aravena, Chile) Haieck, (Venezuela), Plataforma Arquitectura (Mexico) etc., combine their field and on-field experiences with techno-social exploration conducted in research centers such as IAAC (Barcelona), CITA

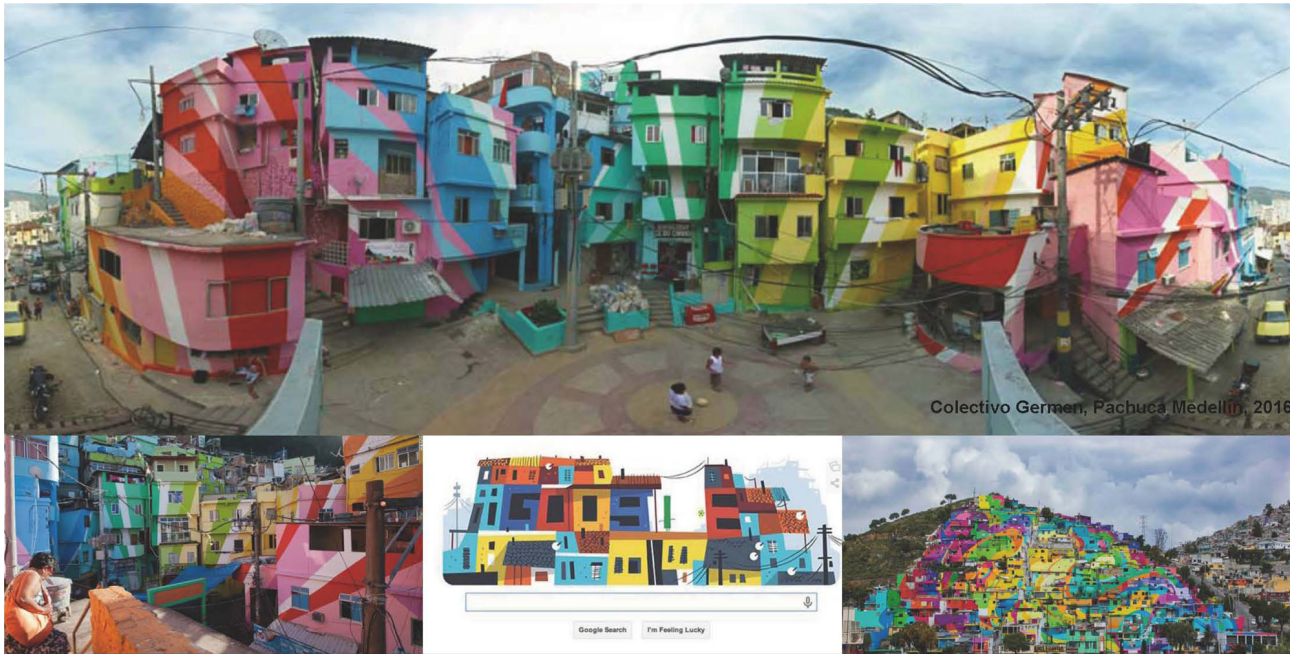


Fig. 11. Pachuca Medellín and Rio di Janeiro. Reactivation of the Favelas with colors painted by the inhabitants through a guide map (Colectivo Germen, 2016).

(Copenhagen) and the Bartlett School (London) etc.
How does representation (or drawing) manifest itself in this type of approach?
In the more or less direct and/or instantaneous expression of its own action programs and movements; experimented programs and scenarios (and, at times, manifested or simulated by graphic or digital expression) in times, phases or sequences of maneuver; in and with different dynamics, but with a strong operative and investigative, social and environmental component.
A representation (manual and digital, but also sensory) that brings together different situationist scenarios (as in the early twentieth century) conducted with a clear operational-informational precision.
The performative capability of this experiential, active/reactive/activist condition brings together new socio-cultural and also material and immaterial (or environmental) programming conditions and its translation into maps that are not exactly psycho/emotional (situational) but socio/activist (experiential) with a high performative capability and with a high degree of conviviality, complicity, sharing and co-creation.

Conclusions. Flexible horizons

The old architectural and urban structures –whether compositional (figurative or formal) or positional (functional or objectual)– have gradually given way to others, more diffuse and impure, which express, then, a new kind of more indeterminate "inform(ation)al" order whose decidedly open, "undisciplined" nature becomes more accentuated in step with the growth in freedom of movement –and displacement– and the degree of interaction between local situations and global structures.
The new "multi-city" is no longer that "island" –harmonious, pastoral, familiar, perfectly defined on the territory– but an increasingly variable and heterogeneous aggregate

Fig. 12. Flow maps and synthesized collective actions. (IAAC - From Craft to Research, Reactive Environments, Rasa Sukkari. In-Between Realities: Towards a Socially Sustainable Urban Strategy for Beirut City, MAA2, 2015).

which, as a complex interactive system developed under the influence of different information and dynamics, has come to be the "polymorphic" and "para-planned" result of successive events and occurrences with –and without– a will to plan.
We experience these phenomena every day, each time more mixed, hybrid and heterogeneous, in the manifestations of our own society.
It is true that in this new age of information, strategy seems to prevail over aesthetics, but not necessarily over creative vision, imagination or the ability to project unexpected (and generally hybrid) "shared scenarios," intended as possible "horizons of action": no longer super-formal, symbolic or totemic but stimulative; conductors, inductors and catalysts at the same time.
Terms such as "idea" or "concept," combined with others such as "representation" or "expression," are still necessary to guide or "design" processes [Gausa, Guallart, Müller 2003].
As architects we work with a secular idea of design able to synthesize creation and technique, subjectivity and objectivity, rigor and flair: compressing information and transforming, manipulating, reconverting and/or visualizing it in synthetic creative spaces, capable of translating an entire universe of messages and analytical data into the form of expressive, visual, perceptual and perceived gambles.
This is/was our strength.
We have talked about this new, progressively open and variable condition, but this condition does not lack the capacity to create "shared horizons" destined to express (orient and induce) qualitatively (and, why not, aesthetically) the new open developments, combining advanced technological models with new, spontaneous, plastic and creative expressions; social, spatial and environmental at the same time; capable of simultaneously combining, in new innovative inhabited spaces (sense-cities), "sensorial" and "sensitive" logics.
CITY_Senses & sens(c)ivilities. Precise DATAS & holistic VISIONS.
Processing capabilities and projectual capabilities; strategic and relational [Gausa 2013, p. 6].
Previsions and interpretations, qualitative actions and visions –strategic scenarios and formulative devices, management or programs, associated with them– define, in any case, urban, spatial and mental "maps," that are no longer closed, totalized or finalistic, but combinatorial, adaptable and increasingly dynamic and evolutionary, and which, in any case, refer to the different cities, both physical and virtual, coexisting in the new "n-city" [Barahonda, Ballesteros 1997].
The three successive approaches that have been presented here, tested or examined at the turn of the century (in relation to the digital revolution itself) do not cancel each other out but, instead, today converge and combine, not replacing, but completing themselves according to the circumstances [13].
The new research springs from this interest in trying to understand the current processes of urban-territorial development [Gausa 2013], not out of mere fascination for the diffuse, chaotic or simply accidental city –or from its mere "intelligent efficiency," through the pure "smart" management of a field of environmental or functional data– but out of a committed and implicated will: that of conceiving new logics and new expressions of interpretation, organization and/or restructuring capable of combining "visions, sensations and information" in new models of action and representation, but also of relation and interaction, more polyphonic, defined beyond the traditional "form" of what has been interpreted historically as city, landscape, territory or, simply, habitat [14].

Notes

[1] The term *geo-urbanity* is introduced in: Gausa, Guallart, Müller 2003; also in Gausa 2009.

[2] See: "*History of Computing*". In <https://en.wikipedia.org/wiki/History_of_computing> (accessed 2 December 2019); <https://www.encyclopedia.com/science-and-technology/computers-and-electrical-engineering/computers-and-computing/digital-computer> (accessed 2 December 2019) See also: Baricco 2018.

[3] We use the term "*agencement*" as "*assemblage*," a contractual (or relational) organization, in a way similar, but not identical, to Deleuze and Guattarri. See: Deleuze, Guattari 1987. See also: Deleuze, Guattari 2007.

[4] See Note 1.

[5] The proposal for MELUN-SENART is found in several publications. See: Lucan 1990; *El Croquis*, No. 53, 1992; *Quaderns*, No. 183, 1989, pp. 94-95.

[6] See: https://es.wikipedia.org/wiki/Fab_lab (accessed 2019, October 16). In 1980, Chuck Hull developed the first 3D printer, whose performance was improved in 1992 with DTM (the first selective laser sintering machines) and was perfected in the late 1990s. From 2001 to 2005, the development of Fab Labs continued its improvement. The incorporation of the first European Dab-Lab into the IAAC dates back to 2003/2004.

[7] 1996-2000, Yahoo; 2000-2002, Google; 2002, Linkedin; 2004-2007, Facebook; 2005-2006, Youtube; 2006, Twitter; 2011, Snapchat; 2016, Uber, etc.. For the history of mobile telephony and networks, see: <https://en.wikipedia.org/wiki/History_of_mobile_phones> (accessed 2019, October 16). For the history of the Internet see: <http://www.fib.upc.edu/retro-informatica/historia/internet.html> (accessed 2019, October 16). See also: Mueller 2010.

[8] See Note 7.

[9] See Note 7.

[10] It is enough to remember the 15th Venice Architecture Biennale, 2016 –*Reporting from the front*– curated by Alejandro Aravena and entitled Unpostponable Dialogues, the Valparaiso Biennale, 2017, dedicated to social activism in Latin America, curated by Felipe Vera and Jeanette Sordi

[11] The importance of new communities, networked, or in common, has increased over the last decade. This refers to the birth of new, (inter)active and collective social communities, but also to a common creativity, obtained from the growing ability to share open source software and programs. See: Markopoulou 2015. See also: Baricco 2018, p. 218.

[12] See: "*agencement*" in: Deleuze, Guattari (2007); and "*engagement*" in Hessel 2011a; e Hessel 2011b.

[13] See: José Ortega y Gasset: "*yo soy yo y mis circunstancias*". See: <https://es.wikipedia.org/wiki/José_Ortega_y_Gasset> (accessed 2019, October 17). See also: <http://memoriamagica.com/yo-soy-yo-y-mis-circunstancias-jose-ortega-y-gasset/> (accessed 2019, October 17).

[14] Original version in Italian with corrections and general revisions by Matilde Pitanti (with the excellent collaboration of Sabrina Leone, Alessia Calabrò and Georgia Tucci).

Author

Manuel Gausa, Department of Architecture and Design, University of Genoa, mgausa@arch.unige.it

Reference List

Allen, S. (2001). La materia de los diagramas. In *Pasajes*, n. 26, pp. 36-38.

Asher, F. (1995). *Métapoles ou l´avenir des villes*. Paris: Odile Jacob.

Barahonda, M., Ballesteros, J. (1997). La ciudad que no se ve. In *Fisuras de la cultura contemporánea*, n. 5, p. 118.

Baricco, A. (2018). *The Game*. Torino: Einaudi (trad. spagnola Barcelona: Anagrama).

Batty, M. (1997). Sobre el crecimiento de la ciudad. In *Fisuras de la cultura contemporánea*, n. 5, p. 4.

Bijlsma, L., Garritzmann, U., Deen, W. (1998). Diagrams. In *OASE*, n. 48, p. 1.

Brillembourg, A., Klumpner, H. (2014). Scarcity as a design tool. In *IAAC Bits*, n. 2, cap. 2.2.1, pp. 1-15.

Deleuze, G., Guattari, F. (1987). *A Thousand Plateaus*. Minneapolis: University of Minnesota Press.

Deleuze, G., Guattari, F. (2007). *Mille Plateaux*. Paris: Les Éditions de Minuit.

Fargas, J.M., Papazian, P. (1992). Territori I modelatge / Territory and Modeling. In *Quaderns*, n. 194, pp. 90-95.

Gausa, M. (2001). Metrópolis>Metapolis: nuevas mapificaciones. En M. Arraiz Garcia (ed). *Ciudad para la sociedad del siglo XXI*. Valencia: Icaro.

Gausa, M. (2009). *Multi-Barcelona, Hiper-Catalunya. Estrategias para una nueva Geo-Urbanidad*. Roma-Trento: List Ed.

Gausa, M. (2010). *Open. Espacio-Tiempo-Información*. Barcelona: Actar Publishers.

Gausa, M. (2011). Diagram as a Battle Map. In AAVV. *Program Diagrams*, pp. 13-17. Seoul: Damdi Publishers.

Gausa, M. (2012a). The diagram as a map of battle and negotiation. In M. Young Pyo, K. Seonwook. *Architectural and Program Diagrams (Construction and Design Manual)*, pp. 216-247. Berlin: DOM Publishers .

Gausa, M. (2012b). City Sense: Territorializing Information. In AAVV. *City Sense, 4th Advanced Architecture Contest*, pp. 6-13. Barcelona: Actar Publishers / IAAC.

Gausa, M. (2013). City Sense. Territorializing information. In L. Capelli, *City Sense. Shaping our environment with real-time data*, pp. 6-13. Barcelona: Actar Publishers / IAAC.

Gausa, M. (2015). Il paesaggio agrario come infra/eco struttura territoriale. In G. Pellegri (a cura di). *Patrimonio artistico culturale paesaggistico. Atti della giornata di studi*. Genova, 11 maggio 2015, pp. 164-180. Genova: GS Digital.

Gausa, M. (2016). Diagrammaticities. Nuove rappresentazioni analitico-sintetiche per la città e il territorio. In G. Pellegri (a cura di). *Di-Segnare Ambiente Paesaggio Città. Atti della giornata di studi*. Genova, 11 maggio 2016, pp. 207-224. Genova: GS Digital.

Gausa, M. (2018). *Open(ing), Space-Time-Information*. Barcelona: Actar

Gausa, M. et al. (2001). *Diccionario Metápolis de la Arquitectura Avanzada*. Barcelona-New York: Actar Publishers.

Gausa, M. et al. (2003). *The Metapolis Diccionary of Advanced Architecture*, Barcelona-New York: Actar Publishers.

Gausa, M., Ricci, M. (2013). *AUM.01 Atlante Urbano Mediterraneo 01. MED.NET.IT.1.0 Ricerche urbane innovative nei territori della costa italiana*. Con P. Scaglione, a cura di N. Canessa, M. Marengo, E. Nan. Trento: List.

Gausa, M., Andriani, C., Fagnoni, R. (eds.). (2017). *AAVV. International Forum MED.NET 3 Resili(g)ence: intelligent cities / resilient landscapes, add scientific meeting. Conference proceeding*, pp. 11-36. Barcelona: Paper Doc.

Gausa, M., Guallart, V., Müller W. (1998). Ideas como estrategias, proyectos como mapas. In *MET 01-Barcelona Metápolis*, pp. 1-3. Barcelona: Actar Publisher.

Gausa, M., Guallart, V., Müller, W. (2003). *HiperCatalunya, Territoris de Recerca*. Barcelona: Generalitat de Catalunya, GENCAT & Actar Publishers (con disegno di R. Prat).

Hessel, S. (2011a). *Indignez-vous! (Pour une insurrection pacifique)*. Montpellier: Indigène éditions.

Hessel, S. (2011b). *Engagez-vous!* Paris: Éditions de l´Aube.

Kleyn, E., Taverne, E. (1997). Painters and satellites. In *Fisuras de la cultura contemporánea*, n. 5, p. 44.

Krausse, J. (1998). Information at a glance: on the history of the diagram. In *OASE*, n. 48, pp. 3-30.

Kwinter, S. (1998). The hammer and the song. In *OASE*, n. 48, pp. 31-43.

Lucan, J. (1990). *OMA-Rem Koolhaas*. Paris: Electa - Le Moniteur.

Lynn, G. (1995). Formas de expresión. El potencial proto-funcional de los diagramas en el diseño arquitectónico. In *El Croquis*, vol. 1, n. 72, pp. 16-31.

Markopoulou, A. (2014). In(Form)ation – Architecture of Data & Code. In *IAAC Bits*, n. 1, cap. 1.3.3, pp. 2-13.

Markopoulou, A. (2015). *Design Behaviors; Programming Matter for Adaptive Architecture*. <https://www.researchgate.net/publication/311516037_Design_Behaviors_Programming_Matter_for_Adaptive_Architecture> (accessed 2019, October 17).

Markopoulou, A., Gausa, M. (eds.). (2014). *Master in Advanced Architecture 2012-2014, Prospectus & Projects*. Barcelona: IAAC.

McHug, I. (2014). *Escaping from planning and world building*. <https://ianmchugh.wordpress.com/2014/06/28/escaping-from-planning-and-world-building/> (accessed 2019, December 2).

Mitchell, W.J. (1996). *City of Bits: Space, Place, and the Infobahn*. Cambridge, Mass: The MIT Press.

Mueller, M.L. (2010). *Networks and States: The Global Politics of Internet Governance*. Cambridge, Mass.: The MIT Press.

Neutelings, W.J. (1992). *Patchwork City*. Rotterdam: 010 Publishers.

Neutelings, W.J. (1994). Patchwork City. In *Architectural Design*, vol. 64, n. 3-4, pp. 58-63.

Ramsgard Thomsen, M. (2014): The role of the new technologies. In *IAAC Bits* n. 1, cap. 1.5.1, pp. 2-7.

Vivaldi J. (2014). Can advanced cities rethink democracy? In *IAAC Bits* n. 1, cap. 1.2.3, pp. 2-13.

Waterworks and Water Systems in Sant'Agata dei Goti. Towards an Integrated Informative System

Giuseppe Antuono

Abstract

The research presents an integrated description of an area in the Campania region between the slopes of the Taburno mountain range and the Terra di Lavoro hills with its numerous infrastructures and factories built from the seventeenth century onwards, small tiles in a cultural-landscape mosaic that still preserves the original engineering works for the supply and distribution of water resources.
Before initiating the study a methodology had to be established to integrate the quantitative data – the geometric and dimensional characteristics of the buildings – with the qualitative data regarding the perception of the landscape and urban image as well as their possible visual appeal.
The study focused on the network of manufacturing and pre-industrial activities along the river north of Sant'Agata dei Goti. The data gathered from historical, iconographic and archival documentation was combined with all the other information (position, orientation, characterisation of the water supply system) and with the data from the digital, photogrammetric and aerial photogrammetric survey. The goal was to create a structured and georeferenced database, organised according to formal, functional, and building types, so as to develop a useful tool to understand and enhance architectural and landscape heritage as well as promote initiatives involving conservation and digital fruition.

Keywords: survey, information system, landscape, enhancement.

Introduction

Water has always been an added value for the landscape and economy of the old Campania Felix region. Small torrential streams between the slopes of Mount Taburno and the Tagliola gorges at the mouth of the valley towards the municipality of Sant'Agata dei Goti wind their way between labyrinthine meanders, embankments, woods and plantations, creating the 'weave' of the landscape; the streams input into the Isclero river which from the Caudina valley, located in a north-west direction, cuts through the Moiano gorge and then merges with the Volturno river.
More or less visible fragments of former infrastructures can be glimpsed nestling in the vegetation while travelling upriver; these infrastructures were used when close ties existed between this area and the Terra di Lavoro province.

As far back as the seventeenth century numerous activities chiefly involving the transformation of agricultural products or textile manufacturing were powered by the waters of the Isclero river thanks to a widespread network of channels and hydraulic engineering works such as the Carolino [Serraglio 2008] and the Carmignano Aqueducts [Fiengo 1990].
The many different forms, dimensions and locations of this extensive heritage of industrial architectures depend on the morphological, hydrological, historical and cultural peculiarities of the territory. The 16 weaving mills that have been identified, in some cases hidden in the dense vegetation, often abandoned and unknown to most, have evolved differently; this is due more to the adaptability of the water

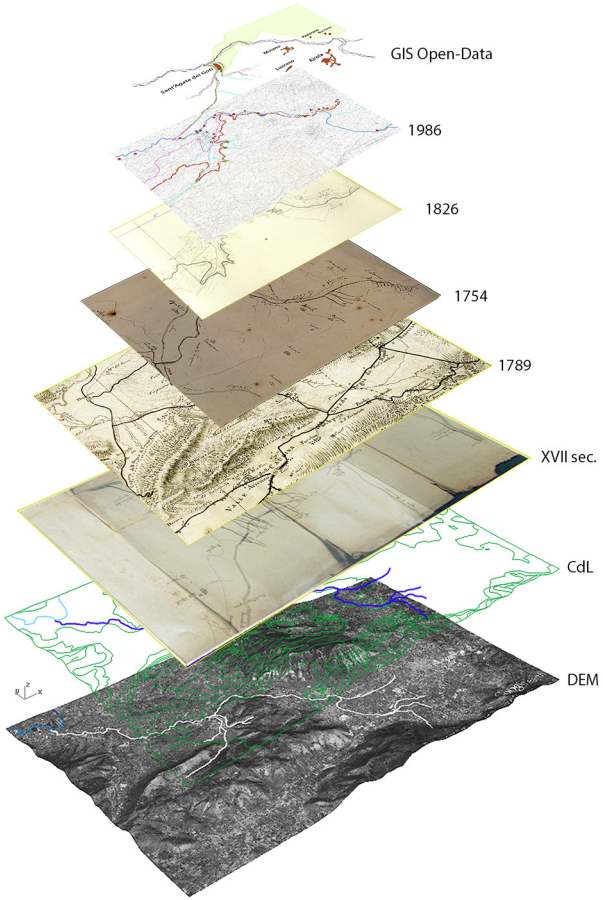


Fig. 1. Overview of the information system; from the bottom to the top: DEM; Level Curve model; Pianta dell'acqua di S. Agata de' Goti… [AAVV XVII sec.]; Carta Topografica delle Reali cacce di Terra di Lavoro… [Rizzi Zannoni 1789]; Disegno a penna che delinea il percorso… [Vanvitelli 1754]; l'Acquedotto Carolino [Pattuarelli 1826, p. 105]; IGM del 1984, Tav. 17; digital model of water infrastructure, (graphic elaboration by the author).

transportation infrastructures and milling systems used to increase yield than to their structure – always in local stone and with a similar topological and spatial distribution. Over the years this infrastructural network has shaped the territory, leaving numerous traces such as embankments, water channels, ravines, small inspection huts, weaving mills and bridges to "organise" or "correct" the irregularities. While inputting into the overall "design", these infrastructures have acted as elements linking and mediating between the city and its surroundings.

The initial informative models

The current urban landscape includes an extensive multifaceted repertoire of archaeological-industrial sites; the fist step was to insert their geometric and topological characteristics and all the pertinent qualitative-quantitative features in a georeferenced database (fig. 1); the comprehensive mapping of the state of the sites revealed a stratified ensemble of components implicit in the structure of the data in order to establish the 'functioning' of the area along the Isclero river.
The study and analysis of archival documents revealed that a string of small businesses were located along the banks of the Isclero; these businesses acted like a 'productive machine' facilitating the creation of fish ponds, washhouses, wells, fountains, animal sheds, product processing huts, and cabins for the inhabitants.
Superimposing and comparing the historical-cartographic documents in a GIS environment highlighted the extent of the operational and environmental transformations that have taken place over the centuries and affected the course of the riverbed, prompting a relocation of the watermills and weaving mills to where they currently stand.
The historical reconstruction of the work of the engineers active during that period shows how their design of the hydraulic works at the outer edges of the built - water supply and outlet channels, filters, sluices, wells – was well-suited to the context and that they solved all the jurisdictional aspects and any conflict of interest between the public and private domain. In fact, since the buildings used to produce iron and copper were economically more important [Bianchini 1834] they were present along the river banks north of Sant'Agata dei Goti during different periods in time (fig. 2).
The building known as the *Mulino-Ferriera Alviggi* (fig. 3) un-

Fig. 2. Overview of the Isclero river belt, north of the inhabited Sant'Agata dei Goti, with the network of water supply and service distribution to factories and mills (graphic elaboration by the author).

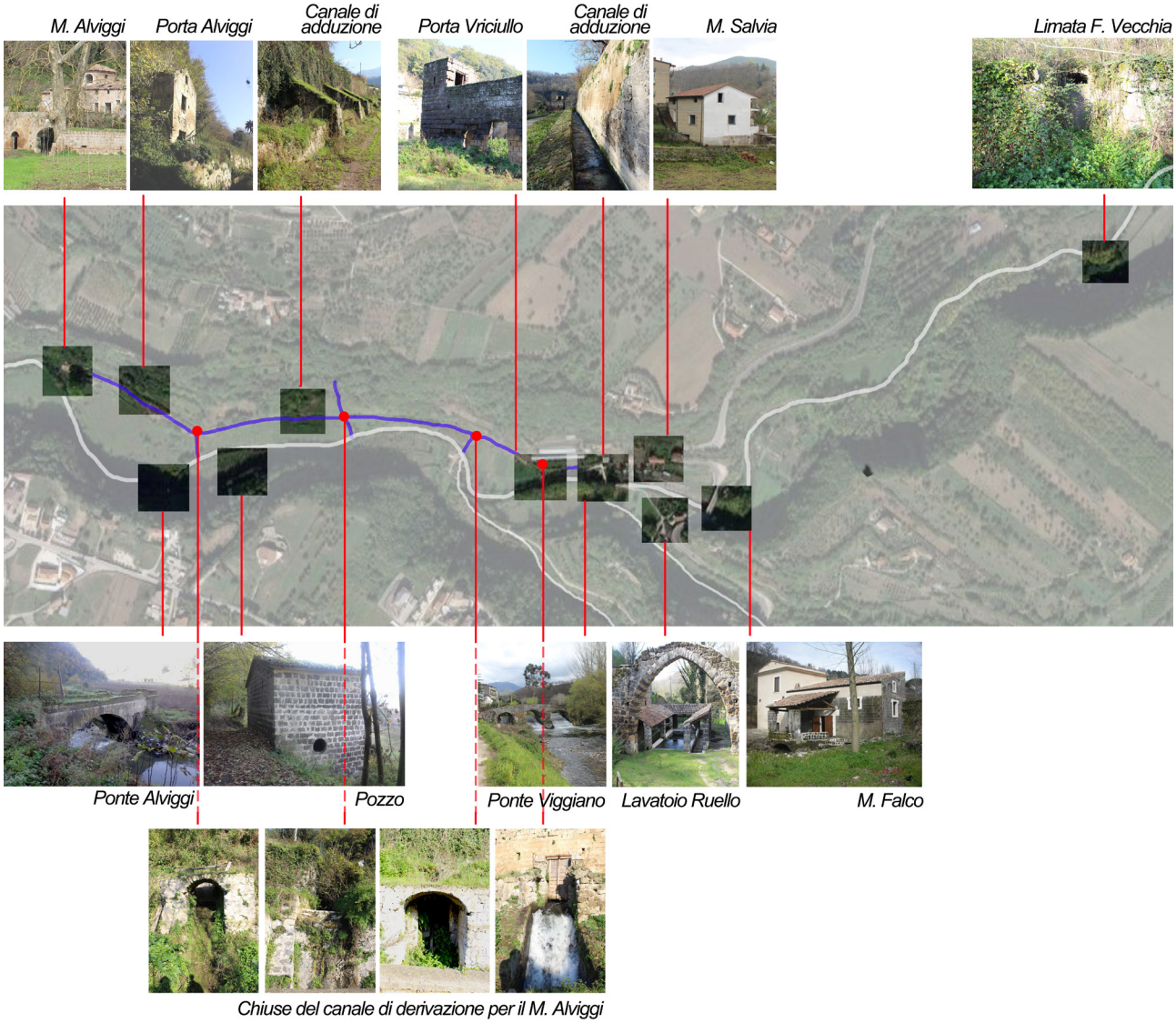


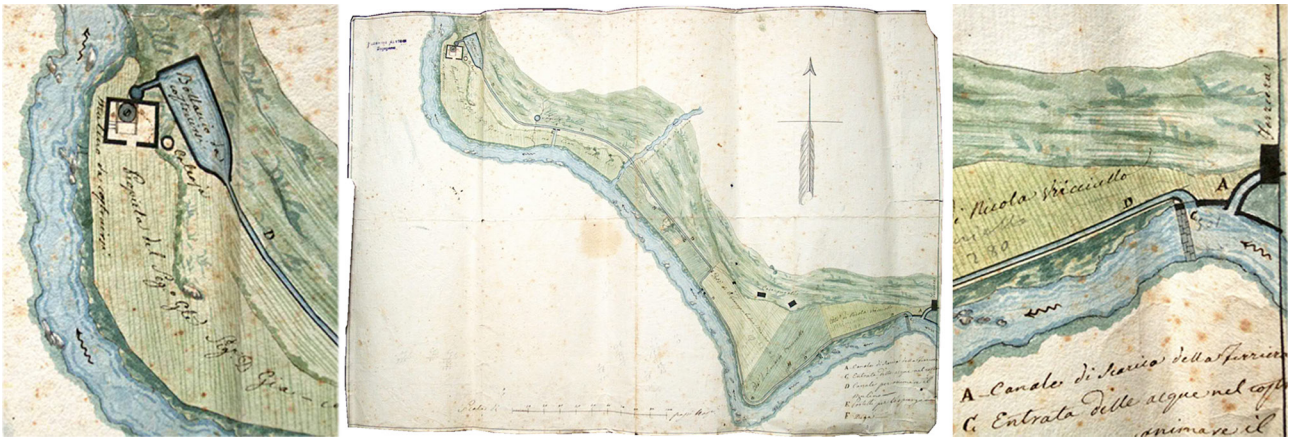
Fig. 3. The complex of the «Mulino-Ferriera Alviggi» in a top view from drone (photography by the author).

doubtedly represented not only an important productive facility in the region, it also contributed to the development of civil society [Rubino 1978, p. 1]. The mill was part of the extensive restructuring and modernisation project implemented by the Bourbons and in fact the site was known as the valley dei ferrari (of the iron workers), (Carolingian Cadastre, 1752). After the Bourbon project this former iron and steel centre in southern Italy became a Hydroelectric Plant supplying electric lighting in the early years of the twentieth century [De Martino, Suppa 2017, p. 429].

It is not easy to establish exactly when it was rebuilt or whether it involved renovating and upgrading a pre-existing building. Several documents show that the first ironworks was located to the east in an area known as the "ferrera" [AAVV 1350-1386, ff. 10-13]. The site is also cited in the reports commissioned by King Charles III of Bourbon to obtain a clear picture of the waters he intended to "divert" to the Carolingian Aqueduct [Fiengo 1990, p. 109]. The estimate drafted by engineer Lorenzo Ruggiano [AAVV 1687] talks of an area called "Limata della Ferrera Vecchia e la sua fabbrica» which in 1689 was unusable; all that remained was "some of its walls", but there is no indication of where it was located [AAVV 1689, p. 152v]. The only helpful maps that exist are: the *Topographical and hydrographical map of the area around Naples* (IGM FI, 1817-1819) and the *Map of Southern Italy* (IGM FI, 1863). Both maps place the "Ferrera Vecchia" building further up, beyond the Viggiano bridge, in a spot that corresponds neither to the graphic images drawn by engineer Alviggi [Alviggi 1853-54], nor to current local toponym. Instead if we step back in time, this site is compatible with statements by Duke Giacomo Cosso when he speaks of the damage to his "Ferriera, e Ramiera" [ironworks and copper works] after the construction of the Carmignano Aqueduct [Arena, Dentice Massarenghi 1796, p. 4]. In fact, the reply sent by Cesare Carmignano and Engineer Alessandro Ciminelli to his summons to appear in court [Mauri, Vargas Macciucca 1759, p. LXXIV] contains information about the state of a "Ferriera, e Ramiera" where "new Buildings were useless, since part of the old buildings were under water and useless […]; but to eliminate any disagreement he said,

they would be rebuilt elsewhere at his expense, in other words in the locality known as S. Francesco Vetere" [Mauri, Vargas Macciucca 1759, p. LXXV]. By using the adjective "old" he clearly indicates that it was a dilapidated "ancient building" in ruins, but at the same time, he differentiates it from another building, the «new» building used for the same purpose and present in the area of Sant'Agata. In fact, the «Book in which all rents are recorded, [...] beginning in this year, 1756 [...]" specifies that the rent contract applies to two territories respectively called Limata della Ferriera vecchia and Limata della Ferriera nuova [AAVV 1756].
In the first drawings of the Alviggi mill [Alviggi 1853-54] the area where the new structure was to be built appears to be free of any other constructions; the general plan (fig. 4) also provides accurate and irrefutable information about the site of the previous Ferriera. A beautiful watercolour shows a small building, outlined in black China ink, towards the mountains beyond the river, close to the Viggiano bridge.
The building, labelled «Ferriera», was active in the Sant'Agata territory as a «tanning house, ironworks and copper works» [AAVV 1689, p. 152v] up until the first half of the nineteenth century (it was later turned into the Salvio mill and is now used as a house).
The area north of Sant'Agata dei Goti was strategic in the steel industry; the infrastructures required careful planning of the water catchment, supply and flow of water to the hydraulic milling machines. This involved establishing the right size of the water catchment basins and regulating canals.
The first problem the engineer Federico Alviggi had to solve was how to overcome a bed fall and ensure a big enough volume of water so that work could continue even during droughts. His solution exploited the orography of the land. The water deviated from the Isclero river – "more specifically in the locality known as Viggiano bridge, the latter having three spans forming a dam at the point of diversion of the waters of the artificial canal" [Alviggi 1934, p. 6] – are channelled into a "regulating canal with tuff masonry walls, 978.65 metres long, partially raised and partially entrenched; not far away from the hillside it is equipped with a surface spillway, and afterwards with overflows and hydraulic screw gates, and with a final outlet channel" [Alviggi 1934, p. 5]. The canal ended in the main «bottazzo», i.e., a catchment basin with masonry walls. From here water flowed downwards into the mill.
The mill had two floors (figs. 5, 6): two millstones were located on the ground floor while the upper floor was reserved for the miller. After further enlargement, an ingenious bypass system was created to serve four basins incorporated into the load-bearing masonry structure [Alviggi 1934, p. 8]; they were connected to the main basin by a longitudinal canal at the foot of the tuff ridge. The canal was also used when the waters were too high and were

Fig. 4. Historical cartography of the Isclero river belt north of Sant'Agata dei Goti [Alviggi 1853-54].



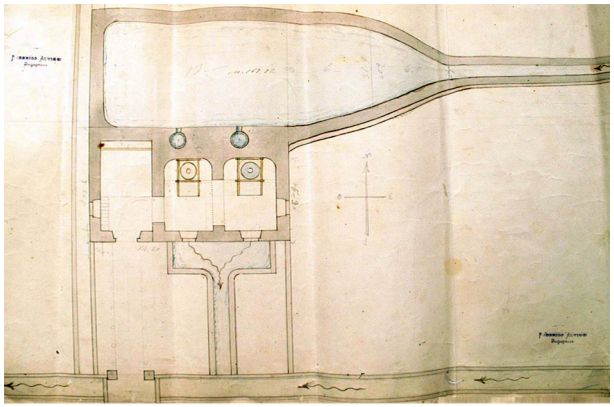


Fig. 5. Plant of the mill with the water system. Drawings of the «Mulino-Ferriera Alviggi» [Alviggi 1853-54].

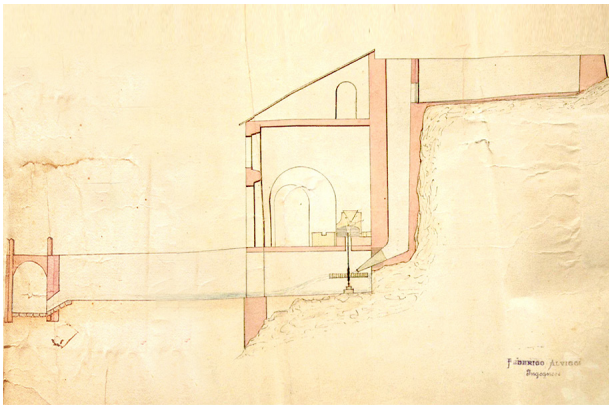


Fig. 6. Section of the mill with the water system. Drawings of the «Mulino-Ferriera Alviggi» [Alviggi 1853-54].

allowed to flow into the river [Alviggi 1934, p. 9].
Three millstones were located in several ground floor areas (still visible); the two big areas were used as a depot, plus a room for the miller, with a small area for the grain grinder next to it. A small flight of steps led to the first floor with a big terrace, four small rooms, and two rooms to store the grain [Alviggi 1934, p. 3]. The mill was active until the second half of the nineteenth century when it had to deal with another product of hydraulic energy: electricity, which led to the construction of a new mill, "next to the Alviggi Mill" [Alviggi 1934, p. 3]. The new mill did not function for long: abandoned and dilapidated it is impossible to instantly interpret its parts, except by reading the draft project report [AAVV 1901, p. 1]

Survey methodology

The methodological approach used integrated survey techniques and instruments to digitally acquire the geometric and chromatic data for the analysis and, more in general, the project to enhance the existing structures. Extremely accurate data is required in certain very specific fields such as industrial archaeology; this data can be obtained by using technologies that integrate traditional survey methods based on passive sensors (image-based) such as high resolution digital photogrammetry [Blais 2004; Guidi et al. 2009; Fiorini, Archetti 2011; Velho, Frery, Gomes 2009; Fiorillo et al. 2013; D'Agostino, Antuono, Pepe 2015]. In order to save time and money, these technologies can replace the ones which use active sensors (range-based), integrated with automatic image processing methods such Structure from Motion [Del Pizzo, Troisi 2011] and segmentation and classification of data [Weinmann, Weinmann 2017; Ozdemir, Remondino 2019]. Choosing the most suitable methodology and technology, and integrating different solutions and technologies, was the best approach for the site of the "Mulino-Ferriera Alviggi" since it would establish the qualitative level of the survey, given the complexity of the object and the communicative goals of the study. The survey programme became an exemplary and repeatable multiscalar study model that can be applied to other buildings with the same geometric-configurative complexity and communication potential.
The survey project was performed using passive terrestrial and aerial technologies to collect comprehensive data (fig. 7). Gathering documents and making a preliminary onsite visit was crucial in order to identify the critical areas that would influence the definition of the points and photographic shots, on the basis of the resolution of the images and scale of representation of the graphic restitutions.
The aerial photographic survey campaign was performed using a Mirrorless Canon Eos M camera mounted on a 4K Xiaomi Mi drone that could either create nadir images, required to acquire detailed images of the covered area, or images produced with a tilted camera in order to survey

and complete the spatial data and permit better, quicker and cheaper alignment with the terrestrial images [Fallavollita et al. 2013; Nex, Remondino 2014]. Mapping the site led to over 1,000 images, acquired at a height of roughly 30-40 metres. Given the conformation and narrowness of the river at that point, the wind and vegetation were an influencing factor. Due to the orographic conditions and difficult access to the site, we drafted a Mission Planner, a waypoint itinerary with tap to fly and circle trajectories that the drone followed based on Google Maps and an onboard GPS, combined with a 720p live video streaming which was useful to follow the drone's flight around the object. This technology made it possible to cover the whole study area once we had established the following: the flight trajectory, the start and end of the recording, the flight height, and the camera's speed and shot angle to ensure adequate superimposition of the shots within a sequence (fig. 8).

The photographic, georeferenced sequences involved several shot points and camera tilts [Barazzetti, Scaioni, Remondino 2010]. The photographs initially focused on the state of the site; they were executed along convergent axes, from south-east to north-west, in a F1 direction; this enabled identification of most of the dominant planes of the main façade of the complex architectural object. The second series, in a F2 direction (tiled by 30°) enabled identification of the upper dominant planes. Finally another series in a F3 direction (longitudinal axis) completed the photographic campaign of the whole object in question.

The dense vegetation along the south-west and north-e-

Fig. 7. Overview of the different photogrammetric and aerophotogrammetric modes of shooting and three-dimensional reconstruction of the «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

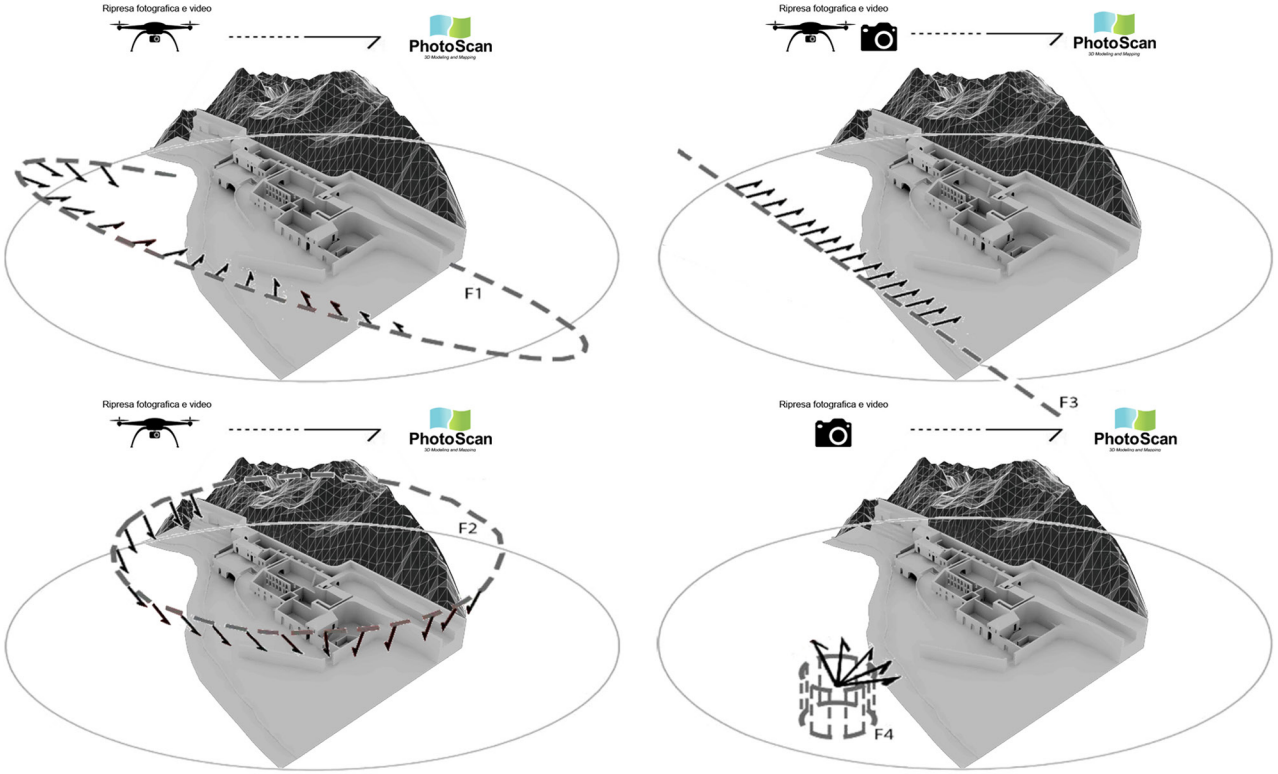


Fig. 8. Mission Planner Overview with longitudinal direction and zenith camera angle, «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

ast side of the building was one of the critical elements influencing the direction of flight (e.g., the tall tree located in front of the main façade). This difficulty, and the complex spatial layout of several areas of the complex (e.g., the grinding area to the east next to the main loading «bottazzo»), led to gaps in the points cloud and noise; to solve this problem burdensome filtering and integration with a photographic survey (F4) was required, including in some areas inside the original nucleus of the mill (this part of the survey was performed using a digital Reflex Canon EOS 600D camera with a EFS 18-55 mm lens and a Reflex K&F Concept TM 2324 tripod). A network of 25 data capturing stations referenced using single points and typoints were related to the points clouds obtained through aerial photogrammetric images (fig. 9).
The SfM and multi-stereo matching algorithms have made it possible to rebuild the cloud of high-resolution, filtered and decimated points to reduce computational burdens, from which to derive a DSM/DTM and the georegerenziate orthophotos geotiff of the site integrated to the discrete geometric data in GIS environment through LAS dataset tools [Remondino, Ozdemir, Grilli 2019] to achieve morphological and relational analysis, operating for different elevation and visibility ranges, useful to reconstruct the spatial values of the architectural complex (fig. 10), with reference also to the widespread degradation phenomena.

GIS-UAV integration to analyse the territory

The creation of interoperable, multiscalar platforms testifies to why the digital model needs to be integrated, in other words because its spatial and metric data, on a DEM or DTM cartographical support, implements the analyses of the landscape and its hydraulic-productive systems.
Each architectural element in this three-dimensional informative system represents an entity to which hetero-geneous information has been added based on an archival system that constantly updates and increases the in-formation contained therein. The "Mulino-Ferriera Alviggi" is just one fragment of a much bigger productive area along the river; its codification helps to re-interpret changes in the architecture and landscape.
The coding, standardization and classification of data from the historical, iconographic and photographic documentation about the conservation status of the site, with the

results of the terrestrial and aerophotogrammetric survey –, allowed the comparative reading of the information to describe the transformations of the territorial context and its water and production component.
The thematic and temporal comparison, through the rubbersheet for "recurrent points" of the carto-photographic and historical database, allows to rediscover the system relations between the building and the context, restoring the picture of the "operation" of the Isclero river belt, with the recognition of its physical-environmental and geomorphological characteristics (fig. 11).
The quantitative-typological information model shows the landscape, its history, the evolutionary dynamics of the riverbed, and the canals leading to the mills; it also reveals how all that changed after the alterations made over the centuries not only affected the way the mills functioned, but also led to a change of location.
This results in a geo-referenced database which, through segmentation and classification into geometric-typological classes, contains formal and functional attributes, including a composition of summary cards and a cataloguing of images oriented according to the observation points, to be recalled through direct links, to describe the individual artifacts and their conservation status, useful tool to enhance the landscape heritage and promote actions of digital enhancement and enjoyment.
The integration of the topographical and cartographic data with the categorization of archival images creates keys of reading of multidimensional reality where each point of the territory has a different 'depth of information' given by the construction of thematic layers that incorporate not only data, numbers and signs, but also the perception of places through images for qualitative analysis.

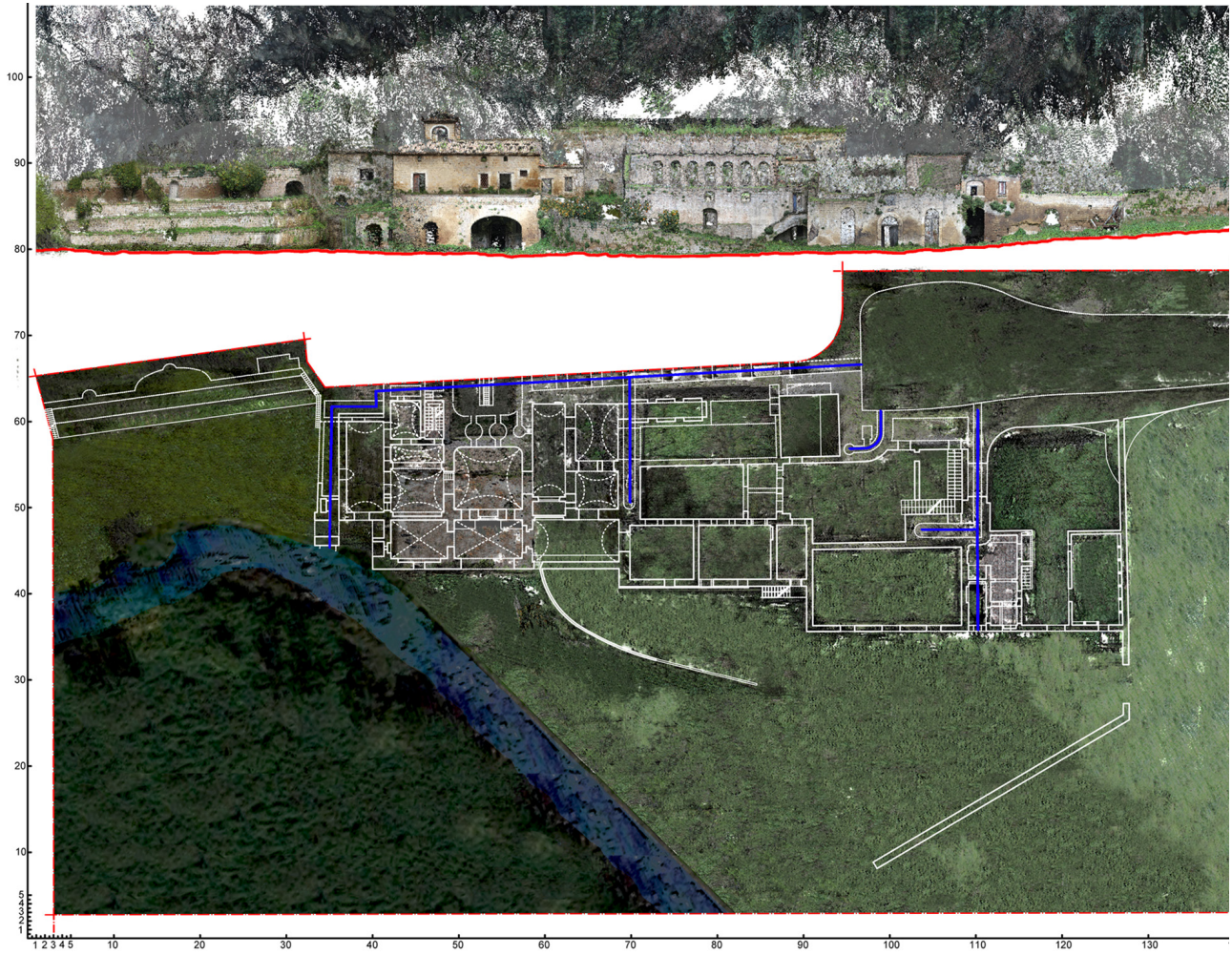
Conclusions

The integration of digital-analogue heterogeneous data with geometric and topographic data into a synthetic information model of the investigated reality, acquired through digital photogrammetric survey techniques (terrestrial and aerial)requires a process of discretisation and segmen-

Fig. 9. View from the south-east of the photogrammetric model of the «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

tation into stratum information units, classified into categories and subcategories, which facilitates the relationship of information through the functions of spatial analysis capable of responding to the problem of "representation" of complex production realities such as that of "Mulino-Ferriera Alviggi". The relational structure of the data, able to reveal a stratified set of components, opens to new forms of interactive and dynamic analysis useful to understand the transformations of the local productive reality, linked to geomorphological aspects and connected to the hydraulic supply network, with significant repercussions on the perceptive component of the places. The possibility

Fig. 10. Plan and elevation of the photogrammetric model of the «Mulino-Ferriera Alviggi», integration of data from terrestrial and aerial technology and return of water supply and distribution (in blue) of service to the premises of the complex (graphic elaboration by the author).



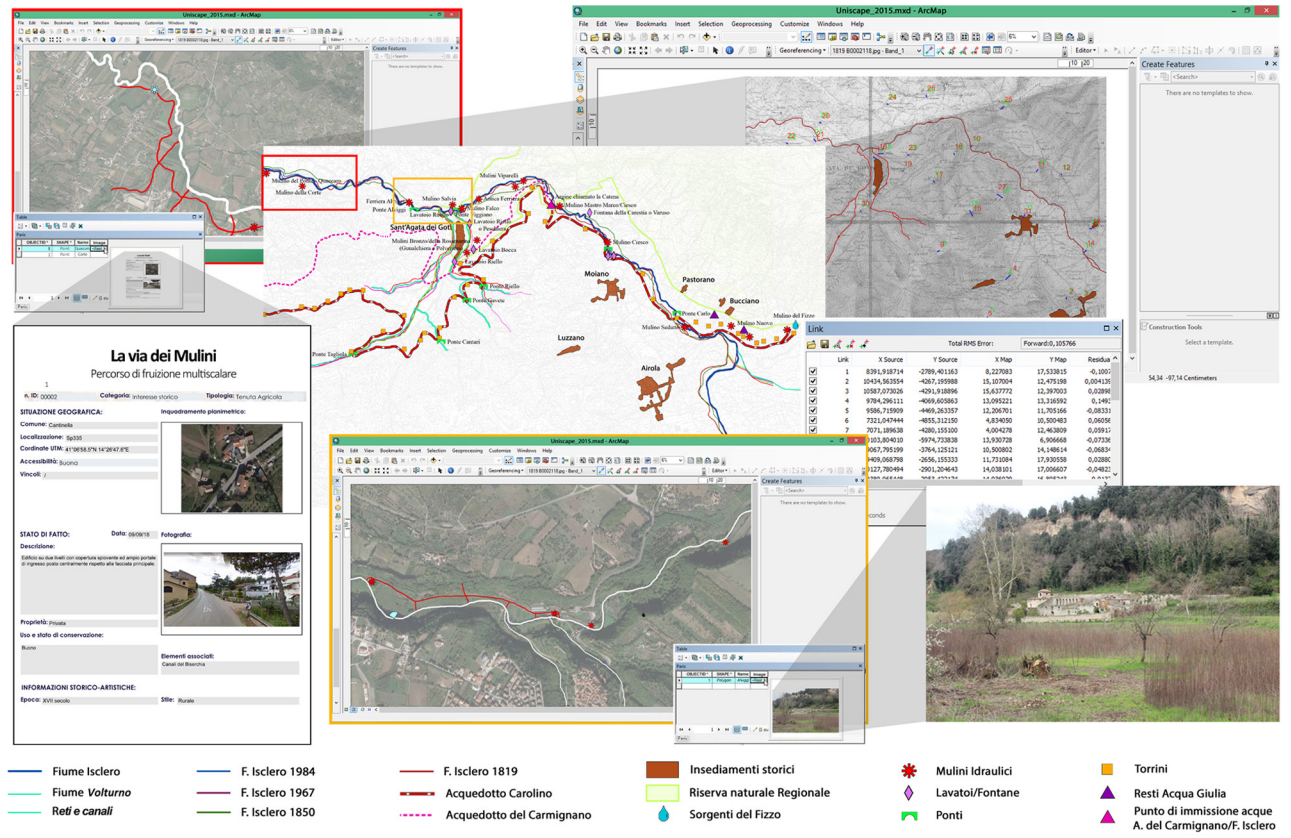
of obtaining geometric and spatial data of greater detail and precision, through the survey with UAV systems and implemented in GIS environment, facilitate understanding of the dynamics of phenomena acting on a given environment, facilitating the monitoring of the territory for control or planning purposes and the diagnosis of materials and the analysis of the state of degradation of such artifacts.

At the same time the adoption of such models and predictive methods favors those stresses for the recovery and enhancement of a past that can be, at the same time, evocative fragment, anatomical text, historical testimony, pretext for new experiments, as well as instrumental object to the knowledge and dating of himself and the related historical building of his reference territory.

Author

Giuseppe Antuono, Department of Civil, Building and Environmental Engineering, University of Naples 'Federico II', giuseppe.antuono@unina.it

Fig. 11. Overview of the Information System: layering of paths, water and production systems along the river; cataloguing of architectures and artifacts; categorization of the perceptive component (graphic elaboration by the author).



Reference List

AAVV (1350-1386). *Diversa Mensae Episcopalis*. Fondo Jura, tomo V, parte III. ADSAG -Archivio Diocesano di Sant'Agata dei Goti.

AAVV (1687). *Processetti per le intestazioni dei Feudi*. Regia Camera della Sommaria, Materia Feudale, vol. 63, processo 930, cc. 17r – 60v. ASN - Archivio di Stato di Napoli.

AAVV (1689). *Copia estratta dalla relazione Apprezzo della Città di S. Agata*. Fondo Atti Demaniali, n. 201. ASB - Archivio di Stato di Benevento.

AAVV (1756). *Libro in cui si registrano tutti gli assensi delli Affitti dell'Eccellentissima Ducal Camera Padronale, principiato in quest'anno 1756. Agente il Razionale D. Menna Albanese et erario il Magnifico Crescenzo Cimino*. ASCSAG - Archivio Storico del Comune di Sant'Agata dei Goti.

AAVV (1901). *Preventivo per la spesa d'impianto Pubblica Illuminazione*. Cartella n. 10. ASCSAG - Archivio Storico del Comune di Sant'Agata dei Goti.

AAVV (XVII sec.). *Pianta dell'acqua di S. Agata de' Goti e sua descrizione de' Confini Durazzano, la Valle, Mataloni, fondo Carafa di Maddaloni e di Colubrano*. II H/2. ASN -Archivio di Stato di Napoli.

Alviggi, C. (1853-54 ca.). *Disegni del "Mulino-Ferriera Alviggi"*. Napoli: AfA - Archivio famiglia Alviggi.

Alviggi, C. (1934). *Relazione tecnica del molino agricolo a cereali, a forza motrice idraulica*. Napoli: AfA - Archivio famiglia Alviggi.

Arena O., Dentice Massarenghi, G. (1796). *Saggio delle azioni promosse dalla Fedelissima città di Napoli contra il Sig. D. Giuseppe Carmignano*, e *'I Patrimonio di Carnevale, anno 1796, Acqua di Carmignano*, fascio n. 1833, Acqua di Carmignano, Napoli: ASCN - Archivio Storico del Comune di Napoli.

Barazzetti, L., Scaioni, M., Remondino, F. (2010). Orientation and 3D modeling from marker less terrestrial images: combining accuracy with automation. In *The Photogrammetric Record*, vol. 25, n. 132, pp. 356-381.

Bianchini, L. (1834). Sullo stato delle ferriere del Regno di Napoli. In *Il Progresso delle Scienze, delle Lettere e delle Arti*, quaderno XVII, pp. 108-125. Napoli: Porcelli.

Blais, F. (2004). Review of 20 years of range sensor development. In *Journal of Electronic Imaging*, vol. 13, n. 1, pp. 231-243.

D'Agostino P., Antuono, G., Pepe, F. (2015). Action cameras in digital photogrammetry. Experiences of comparison of dense point clouds. In *Proceedings of VII Convención de Agrimensura*. La Habana, Cuba, 23-26 de septiembre 2015, pp.1-12. La Habana: Editorial Obras.

De Martino, G., Suppa, M. (2017). Didattica, Ricerca, Tutela. Il caso del mulino-feriera Alviggi a Sant'Agata de' Goti. In *Scienza e Beni Culturali, Atti del XXXIII Convegno Internazionale Le nuove frontiere del restauro, trasferimenti, contaminazioni, ibridazioni*. Bressanone 27-30 giugno 2017. Treviso: Edizione Arcadia Ricerche Srl.

Del Pizzo, S., Troisi, S. (2011). Automatic orientation of image sequences in cultural heritage. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Science*, vol. 38, n. 5/W16, pp. 293-300.

Fallavollita, P. et al. (2013). UAS for archaeology. New perspectives on aerial documentation. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences. Proceedings of UAV 2013*. Rostock, 4-6 September 2013, vol. 40, n. 1/W2, pp. 131-135.

Fiengo, G. (1990). *L'acquedotto di Carmignano e lo sviluppo di Napoli in età barocca*. Firenze: Olschki.

Fiorillo, F. et al. (2013). 3D digitization and mapping of heritage monuments and comparison with historical drawings. In *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Proceedings of XXIV International CIPA Symposium*, Strasborurg, 2-6 September 2013 vol. II-5/W1, pp. 133-138.

Fiorini, A., Archetti, V. (2011). Fotomodellazione e stereofotogrammetria per la creazione di modelli stratigrafici in archeologia dell'architettura. In *Archeologia e Calcolatori*, n. 22, pp. 199-216.

Guidi, G. et al. (2009). A multi-resolution methodology for the 3D modeling of large and complex archeological areas. In *International Journal of Architectural Computing*, vol. 7, n. 1, pp. 39-55.

Mauri, C., Vargas Macciucca F. (1759). *Ragioni per la diversione ordinata dalla Maestà del Re di alcune acque d'Airola per la Regal Villa di Caserta, Napoli*. 5 agosto 1759, e pubblicato nel 1827, SBN, XV, C 17. Napoli: SNSP - Società Napoletana Storia Patria.

Nex, F., Remondino, F. (2014). UAV for 3D mapping applications: a review. In *Applied Geomatics*, n. 6, pp. 1-15.

Ozdemir, E., Remondino, F. (2019). Classification of aerial point clouds with deep learning. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences*. Proceedings of Geospatial Week 2019, Enschede, 10-14 June 2019, vol. XLII, n. 2/W13, pp. 103-110.

Pattuarelli, F. (1826). *Caserta e San Leucio*. Napoli: Stamperiae Colubrano.

Remondino, F. Ozdemir, E., Grilli, E. (2019). Nuvole di punti semantiche. In *Geomedia*, vol. XXIII, n. 2, pp. 12-13.

Rizzi Zannoni, G.A. (1789). *Carta Topografica delle Reali cacce di Terra di Lavoro e loro adiacenze, IGM FI sez. cartografia storica*. Inv. gen. n. 57, doc. n. 10.

Rubino, G.E. (1978). *Archeologia Industriale e Mezzogiorno*. Roma: Giuditta.

Serraglio R. (2008). L'acquedotto Carolino: il sistema produttivo dei mulini. In *Storia dell'Ingegneria, Atti del Secondo Convegno Nazionale*. Napoli: Cuzzolin Editore.

Vanvitelli, L. (1754). *Disegno a penna che delinea il percorso del condotto che porta l'acqua a Caserta Nuova*. BNN, sala mss., Autografi Vanvitelliani, XV A9 bis, busta 4, f. 13.

Velho, L., Frery, A.C. Gomes, J. (2009). *Image Processing for Computer Graphics and Vision*. Cham: Springer.

Weinmann, M., Weinmann, M. (2017). Geospatial Computer Vision based on multi-modal data - How valuable is shape information for the extraction of semantic information? In *Remote Sensing*, vol. 10, n. 1, pp. 1-20.

Lucania's Landscape and Territory between XVII and XIX Centuries through Archival Drawings

Giuseppe Damone

Abstract

Military reasons, disputes over matters of borders, indications on the use of the land, appraisals for damage following natural disasters have led, over the last few centuries, to the production of a considerable archival graphic material, whose study allows us to understand the settlement geography of an area, grasping the architectural peculiarities of buildings and reconstructing their transformations, but also tracing signs of urban reality that have disappeared today, even before the traditional archaeological studies. No less important is the graphic study of these iconographic testimonies to understand the rules of representation known to the technicians of the time.
Starting from the examination of archive folders, among the various papers numerous graphic documents have been traced which allowed to reconstruct the Lucanian settlement geography between the XVII and XIX centuries. A fundamental reflection was reserved to the graphic study of these maps which highlighted the knowledge of the time surveyors on the construction of the represented space, and how these were 'adapted' to the communication needs required by the different commissions.

Keywords: territory design, landscape, cabrei, *maps.*

Introduction

The importance of reading the iconographic testimonies of the past implies the possibility of reading the transformations that have affected the landscape and the territory in a time frame taken as a reference. Through geometric designs of the territory and symbols, man documents natural spaces and anthropic actions, but the semantic value of the sign used "has always taken on a more important role than the sign in itself, becoming a real language" [Iannizzaro 2006, p. 9]. The change ability of the communication needs, useful to describe the territory and how much it develops, which has characterized the evolution of man in the various ages and in the different civilizations of history, has led to the introduction of a communication based on "visual elements of immediate understanding" [Iannizzaro 2006, p. 9] that we find, among other things, in the thematic representation of the territory.
Leaving aside the birth and development of the representation of the territory in the civilizations of the past, where we find both the first attempts at depicting the known world, and drawings of the territory on a reduced scale for reasons of confinement between cultivated fields or between areas of different jurisdiction, we want pay attention to particular aspects of representation between the seventeenth and nineteenth centuries.
In the specific case of Basilicata, cartographic production is mainly linked to the activity of land surveyors where "the practice of representation is essentially linked to the juridical relationships that are established on the earth;

hence the marginality of urban images, almost always limited to symbolic representations within a wider territorial context" [Angelini 1987, p. 191].
The reading of these maps becomes fundamental to read the evolutions that the territory, in the specific case the Lucan one, has undergone over the centuries, and to identify the traces of human activities in the period taken as reference [1].

From the practice of surveying to the technical design of architects and engineers: centuries in comparison

The reappearance of the surveying practice, after its absence during the Middle Ages, is linked to the need for a new management of the territories, where the figure of the land surveyor has in himself legal knowledge –civil, feudal and customary law– and techniques, besides having a recognized power in the legal system. It should also be said that the Neapolitan survey does not record a technological progress between the sixteenth and eighteenth centuries, as instead occurs elsewhere. In fact, the use of instruments such as the squaring, the compass, the compass and the chain is still used, even when the distance gauge telescope and the preparatory tablet made their appearance, while the use of the triangulation method for measuring is documented of funds.

Fig. 1. Two of the maps contained in the platea of the church of Albano di Lucania designed by the surveyor Angelo d'Ostuni in 1757 (Historical parish archive of Santa Maria Assunta, Albano di Lucania).

"The surveying practise remains fixed to the most elementary knowledge of plane geometry: every shape must be reduced to triangles, rectangles, trapezoids, in order to be measured with rudimentary tools" [Angelini 1989, p. 267] .
We will have to wait until the nineteenth century to see the use of the new instruments, probably not suitable for simple surveys of bases and measurements of tracks of moderate length that represent the main land surveying activity carried out in the previous centuries, and that would have made the use useless of more complex instruments [Angelini 1987, pp. 192, 193].
"In the XVIII century, the surveyors had acquired a discreet representative capacity; the works, often executed with skill and taste […] represented only small extensions of territory. In most cases, as Domenico Grimaldi described in 1780, they were "very ignorant of the first rules of Geodesy, incapable, therefore, of carrying out extensive geographical areas" [Valerio 1993, p. 123].
The production of drawings of the territory, often gathered in *cabrei* and slabs, responds to two fundamental requirements: the maps represent a document to resolve legal questions regarding boundaries, usurpations, easement of passage, etc., or become 'an element' for the inventory of owned assets, as often happens for monastic orders or for secular clergy.
"In the inventory the land surveyor, who is always a freelancer or a clergyman authorized to exercise, has a subordinate position, since it is the intervention of a notary who gives the document legal value; however the geometrical operations constitute the substance and sometimes they are not limited to simple measurements and scale reductions, but also contain hypotheses for a more rational management of the lands: planting of farms, redefinition of contracts, cultivation destination" [Angelini 1987, pp. 199, 200].
Another peculiarity is that the cartographic production in Basilicata is not homogeneous and is strongly linked to aspects of the local tradition developed in relation to the large landed property and feudal customs: "In the lands where the barons and the church demand the tenth, that is a proportional service to the product, the surveyor does not serve the social organization and the design never reaches acceptable levels; in lands where use is to collect land, a performance commensurate with the area cultivated by the settler, the experiences are early and higher. In the mountains, where a subsistence economy is based on small peasant property and on the communal

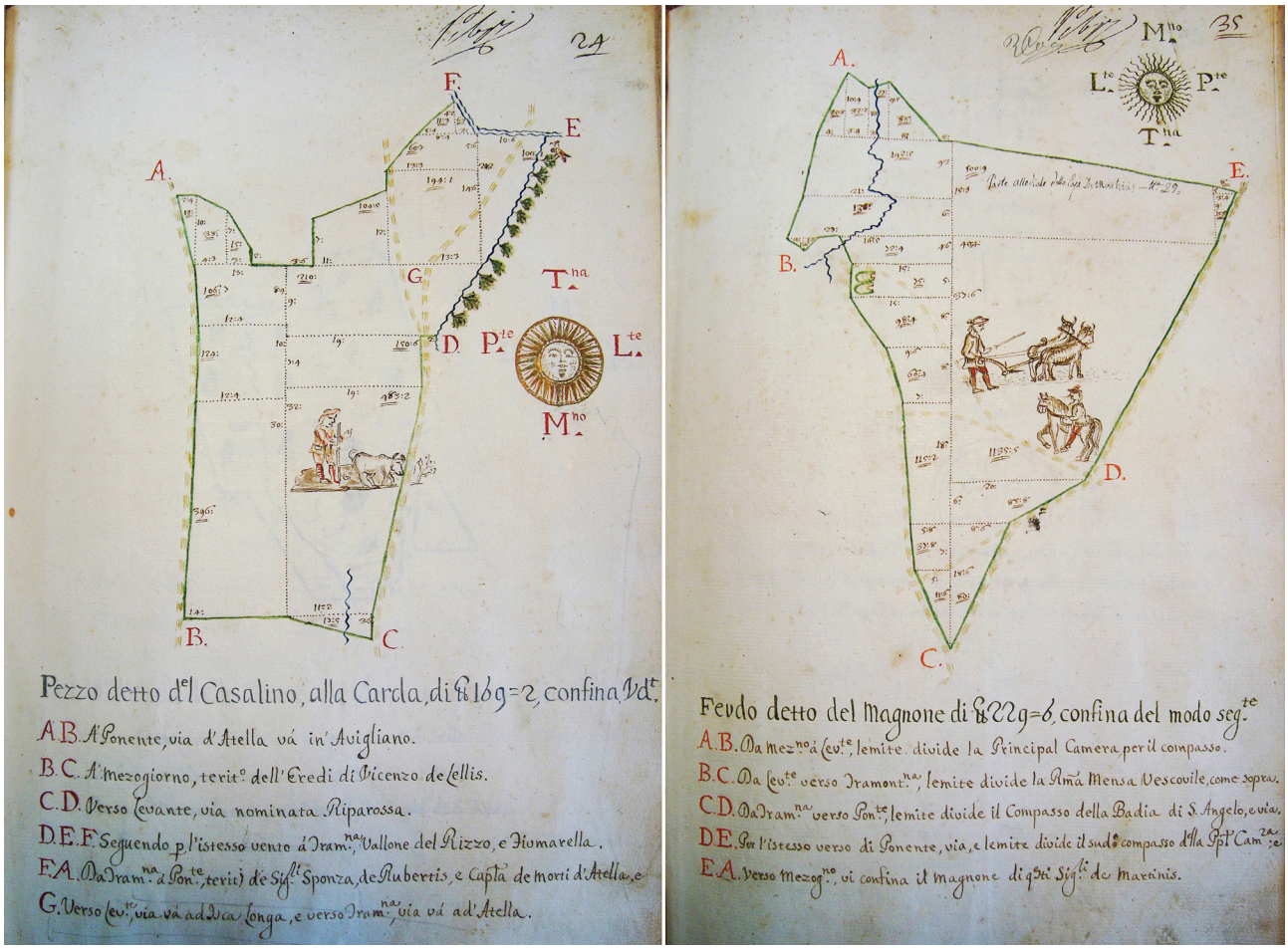
uses of pasture and wood, there is no local production of papers until the nineteenth century; on the plain where the great fiefdom dominates, the cartography summarizes all the essential data of agricultural management" [Angelini 1989, p. 267]. In a region like Basilicata characterized by a morphological heterogeneity and a different political-social organization, what has been said explains the quantitative and qualitative diversity of the cartographic material preserved.

Another important theme is the iconographic aspect still linked to the tradition that characterizes the entire production of the 18th century, and of which we still find a trail in that of the following century. An example of this is the cabrei produced for the monastic structures that represent a conspicuous cartographic corpus that has come down to us [2]. These documents are the result of the need to manage the assets owned by convents and monasteries, and is these cartographic materials, contained in

Fig. 2. One of the pages of the sketchbook of the royal surveyor Giuseppe Pinto with the funds of the convent of Santa Maria la Scala di Venosa of 1773 (ASPz, Raccolta cartografica di agrimensori venosini (XVIII-XIX secolo), vol. 3, doc. 166).

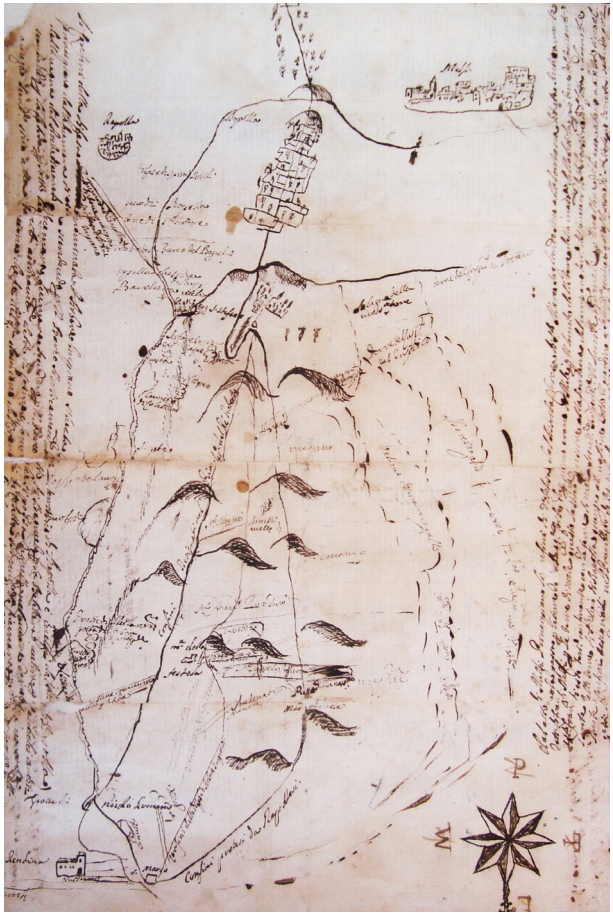
the audiences, which provide us with information on the organization of the territory, on the roads, as well as on the location of abandoned houses of which today we no longer have traces on the surface.
In them we have the coexistence of the technical-geometric aspect, with which the boundaries of the different backgrounds are returned, and an 'iconic' representation, still tied to the tradition of medieval papers [3] with which they are given indications on the crops, on the physical elements morphological and on the architectures present. The graphic synthesis adopted aims at exemplifying the visual reality, thus becoming complex to separate the drawing from the symbol. The 'repetitive' elements, in fact, are returned by resorting to the use of icon-drawings that

Fig. 3. Two maps of the Holy Spirit of Atella convent designed by the notary and land surveyor Gerardo Musio in 1770 (ASPz, Corporazioni religiose, vol.3, docc. 24-35).



do not make a legend necessary to encode what is represented. Particularly interesting is the representation of trees and plants where, in many cases, it is so true that it is immediately possible to identify the species represented (fig. 1).
Real miniatures suggest the cultivated species, the agricultural activity practiced, the eventual forest cover and the presence of buildings, mainly farms, monasteries or farmhouses, to which the represented territories are substantially head (fig. 2).
Another peculiarity, then, concerns the geometric construction of the design. In fact, if the territorial plots are returned to the plant with geometrical foresight also, in some cases, using triangulations, and each drawing is accompanied by a graphic scale and by the indication of the cardinal orientation, the icon-drawings used for the elements listed above are rendered by resorting to a reversal of the representation plan with respect to the plan, and without any foresight in reducing the scale proportional to that used for the restitution of the boundaries.
Among the various graphic testimonies contained in the audiences and concerning the Lucan territory, that of the Benedictine female monastery of S. Spirito of Atella, designed by the royal notary or surveyor Gerardo Musio [4] in 1770, is accompanied by true and own miniatures of the agricultural activities carried out in the represented lands, in which the men working in the fields are depicted (fig. 3).
It is emblematic to note how in some of these drawings, as in the stalls of the Holy Trinity of Venosa designed in 1774 by the surveyor and painter Giuseppe Pinto [5], are also indicated buildings in ruins that evidently represented references in the territory: the ancient it is functional to the contemporary as a reference element or perhaps also for the recovery of building material. In addition to the audiences, which as mentioned represent a sort of inventory of immovable property owned by convents, monasteries and secular clergy, the map produced for "confinement operations concerning disputes between fiefdoms and universities", entrusted to professionals higher than the royal land surveyor, it becomes a necessary tool for comparing documentary sources –fiscal, diplomatic, feudal documents– and direct analysis on the ground [Angelini 1988, p. 21]. These maps are often accompanied by a legend that helps to tell the territory, and are among the richest documents on the agricultural and settlement landscape of Basilicata. Streams, hills, roads and buildings

Fig. 4. "Confinazione della difesa di Albero in Piano in territorio di Melfi e Rapolla", copy of 1697 of a map of 1547 (ASPz, Azienda Doria Pamphili, pianta e disegni, map 8).



–castles, farms, chapels, mills, caves and ruins of buildings and farmhouses– represent fundamental elements to define the boundaries with greater skill and, therefore, are reported by returning, at times, a less geometric view and closer to the picturesque views of the territory represented. Of course, as in the case of the previously analyzed slabs, attention is paid to the presence of specific crops returned using icons represented with the same rules described for the previous case. In particular, the restitution of the orography of the territory is made either by resorting to two-dimensional representations of the reliefs by overturning the representation plan, or by introducing in some cases a view of the top of the same and, with the aid of color and nuance, we try to emphasize the altitude (figs. 4, 5).

It should also be emphasized that in these maps the variation of the reduction scale factor adopted in relation to the extension of the territory to be represented does not involve the use of different graphic annotations for the elements represented, given that it makes these documents fairly homogeneous. The pictorial aspect in all these documents coexists with the metric and geometric restitution of the territory, while not giving, in most cases, detailed information on the actual position of the elements in the same territory. But despite this, the result achieved allows us to interpret the evolution of many of the Lucanian realities, and the reading of the map is directly linked to the artistic skill of the surveyor. The territory is represented in these maps through a threshold that becomes the thin border between representation and truth, objectivity and subjectivity, and where the tools of drawing become a means by which the drawing-artist describes what he sees, and where he passes content and messages related to his culture and vision. However, a care for the details that provide important information for the study of the Lucan landscape emerges: the color used in some maps for buildings that probably refers to the material used for the construction, the indication of the sense of plowing with different orientations, the presence of rows of vines, olive trees and fruit trees, the graphic suggestion for a grazing arrangement of the bottom, etc., which make these drawings the forerunners of the subsequent

Fig. 5. "Pianta delle due linee di confine segnate a color rosso, una delle quali corrisponde alla indicazione di Marsicoveteresi, e l'altra a quella di Calvellesi, con le aggiacenze della campagna dè due comunati Comuni e di Viaggiano", 1845, July 20, Tommaso Curcio judicial architect (ASPz, Intendenza di Basilicata, Atti demaniali, b. 583, fasc. 269 – Calvello-Marsicovetere).

Fig. 6. "Metà del feudo della Grancia di proprietà degli eredi del fu don Luigi Blasi sito nel tenimento di Brindisi", Camillo Giordano architetto - 1843 (ASPz, Tribunale civile di Basilicata, Perizie e atti istruttori, b. 29, fasc. 21 – Brindisi Montagna).

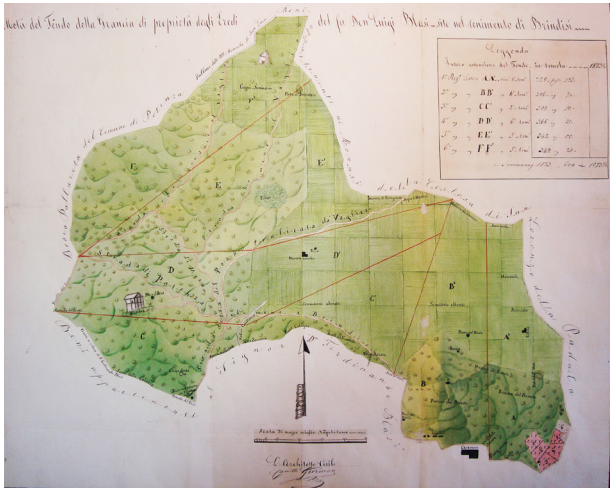
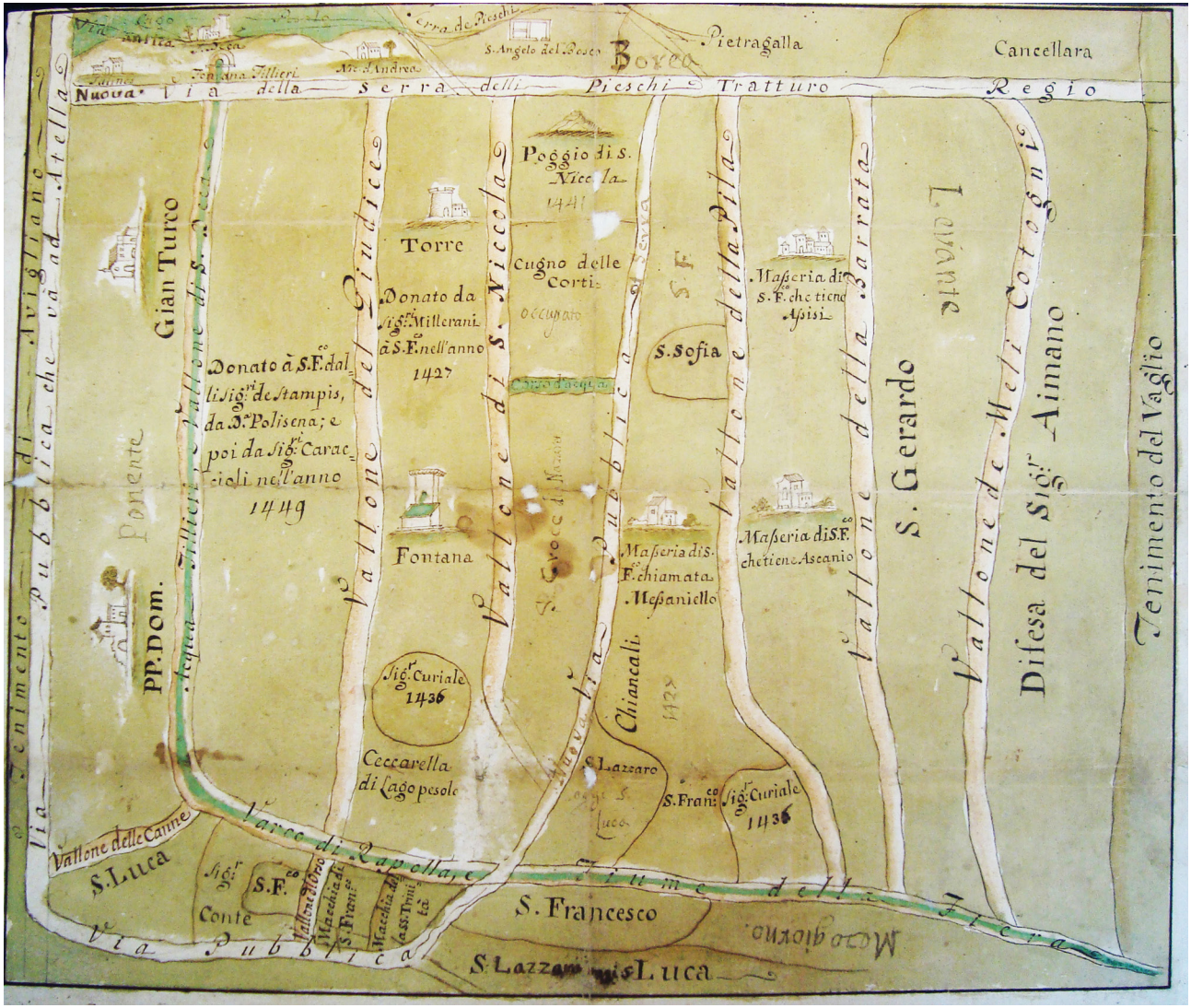


Fig. 7. "Poggio S. Nicola", late seventeenth - early eighteenth century (ASPz, Intendenza di Basilicata, Atti demaniali, b. 564, fasc. 13 – Avigliano).



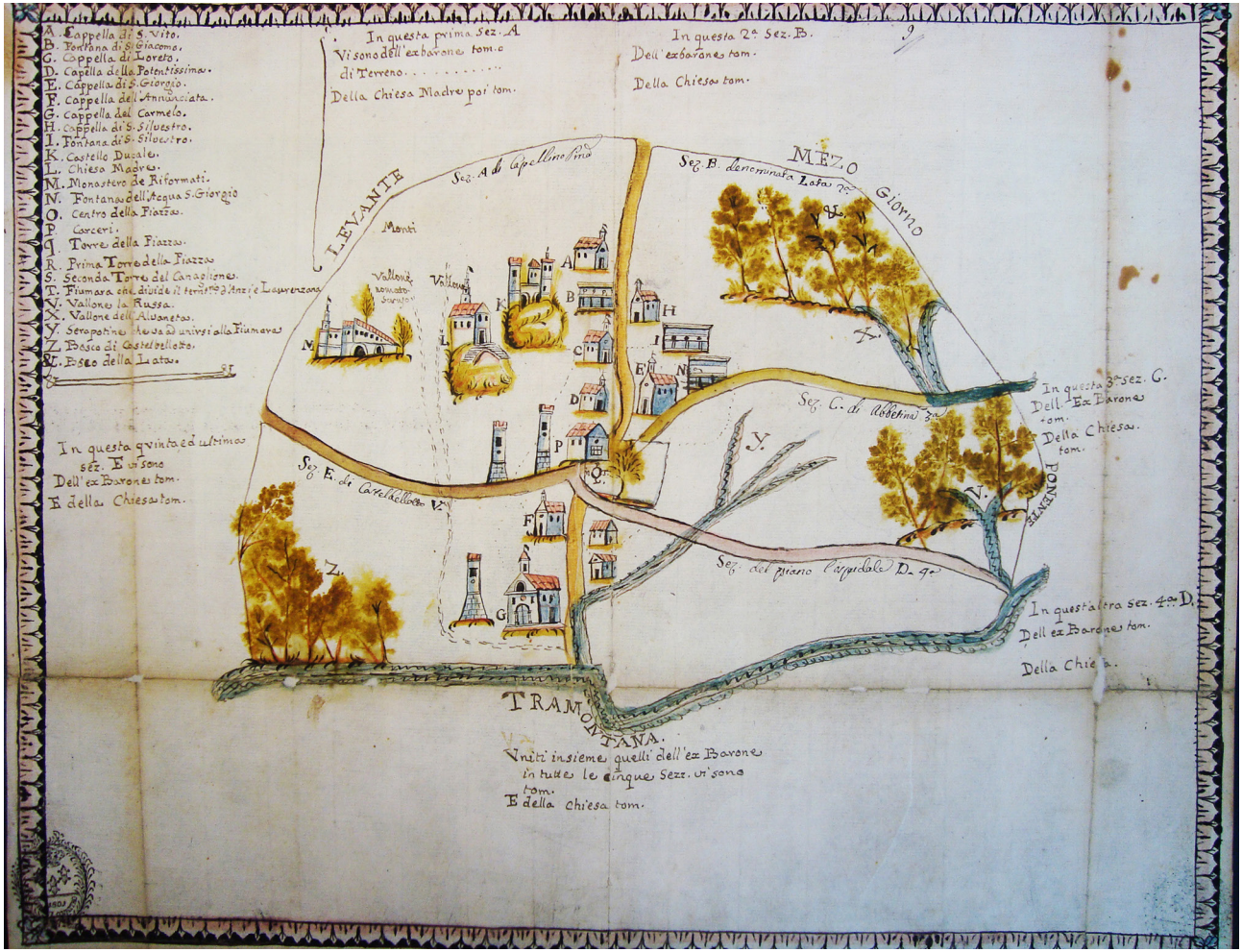
thematic maps. Furthermore, a hierarchy of the elements represented emerges: the physical-morphological components, the anthropic elements understood as traces and architectures, and the use of the land (fig. 6).
Another particular case is represented by those maps not produced to describe the land properties geometrically or qualitatively, but in these cases, although the rules of the territorial survey are no longer valid, we can still obtain important information on the organization of the roads, on the presence of buildings chosen for their importance linked not so much to their architectural level, but rather because recognizable references in space. Another feature of these cards is the return of the hydrography that marks, together with the roads, the territory and its subdivision. However, references to land use and the scale of representation are not included, as proof of the purely indicative purpose of the areas depicted. An example is the map drawn up probably between the seventeenth and eighteenth centuries for the controversy underway on some properties between the convent of San Francesco di Potenza and the count of the same city [6] (fig. 7).
Other examples comparable to this are represented by the maps produced, during the nineteenth century, for the subdivision of municipal territories into cadastral or contribution sections [7]. Also in these cases within well-defined boundaries –those of the municipal territory with the indication, in some cases, of neighboring centers–, the elements represented are only urban and extra-urban road layouts, which often become the margins between the various sections, the inhabited center returned without any reference to its true consistency, but simply drawing the major architectures enucleated from the compact building fabric (the latter made instead in a symbolic manner) and recognizable by a caption or by emphasizing the architectural elements that make up like towers, domes, bell towers, stairways. With the same graphic features the extra moenia architectures are also drawn, mainly monumental fountains and chapels (figs. 8, 9).
Similar graphic devices can also be found in the maps for the subdivision of the territory into cadastral sections produced in the same period (fig. 10).

Fig. 8. Division of the territory of Craco (Matera) in contribution sections, first half of the nineteenth century (ASPz, Direzioni delle contribuzioni dirette, vol. 40 – Craco).

Fig. 9. Division of the territory of Bernalda (Matera) in contribution sections, 1807 (ASPz, Direzioni delle contribuzioni dirette, vol. 37 – Bernalda).

During the nineteenth century, the figure of the surveyor changes again, and is increasingly often flanked by that of the architect. The subversive laws of feudalism and the suppression of monastic orders lead to the need for greater production of surveys of the territory, above all to resolve disputes related to the new reorganization of the state and former feudal territories. The need to define precise boundaries between municipalities also leads to the need for detailed maps of the territory [8]. It is in this phase that old surveys are recopied and updated for an updated knowledge of the territory aimed at governing the same.

Fig. 10. "Mappa delle sezioni catastali del comune di Laurenzana", 1807 (ASPz, Intendenza di Basilicata, b. 625, fasc. 559).



With the Napoleonic reorganization of the administration of justice, appraisals are often carried out by technicians who compose expert books. From the examination of the documents produced it is clear that by their very nature we resort to more objective representations of the territory. "With the cadastre and with the suppression of religious corporations, a long season of studies has been concluded, of which the land surveyor was the protagonist" [Angelini 1987, p. 203].

Fig. 11. "Topografia del sito sovranamente approvato per la riedificazione del distrutto Saponara", civil engineer Francesco Pagliuca, 1859 (ASPz, Consiglio d'Intendenza, map 19).

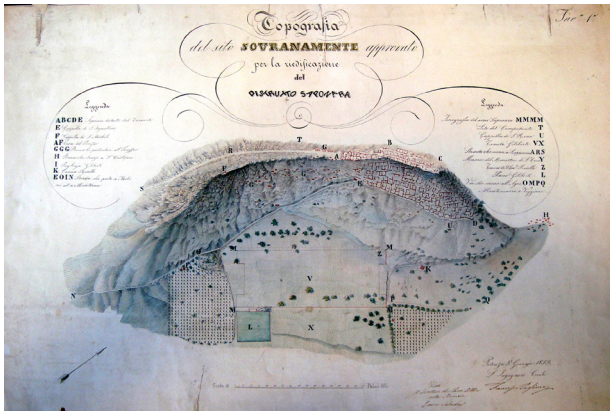


Fig. 12. "Pianta del domanio di Melfi", XVIII century (ASPz, Azienda Doria Pamphili, cas. 66, sez. II, b. 367).

Study papers for the construction of public works: reclamation of areas, definitions of tracks, construction of hydraulic works and, more generally for the improvement of living conditions, are the reasons that explain the production of maps throughout the nineteenth century. There are also episodes, though isolated, of graphic survey for the documentation of the damages in the centers hit by seismic events. A significant example is the survey of the center of Saponara, today Grumento Nova, written after the destructive earthquake of 16 December 1857 [9].
In the table (fig. 11), designed by the engineer Francesco Pagliuca, the territory of Saponara is represented with the indication of the crops present, of the hydrography, of the road network, in addition to being detailed the areas hosting the temporary shelters for displaced persons, the ruins of the town and the hypothesized area for the delocalized reconstruction of the center [10].

Urban centers in Lucan maps

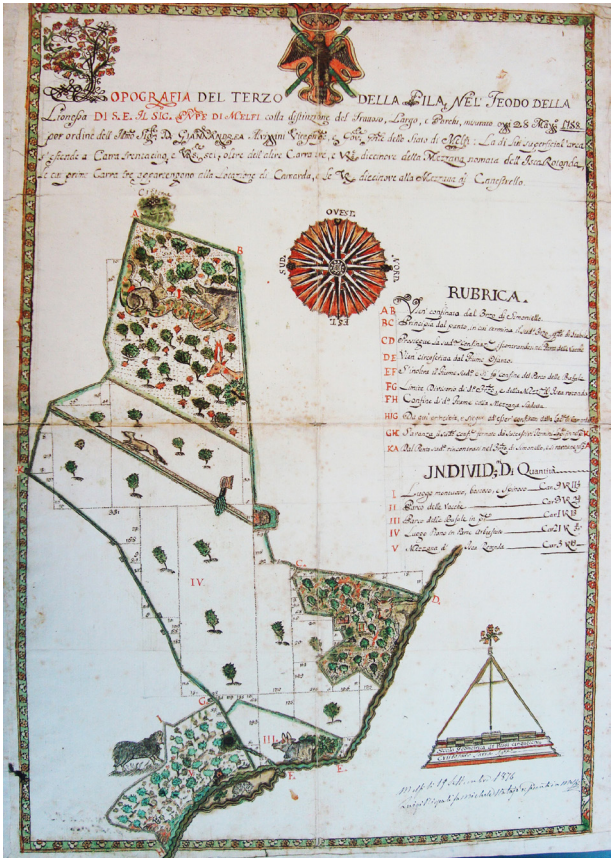
The representation of the inhabited centers in the maps between the XVIII and the XIX century deserves a particular deepening.
At first we are facing a purely symbolic restitution of urban centers and very far from subsequent cadastral plans or from the views that had been circulating in the courts of Europe for some centuries. In fact, as early as the second half of the 16th century, the designers 'portrayed' the cities and "emphasized the constituent elements (walls, doors, towers, and monuments) and their geometric shape, real or ideal" [Cerotto, Rispoli 1995, pp. 3, 4]. It is in this way that complex and stratified urban realities, whose reading becomes immediate, are returned, even with a few pencil strokes.
The urban views become "the junction of art and science and the crossing of multiple skills" [Cerotto, Rispoli 1995, p. 111] where it is possible to find a subtle boundary between the technical and symbolic representation of the represented reality, and where, naturally, the subjective contribution of the artist who sees, studies, breaks down the city, and then realizes the work.
The various centers of which we have documentation are, instead, drawn in the maps of the territory resorting, once again, to simple symbols that give little quantitative and qualitative information of the center itself (fig. 4). Analyzing the various maps we can only understand the

dimensional hierarchies between cities and neighboring countries –more or less houses in relation to the size of the center– or if these are characterized by military architecture (doors, walls, castles and towers) or buildings of cult dimensionally significant (figs. 8, 10).
The reason for this graphic 'choice' for the restitution of inhabited centers is linked to the nature of the designs produced, ie we are dealing with maps whose purpose is 'legal' management –definitions of boundaries, use and income– of the represented territories.
In particular, the architectures symbolizing power and faith are emphasized (fig. 12) which become expressions of the city and points of orientation in the surrounding territory. Prospective measures are also adopted in order to be able to return, within the urban fabric, buildings that are visible only from different points of view, in order to obtain a complete graphic description of the represented reality, surely arising from the observation at sight of reality itself, but certainly far from a scientific relevance of the existent. It is only in the nineteenth century, "when a direction of urban government is affirmed in the legal systems" [Angelini 1987, p. 191] that a cartographic production will start paying attention to a 'truthful' representation of urban centers. A good example of this are some of the plants for the division of the Lucanian centers into census areas designed in 1881 [11].

Conclusion

The examination of Lucanian archival sources reveals the attention that, land surveyors earlier and architects and engineers later, payed to the representation of territory.
The improvement of graphic techniques and the innovation of representative tools have given, above centuries, a production of maps and cabrei more reflective of reality they wanted to represent. In addition to this graphic production merely technical, many others graphic expressions have come to us –travellers draws, sketches and miniatures– which give a picture of a certain place at a given moment.
The study of these documental evidences means to trace the evolution of natural, agricultural or urban landscapes or of suburban areas in spite of big cities and important territories set of historical and cultural events object of historiography and research.
What emerge is a territory rich of analysis cues and architectural, urban and historical peculiarities which are evidences of the different cultures that thrived enriching with new signs the landscape. The comparison with what was happening in other Italian or European contexts identifies differences and similarities with the 'Lucanian case study' by revealing contact points among different realities often connecting various geographically distant locations, this allows to read the study of different maps and their evolution –from the symbolic and geometric drawing to the modern cartography– in a wider context.

Fig. 13. "Topografia del terzo della Pila del feodo della Lionessa", 1876, September 19 (ASPz, Azienda Doria Pamphili, cas. 106, sez. X, b. 652).



Notes

[1] "Through the iconography of a site it is possible to describe characterizing morphologies, to detect and analyze recurrent typologies, thus to decipher a second-level portrait of the territory within the landscape image, a mixture of relevant elements and interpretative elements coming from the complex of historical and scientific disciplines, and capable of studying the functional and practical 'meaning' denoted by the signs and paratactic and syntactic organizations used for its representation" [Mazzolemi 2005, p. 34].

[2] The slabs or *cabrei*, graphic or descriptive documents of the properties of convents and monasteries are, following the suppressive laws of the French Decade and unitary post, transferred to various financial offices in order to allow the assessment of the properties and revenues of the different goods. Following the royal decree of 1911, October 2 n. 1163 are paid to the State Archives of Potenza. See: Verrastro 2004, p. 32.

[3] Medieval papers are characterized by the presence of figurative elements that "describe and tell, with a prevalence of drawings on symbols" [Iannizzaro 2006, pp. 38, 39].

[4]State Archives of Potenza (ASPz), *Corporazioni religios*e, vol. 3.

[5] ASPz, *Corporazioni religios*e, vol. 200.

[6] In the specific case of this map the titles of possession that prove the ownership of the convent of the land object of the controversy are also reported. See: Angelini 1988, pp. 22, 23.

[7] With the single property contribution, introduced with the decree of the 8th August 1806, and by which the taxes in force until that moment were replaced by pursuing an equal contribution for all the landowners (according to quotas established by the Council of State, divided among the districts by the Provincial Councils, divided among the various Municipalities by the District Council, and thus subdivided by the decurions among the different owners), it became necessary to produce maps of the municipal territories on which the different sections were indicated. At the center of these drawings are represented, through sketches, the inhabited centers of which a symbolic image is provided. See Principe 1991.

[8] "The cartography that is produced in border disputes by judicial experts and part technicians, although it cannot be framed in precise models, generally responds to a univocal procedural scheme: the comparison between a documentary tradition (diplomatic, feudal writings, fiscal, judicial), which constitutes the complex of the historical memory of the territory, and the investigation on the ground" [Angelini 1988, p. 21].

[9] ASPz, *Consiglio d'Intendenza*, map 19.

[10] On the reconstruction of Saponara after the 1857 earthquake. See: Damone 2018, pp. 90-99.

[11] ASPz, *Prefettura di Basilicata*, *Atti Amministrativi* (1878-1882), Census of 1881.

Author

Giuseppe Damone, Scool of Engineering, University of Basilicata, giuseppe.damone@unibas.it

Reference List

Angelini, G. (1987). Agrimensori-cartografi in Basilicata tra l'Antico Regime e l'Unità d'Italia. In *Bollettino Storico della Basilicata*, n. 3, pp. 189-203.

Angelini, G. (1989). Un'altra cartografia: il disegno geometrico e topografico a grande scala tra '500 e '800. In I. Principe (a cura di). *Cartografia storica di Calabria e di Basilicata*, p. 267. Vibo Valentia: Edizioni Monografiche.

Angelini, G. (2000). La cartografia storica. In A. Cestaro (a cura di). *Storia della Basilicata. L'età moderna*, pp.114-138. Bari-Roma: Edizioni Laterza.

Angelini, G. (a cura di). (1988). *Il disegno del territorio. Istituzioni e cartografia in Basilicata. 1500-1800*. Roma-Bari: Edizioni Laterza.

Cadinu, M. (a cura di). (2012). *I catasti e la storia dei luoghi. Storia dell'Urbanistica*, n. 4. Roma: Edizioni Kappa.

Capano, F. (2004). Iconografie urbane di centri lucani tra XVII e XVIII secolo. In De Seta C. (a cura di). *Tra oriente e occidente. Città e iconografie dal XVI al XIX secolo*, pp. 209-215. Napoli: Electa.

Cerotto, P., Rispoli, F. (1995). *Dentro la città: Potenza*. Potenza: Edizioni Ermes.

Damone, G. (2018). *L'eredità dei paesaggi di pietra. Lettura e documentazione dei centri scomparsi tra memoria e opportunità di recupero*. Lagonegro: Zaccara Editore.

Iannizzaro, V. (2006). *Dalle Mappae mundi alle immagini satellitari. Rappresentazione del territorio e cartografia tematica*. Fisciano: Cues.

Ludovico, A. (1991). *Rilevamento architettonico e topografico metodi e strumenti nei secoli XVIII e XIX secolo. I catasti geometrici preunitari e la misura generale del Granducato di Toscana*. Roma: Edizioni Kappa.

Mazzolemi, D. (2005). Il valore iconologico. In D. Mazzoleni, M. Sepe (a cura di). *Rischio sismico, paesaggio, architettura: l'Irpinia, contributi per un progetto*, pp. 31-39. Napoli: Università degli Studi di Napoli Federico II.

Principe, I. (1991). *Atlante storico della Basilicata*. Cavallino: Capone.

Valerio, V. (1993). *Società, uomini e istituzioni cartografiche nel Mezzogiorno d'Italia*. Firenze: Istituto Geografico Militare.

Verrastro, V. (2004). *Archivio di Stato di Potenza*. Viterbo: Bettagamma editrice.

Integrated Procedures for the Drawing of Linear Networks: Digital Graphic Processing of Cycling Paths

Barbara Messina, Pierpaolo D'Agostino

Abstract

The paper aims to highlight the potential and applicability of an integrated digital approach that uses the drawing as a concrete tool in support of the territorial and urban design. The integration of territorial analysis tools, together with others more traditionally used in algorithmic-generative processes, could allow to reach a global management system of data and information. In fact, territorial and urban transformations, by their nature or by virtue of their intrinsic complexity, require multi-scale control and managed on multiple interconnected levels.
Through specific digital representations, we intend to illustrate the possibility of using a GIS system, integrated with parametric modellers, for the management and verification of a series of design choices that involve urban or territorial transformations.
The proposed methodology aims to validate an analysis system applicable whenever actions are needed within an already consolidated urban space, especially to create or implement linear networks. The proposed operating procedure is therefore aimed at identifying cycle paths through a semiautomatic framework: the contribution proposes, in particular, an application on the road network of the Capaccio-Paestum Municipality, in the province of Salerno.

Keywords: digital integrated system; representation of the territory; informative database, linear routes, graphic simulations.

Introduction

The use of information systems, capable of implementing in variously algorithmic forms the interactions between the territorial and geo-topographic context, is today consolidated. In fact, the simulations generated by these systems (two-dimensional and, nowadays, more and more often three-dimensional) allow us to describe, in interactive modes, the functional conditions of project prefiguration, as well as the transformation of a context [Arctur, Zeiler 2004; Fistola 2009]. These systems are useful tools to understand and graphically describe the changes that, in specific places, result from natural or anthropic, material or immaterial events.
The geometric and topological interpretation of space, translated into a set of integrated, computerized and multi-sectoral data, allows interactive management of spatial information by virtue of which it is possible to control, process and connect all the data through appropriate digital representation systems [Du et al. 2019]. In this sense, the idea of integrating GIS software with platforms properly intended for solid and parametric-generative modelling is particularly effective, with the aim of producing infographic representations useful for the simulation of phenomena that characterize a territory [de Silva, Eglese 2000].
So, starting from some experiments, the paper highlights the potential and the applicability of this integrated digital approach, that uses drawing as a concrete tool to help in the design of the transformations of the territory and the city.

Integrated systems to represent urban and territorial phenomena

The drawing of the territory has always been a not simple challenge for man: being able to translate, into images, his morphological complexity–often due to the close interconnection between anthropic space and natural space–as well as the phenomena that occur in it, indeed requires considerable analytical and graphic skills. Then, representing the territory means understanding its relevant elements [Bonora 2012], summarized in images which, by virtue of a rigorous and essential graphic code, make immediately perceptible the aspects and specificities that distinguish it. The contribution of the Drawing's disciplines is therefore fundamental, with reference to this issue. If, in fact, the treatment of this topic "*quanto mai vasta e specialistica, necessita di un approccio multidisciplinare […] tuttavia i prodotti grafici di tali studi sono pur sempre modelli che coinvolgono l'esperto di espressione grafica di natura tecnica*" [Cardone 2015, p. 301]. This explains the great interest that the Drawing area scientific community, nationally and internationally, has been giving to this issue for some time [Chias Navarro, Papa 2019; Marotta, Novello 2015; Centofanti, Brusaporci 2011; Novello 2002]. In recent years, however, alongside more traditional research and studies–that is, oriented to the thematic reading of urban or territorial contexts [Martone 2007; Rosi 2003]–a new scientific approach has been affirmed. This one uses digital modelling and advanced graphic simulations as an irreplaceable tool for the representation of the territory, in all its aspects [Piga, Salerno 2019; Llopis Verdú, Serra Lluch, Torres Barchino 2019].
Certainly the tools available today, such as digital systems for integrated management and data representation on an urban and territorial scale, facilitate the analytical approach for reading a specific area and the phenomena connected to it [Mingucci, Moura 2013] [1], thus making it possible to elaborate, and effectively visualize, information available on several interrelated levels (fig. 1).
While, on the one hand, the use of GIS appears to be consolidated as a tool for analysing the physical and immaterial phenomena that characterize a context, the possibility of combining it with three-dimensional parametric modellers [Moura 2013] is less explored. The use of these can actually allow better management of data in all those cases in which the presence of buildings, or of design realities, intervenes in the definition and characterization of the investigated area [Yin, L. 2010].

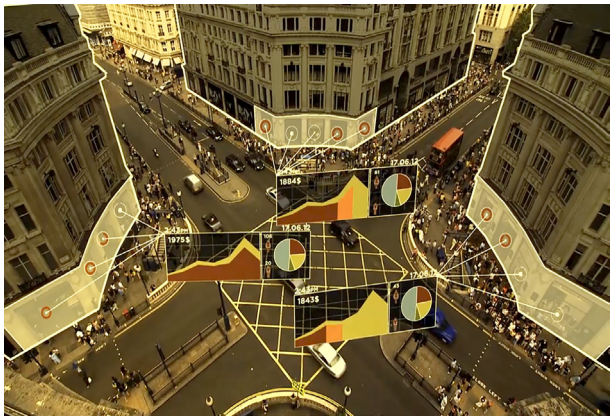


Fig. 1. Graphic-digital approach for analyzing complex realities. Example of use of the "Urban Network Analysis" toolbox, developed for the Rhinoceros software by City Form Lab. In <http://cityform.gsd.harvard.edu/videos> (accesed 2019, September 26).

The integration of these digital representation tools, therefore, perfectly meets the need to have a global data and information management system that is at the base of those projects–architectural, engineering, urban planning etc.–which, by their nature, or by virtue of their intrinsic complexity, require multi-scale control and managed on multiple interconnected levels.
In fact, the possibility of organizing and representing space geometrically and topologically in a GIS system, starting from a set of georeferenced and correlated data, acquires new and significant implications–for what concerns the analysis and design of the configured realities–if we consider the potential of three-dimensional simulation typical of parametric modelling software [Semeraro et al. 2019] [2]. Indeed, the integrated representation, thus understood, not only allows the localization of the examined phenomena, and their spatial analysis, but opens up to the possibility of foreseeing several scenarios; these ones are conceivable in the digital environment as a function of the input data, thanks to the processing of visually convincing images, that are of immediate interpretation. Precisely thanks to the visualization and virtual reproduction of space, and of phenomena that occur in it, characteristic of three-dimensional modelling software, the traditional cartographic approach, possible through GIS, evolves into a more complex pro-

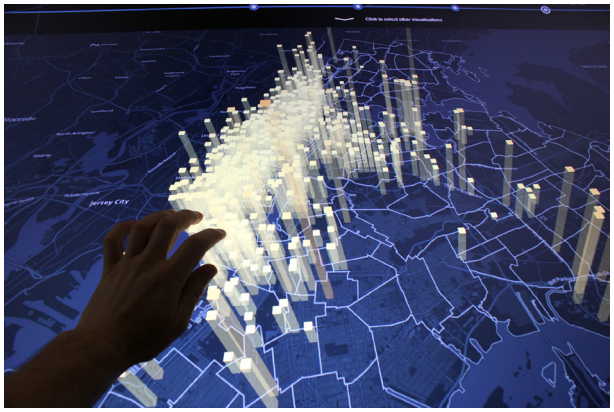


Fig. 2. Interactive representation of spatial phenomena. Visualization and analysis of data based on a "Data Collider" application, a system developed by the MIT Senseable City Lab. In <https://morphocode.com/visiting-mit-senseable-city-lab-singapore/> (accessed 2019, September 10).

cess. That is to say, a system capable of supporting–in a unitary and multidisciplinary structure–the design choices resulting from an assessment aware of the impact that a planned project can have. A system, therefore, able to suggest the most appropriate solution, from time to time, with reference to a series of transformation hypotheses conceived for the territory or the city (fig. 2).
With reference to this approach, it should first of all be noted that, although the GIS was born as a platform for data management and cartographic representation in two-dimensional form, over the years it has shown a growing interest in the aspects related to a broader interpretation of the graphically described phenomena. This conceptual evolution has increasingly required systems for the three-dimensional representation of the analysed reality. Starting therefore from the first experiments of the so-called DEM models, the territory is read and conceived no longer, and not only, for contour lines and quoted points, but in its three-dimensional structure, of which it is possible to interpret and understand characteristics and aspects whose development is not limited to the two dimensions [3]. The GIS platforms thus begin to experiment with "editing modules of the 'geographic objects "*moduli di editing degli 'oggetti geografici' assai simili a moduli CAD [...] tentando di integrare (o di far interagire) la piattaforma GIS con funzionalità di modellazione tridimensionale parametrica alla scala urbana a fini progettuali e non solo di analisi dei dati e di supporto alle decisioni*" [Muzzarelli 2016, 2].
It is a use of GIS that, overcoming the idea of a simple digital map, prefigures new perspectives of graphic and design applications, which can be summed up in the so-called 'Geodesign' [Campagna 2013; Santana, Moura 2013] (fig. 3). This is a process of land management, including its transformations, based on the combination of "*metodi, tecniche e strumenti delle scienze dell'informazione territoriale ('geo') a supporto del progetto e della pianificazione dello sviluppo fisico ('design'). Il Geodesign propone un approccio collaborativo e partecipativo integrato che parte dalla concettualizzazione del progetto e prosegue con l'analisi, la simulazione, lo sviluppo di alternative, la valutazione degli impatti e la scelta (tra le varie fasi)*" [Campagna 2014, 71].
In this direction, especially at international level, numerous studies have been carried out to test the practical applicability of integrated approaches for the representation and planning of the territory. New systems have thus emerged from the GIS, the so-called *PSS* (Planning Support Systems), the *SDSS* (Spatial Decision Support Systems) or the *PPGIS* (Planning Participation GIS). They summarize the GIS analytical capabilities with the potential of virtual simulation of 3d modelling software, in order to prefigure and verify different aspects of the planning realities, and different options that can be pursued, integrating the building modelling in the territorial context that will host it [4].
In light of these considerations, the paper, through specific digital drawings, aims to illustrate the possibility of using a GIS system, integrated with parametric 3d modelling software, for the management and verification of a series of design choices that involve transformations on an urban or territorial scale [Rybarczyk 2010]. In particular, we propose an operating methodology for the elaboration of models that record and integrate specific data to the context and to the events taken into consideration. So, these models permit us to arrive at graphic simulations that allow classifying, representing and interpreting a territorial area on the basis of a series of synchronic and diachronic spatial relationships between the anthropic, natural and environmental elements that characterize it. This is a particularly delicate problem when the area is characterized by specific environmental peculiarities, or when there is the presence of monuments, archaeological sites or other structures that impose themselves as cultural attractors, so orienting territorial transformations.

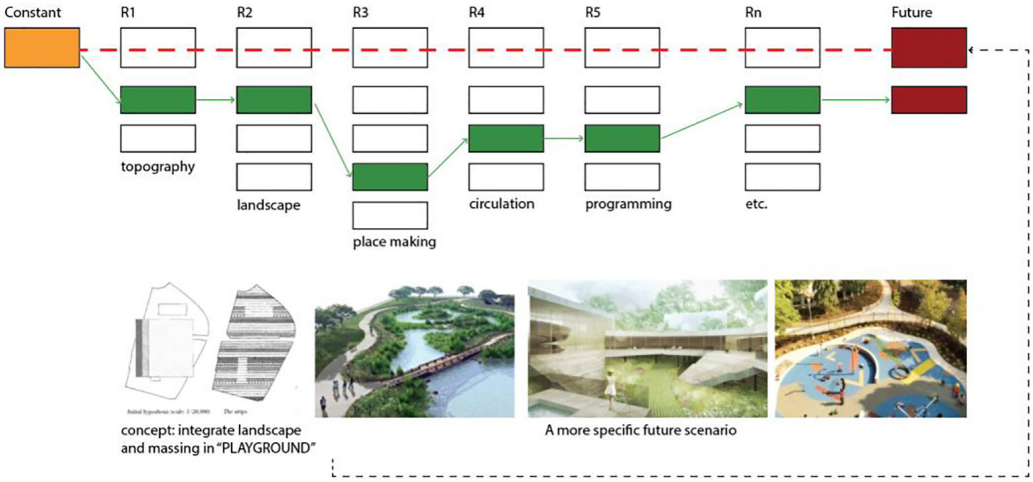


Fig. 3. An example of the application of the Geodesign logic, as a tool for participated choices in urban or territorial planning. The diagram is edited by [Wu 2018, p. 39].

Specifically, the research is addressed to the territory of Capaccio-Paestum Municipality (near Salerno) and to the coastal stretch of the provincial road that leads to it. In fact, this area is emblematic for our research, given the presence of one of the most significant archaeological sites in the world and–as better described later–of a series of other tourist attractions. Therefore, we analyse the opportunity to design cycling paths defined through digital procedures capable of 'automatically' generating a network which, according to these elements and on the basis of a series of choices and hypotheses formulated, can satisfy the needs of this context's development. Starting therefore from a project written up from the Technical department of Capaccio-Paestum Municipality, and using digital graphic elaborations generated with a specially structured GIS system, we try to verify the adequacy of urban cycle paths (designed and not yet realized) with respect to the location of a whole of attractors significant for designing them. Alternatively, we propose design hypotheses to enhance existing routes, in light of the emerged needs.
Therefore, the experimentation carried out concerned, on the one hand, the already existing network, with the aim of improving its usability by virtue of checks on specific aspects, possible thanks to infographics simulations [5]. On the other hand, we have analysed areas that are currently not involved but potentially interested in cycling: of these, we have assessed the suitability and adequacy as a function of their intrinsic and extrinsic characteristics [6]. In these cases, the spatial analysis underlying the GIS has led to outcomes and possible design solutions: of these, also through three-dimensional modelling, we have assessed the compatibility with the real situation (fig. 4). An integrated approach, therefore, that exploits the ability of parametric modelling software to interact with the data implemented in the GIS system.
So, the proposed methodology aims to validate an analysis system applicable whenever it is necessary to intervene within an already consolidated city. For example, creating or implementing a linear network, which specifically refers to cycle routes. This with the purpose of preliminarily evaluating, through graphic-analytical considerations, the compatibility of the choices made during the design phase with a series of specific urban and territorial contingencies, which must inevitably be taken into account.

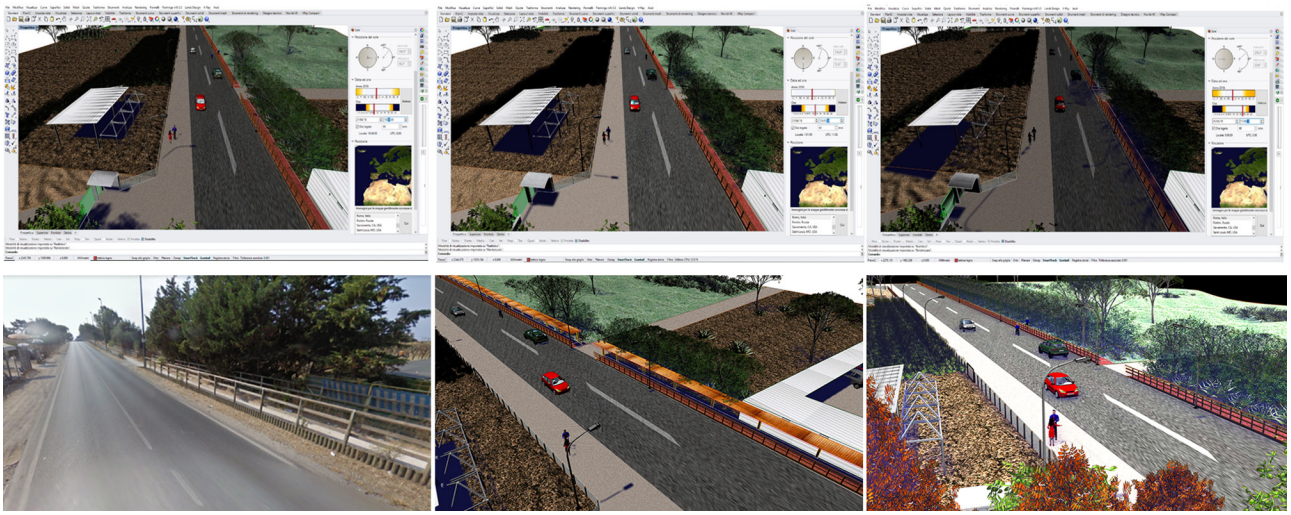


Fig. 4. Interactive simulations of the shading of the coastline cycle network, between Eboli and Capaccio-Paestum, to support future design choices (edited by Gerardo Virgilio Calzaretta; coordinator: Barbara Messina).

A practical approach: the cycle network of the Paestum coast

The context of the costal and hinterland area nearby the archaeological site of Paestum, between the Municipality that hosts it and the ones adjacent to it, therefore represents a test opportunity to check the possibility to integrate typical approaches of the representation and the information management of vast area with tools and dynamics typical of the visual scripting. In this sense, taking advantage of the possibilities that parametric modelling, in its most generalized meaning, offers thanks to increasingly specific and detailed nuances in underlying algorithmic terms, today appears to be substantially effective; especially where it is necessary to give shape to operational flows through tools that go beyond the boundaries of the aseptic and less interactive traditional programming, to develop more user friendly layouts that are no less objective and scientifically consistent than pure computing [Brown, Knopp 2008].
In the context of the elaboration of the operational procedure aimed to identifying cycle paths through a semiautomatic framework [Messina, D'Agostino 2011], assuming the reuse of the already existing road system as a starting hypothesis, it appeared first of all appropriate to vector drawing the roads belonging to the Municipality of Capaccio-Paestum, disregarding in a first phase the relative typology and, therefore, the geometric characteristics and vehicular use features. As before mentioned, in addition to the clear interest for a territory dense in singular elements suitable to a network integration proposal, the choice to experiment in this area the described methodology finds as a further motivation the executive planning developed in the last years of a cycle and pedestrian path along the coastal axis of ordinary roads. This has led to reasoning aimed to understanding about the feasibility of choices alternative to those that have already found material implementation or choices that, by integrating with the already existing ones, suggest a possible irradiation of the slow road system even beyond the coastline [Passigato et al. 2008]. In this sense, has to be reported that the idea has been to test processes that from the vast area study moved towards the creation of a database both of merely objective data and digital models. The latter, outputs of a spatial analysis, are conceived at the same time as input of further steps, at more detailed levels, to express punctual parametric generative models

intended as general cues and susceptible to become design proposals that can be refined and finalized to their engineering implementation.
In order to create the context database, useful for the identification of the existing road network suitable to host a cycle path, the workflow required a preliminary digitalization of the available cartographic repertoire which, along with the punctual data obtained with in situ survey campaigns, has contributed to the context characterization. In this sense, therefore, the entire road network has been correlated to a graph-numerical database–typically collected within an interoperable GIS oriented format–indeed related only to part of the existing road network: it was in fact imposed as a design and operational constraint the exclusion of the suburban and urban roads from the spatial elaborations, both because of their high

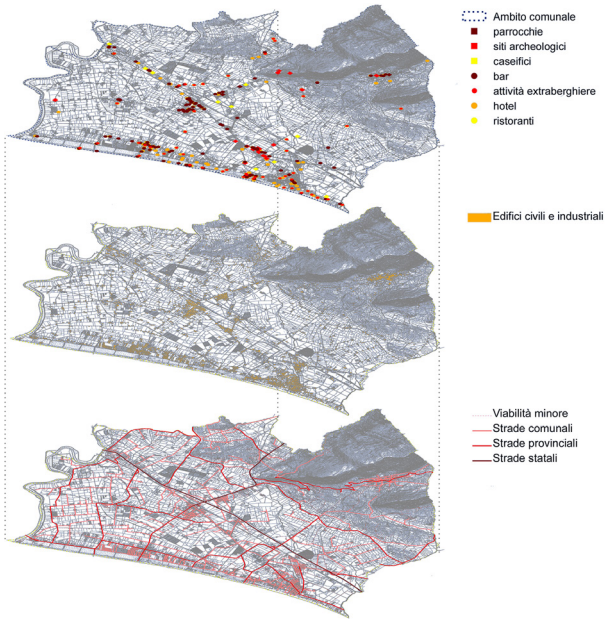


Fig. 5. The territory of Capaccio-Paestum (SA). Overlays of critical areas present in the area (viability and civil or productive settlements) related to the point attractors, interested in spatial analysis (edited by Pierpaolo D'Agostino).

design speed and their typology of road section and appurtenant areas, actually inadequate to the simultaneous presence of vehicular and cycle traffic. A similar fate for the minor roads, substantially corresponding to the penetration network to private properties, which appeared to be of little significance for the individuation of a public cycle path.
The residual road network, definitively susceptible of being processed in spatial analysis algorithms, was therefore related to the punctual database of the relevant elements of the investigated territory. The territorial density of such elements–distinguished between attractors and criticalities–has been obtained through a specific analysis of Euclidean distance. The latter was used to define the area of influence of each attractor, in other words presences–graphed as points and organized by category in cultural, receptive, productive and commercial–capable of 'magnetizing' tourist flows, and consequently of orienting the road practicability in the territory of the Municipality of Capaccio-Paestum. The results were then reported in an ad hoc raster grid in which the distances between the attractors were also calculated, assuming the 1 km threshold as a limit beyond which a user is not normally willing to walk, choosing instead other transport carriers. Outputs of this process are therefore the bands within which it may be appropriate to locate the cycling roads in order to guarantee an adequate networking to connect the elements that potentially move the main tourist flows in the area (fig. 5).
Contrasting the territorial and spatial definition of the attractor points was the identification of those intended as 'criticalities', in other words conditions, punctual or spatial, considered impassable by bicycle or because the transit is physically obstructed, both due to the presence of a series of factors that make the journey strenuous and for the riskiness of using the bicycles in relation to the geometric characteristics of the road curves. The main anthropic and natural criticalities identified and classified were the slope of the territory and the density of the urban construction. The first one, in particular, can be deduced from the orography gathered from the polygonal height field shape of altimetric interpolation, identifying the areas resulting under 15% slope, corresponding to the limit, beyond which an inexperienced cyclist isn't able to easily ride.
Similar considerations, although conducted with different spatial analysis functions, have been established as a basis

of the reasoning about the perimeter delimitation of the criticality linked to the urban construction. For this purpose, an analysis of kernel density has taken into account the distribution of buildings on the territory, allowing the identification of areas of influence in which the urban fabric tends to thicken the most. Only buildings for civil and industrial purposes have been taken into account: it is for them in fact that it was considered more likely the interference between vehicular and pedestrian roadways, given that for different categories (such as rural buildings, greenhouses, temporary buildings) there was a limited impact on the cycle path, both because of their small size, and because in general these structures are located in such a way that doesn't generate risky intersections of vehicular traffic.
The vectorization of the buffer zones, intended as enveloping bands of the critical densities, has allowed to visualize–within the roads network potentially suitable to host the cycle traffic according to the road characteristics only–all the sections in which the cycle or pedestrian transit should be interdicted. The road arcs that could be 'mapped', namely the only ones that, also in compliance with the previously described unfavourable conditions, were actually compatible with the presence of cycle paths, were therefore extrapolated.
The cycle network obtained through the described procedure was then compared with the planned network developed by the competent administrative authority, verifying its effectiveness for the good, even if not total, overlap between the output of the described operating methodology and design choice (fig. 6).
The processes here described, usually domain of GIS oriented applications, have found in the algorithmic-generative modelling tools a new operative mean for the construction of analyses that more directly, and without intermediate steps, can evolve in close connection with the related elaboration of solid models. And that is possible thanks to the management of data within workflows that directly act on the factual conditions, through their modification, thus producing the shaping and the articulation of new conformations aimed at the design intervention. In particular, these tools have demonstrated and still amply demonstrate their effectiveness even when only referring, in the need to give shape to design actions that go from the vast scale to the detailed scale, to the first dimensioning of architectural and civil elements standing on specific areas of intervention.

Fig. 6. Comparison between spatial analysis and current context. In green, the outcome of the semi-automatic analysis process carried out for the identification of possible cycle-pedestrian paths and, in red, the real structure of the existing or running tracks (edited by Pierpaolo D'Agostino).

Not only that, but the variety of operational tools provided by the most widespread parametric-generative modelling software–also in relation to the insertion of territorial and wide area data in generative processes–allows to compare and evaluate, ex ante, pros and cons of different design hypotheses. In fact, the potentialities for procedural generation of algorithmic processes is able to provide solutions that, in compliance with constraints imposed in visual scripting and with input data, provide new solutions that are difficult to prefigure and conform with a traditional process of collection of design inputs. It should also be noted that while the traditional design approach makes use of the simulation of the designed space as an evaluation tool, in a decision making process capable of providing a single solution, the new approach has definitively clarified, but not standardized, that the potential offer of data tuples can become an additional tool for decision makers [Vanky 2016]. Thus, within the current experimentation, it was assessed the viability of a further refinement of the graphic control ability deriving from the digital tools that the representation makes us avail-

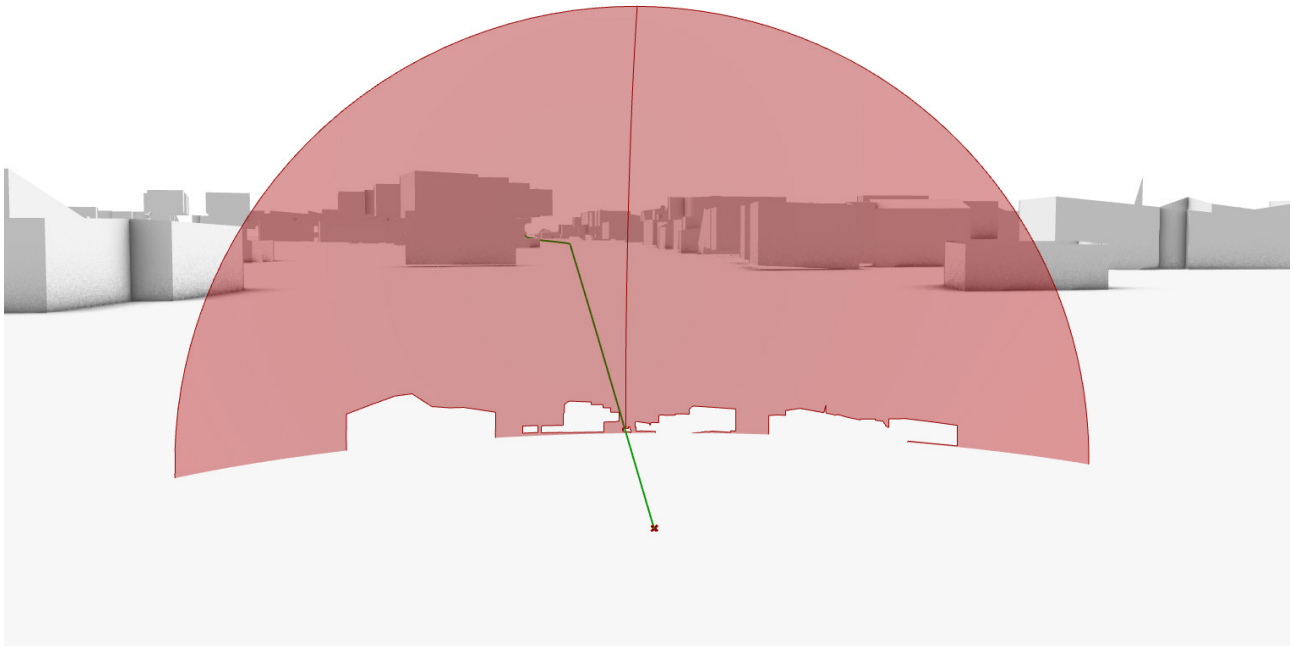


Fig. 7. Exemplification aimed at understanding the visual impact of the context around a reference point on a road layout. In green, the center line of the route; in red, the area of simulated impression of the visual field and the relative buildings offered to the perception of a user (edited by Pierpaolo D'Agostino).

able today, by entering, as an input, data relating to the visibility of road systems. A digital framework was therefore built to simulate the visual field of a virtual driver, in order to understand if and how to intervene punctually to improve conditions, before defined criticalities in the pure GIS system generated at the territorial scale, that are indeed susceptible to find a detailed solution in the modification of geometric configurations of road intersections and points of intermodal interference (figs. 7, 8).

Conclusions

The paper, focusing on the results of some experiments carried out on the Campania coast network developed between Eboli and Capaccio-Paestum, has been aimed to the implementation of a digital workflow designed to create and track, in semi-automatic and interoperable forms, linear development systems characterized by precise characteristics, also compatible with the morphological requirements of specific territorial areas.
A digital approach, therefore, able to define paths–such as for example the cycle ones, specific object of this investigation–on the basis of several data and constraints integrated as input in the digital system prepared [Cooper 2017; Terh, Cao 2018]. The outcomes of the approach described have been validated by comparing the paths already present in a specific context with those generated automatically by the system, in order to verify possible strengths and weaknesses of the various followed design methods. Digital models of virtualization defined *ad hoc* that illustrate, therefore, as a GIS can be used in the management and validation of design choices involving changes in a given context. Specifically, the suggested operational methodology reveals and

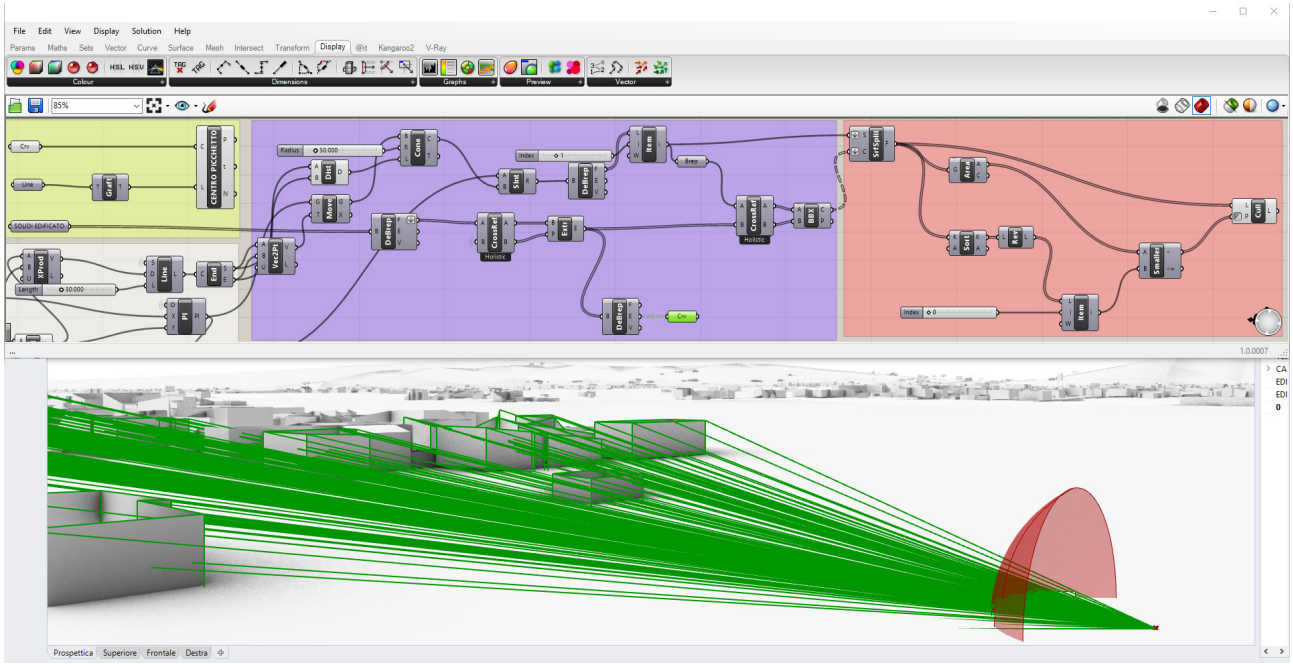


Fig. 8. Synthesis of the work interface, showing the development of the visual scripting constructed and the complete outcome of the analysis in relation to a selected point of view by way of example (edited by Pierpaolo D'Agostino).

integrates geographical information and boundary conditions deriving from various external factors, finally arriving at graphical simulations able to classifying, representing and interpreting a territorial area based on synchronic and diachronic relations between its anthropic elements, natural and environmental [Maantay, Ziegler 2006].
The work therefore aims to define a digital process imaged as a useful consultation tool in all cases where an integrated analysis of "multilevel" data is required, a support for a multi-scale design. This can modify a particular place in respect of its specificity, also with approaches that, deriving from GIS procedures, transform the relative output into analytical input for algorithmic analysis. This is particularly useful both for producing 2.5D analyses, in which the graphic descriptor is in any case a strong analysis performed in the three-dimensional domain, and in the representation of the phenomenon and of the investigated data, using visual scripting for signalling in relation between raster data and vector. The result is the cognitive expansion of conditions and phenomena through new information sets, alternative alternatives to certain spatial analysis processes [Ratti, Sommer 2012]. A mutual contribution that increases the usefulness of an interoperable work that sees, in the transition from merely modelling to the service of traditional representative dynamics, the overcoming of the cartographic production statistics useful to the final decision maker who, in the multiple offer of solutions and information, finds another easy path to the final choice.

Credits/Acknowledgements

We would like to thank Luigi Di Lascio, Paolo Marchese and Gerardo Virgilio Calzaretta. For the preparation of his

final dissertation (undergraduate degree in Civil Engineering, University of Salerno–speaker: Barbara Messina, co-rapporteur: Pierpaolo D'Agostino) they have contributed to the collection of data then implemented in the GIS environment and with the help of parametric modellers (Rhinoceros and its Grasshopper plug-in). The present work includes the authors' individual contributions. Specifically, Barbara Messina described the methodological approach adopted, from a theoretical point of view (in the section: Integrated systems to represent urban and territorial phenomena), while Pierpaolo D'Agostino described the operational processes (in the paragraph: A practical approach: the cycling network of the Paestum coast).

Notes

[1] The use of methodologies of landscape analysis and drawing, through integrated digital systems, appears today a priority objective at the base of the definition of the Italian professional profile of the civil and environmental engineer. In fact the new Code for public contracts and Ministerial Decree n. 560 of 1.12.2017, by the Ministry of Infrastructure and Transport, provides for "*modalità e tempi di progressiva introduzione […] dell'obbligatorietà dei metodi e degli strumenti elettronici specifici, quali quelli di modellazione per l'edilizia e le infrastrutture, nelle fasi di progettazione, costruzione e gestione delle opere e relative verifiche*". A revision of three-year and two-year graduate programs in Environmental Engineering and the Territory is underway. This change is aimed at providing knowledge and skills in the use of integrated digital modelling techniques and tools in the field of structures and infrastructures, as well as advanced experimental methods for representation and analysis of the characteristic problems of engineering for the environment and the territory.

[2] The software for parametric modelling, in general, facilitates a comparison between different design scenarios, allowing rapid changes to the objects represented, and viewable in real time on the entire project. The implementation of BIM systems for building modelling, which is based on an interrelation logic between the information database and the digital model similar to that of the GIS platforms, has contributed to making the management process of territorial or urban contexts more effective. This made it possible, in each phase (planning, execution, maintenance), wide reading and checking of the interventions designed in them.

[3] On the evolution of GIS systems, in terms of technological progress and graphic potential, much has been debated in recent years, both nationally and internationally. On this topic, we highlight, among others, the studies of Arctur and Zeiler [Arctur, Zeiler 2004], of Picon and Ratti [Picon, Ratti 2019], as well as of Muzzarelli [Muzzarelli 2016].

[4] On the diffusion and the experiments in this direction see the studies of Geertman and Stillwell [Gertman, Stillwell 2003], of Campagna [Campagna 2014], and of Di Cesare [Di Cesare 2016].

[5] Digital modelling has allowed, for example, to verify with interactive simulations which sections of the existing cycle paths require shading systems and, at the same time, to compare multiple design solutions.
In the example in figure 4 two of the three options considered are illustrated: the first consisting in the arrangement of sunshade systems, the second in the planting of suitable tree species in order to project shade on the road, the third in the deviation of the cycle path into the existing pine forest. The graphic simulations have allowed, in all cases, to verify ex ante the hypotheses formulated, thus allowing the designers a more informed choice.

[6] With specific reference to the investigated area, the spatial analysis–carried out graphically in both two-dimensional and three-dimensional form–was aimed at identifying areas suitable for hosting cycle paths. The conditions at the base of the graphic considerations were the presence of tourist "attractors" and the absence of significant "criticalities".
For example, for the coastal area next to the beaches, depending on the number of tourists present here in the different periods of the year, the existence or not of excessive traffic on potentially suitable routes has been verified. More precisely, identified as the fulcrums of the spatial analysis the groups of dwellings present in the coastline, of which a part exclusively destined to summer tourism, first of all we have estimated the visitors' presences in the various months, in order to evaluate the trend of the expected population density during the year. In particular, we have represented the areas of "influence" such as circumferences–of variable extension with the variation of the population density–with the center placed in correspondence of the main housing aggregates and radius equal to the numerical datum associated to the density. The areas–derived from the overlap of two or more circumferences–have therefore been identified as critical because they are too trafficked and, therefore, not suitable for a cycle crossing.

Authors

Barbara Messina, Department of Civil Engineering, University of Salerno, bmessina@unisa.it
Pierpaolo D'Agostino, Department of Civil, Architectural and Environmental Engineering, University of Naples "Federico II", pierpaolo.dagostino@unina.it

Riference List

Arctur, D., Zeiler, M. (2004). *Designing Geodatabases: Case Studies in GIS Data Modeling*. California, (U.S.A.): ESRI Inc.

Bonora, P. (a cura di). (2012). *Rappresentare la territorialità. Quaderni del territorio*. Bologna: Archetipo libri.

Brown, M., Knopp L. (2008). Queering the Map: The Productive Tensions of Colliding Epistemologies. In *Annals of the association of American Geographers*, vol. 98, n 1, pp. 40-58.

Campagna, M. (2013). Geodesign, sistemi di supporto al piano e metapianificazione. In *DisegnareCon*, vol. 6, n. 11, pp. 133-140.

Campagna, M. (2014). Geodesign: dai contenuti metodologici all'innovazione nelle pratiche. In Atti della *XVII Conferenza Nazionale SIU. L'urbanistica italiana nel mondo*. Milano, 15-16 maggio 2014. Roma-Milano: Planum Publisher, pp. 71-76.

Cardone, V. (2015). *Modelli grafici dell'architettura e d el territorio*. Santarcangelo di Romagna (RN): Maggioli editore.

Centofanti, M., Brusaporci, S. (2011). Il disegno della città e le sue trasformazioni. In *Città e Storia*, anno IV, n. 1, pp. 151-187.

Chias Navarro, P. Papa, L.M. (a cura di). (2019). *DisegnareCon*, vol. 12, n. 22, "Drawing the territory and the landscape".

Cooper, C.H.V. (2017). Using spatial network analysis to model pedal cycle flows, risk and mode choice. In *Journal of Transport Geography*, n . 58, pp. 157-165.

de Silva F.N., Eglese, R.W. (2000). Integrating simulation modelling and GIS: spatial decision support systems for evacuation planning. In *Journal of the Operational Research Society,* vol. 51, n. 4, pp. 423-430. <https://www.tandfonline.com/doi/abs/10.1057/palgrave.jors.2600879> (accessed 2019, September 26).

Di Cesare, E.A. (2016). *Geodesign and metaplanning: advanced planning support systems development*. Milano: Franco Angeli.

Du, R., Santi, P., Xiao, M., Vasilakos, A.V., Fischione, C. (2019). The sensable city: A survey on the deployment and management for smart city monitoring. In *Communications Surveys & Tutorials,* vol. 21, n. 2, pp. 1533-1560. <https://ieeexplore.ieee.org/document/8533352> (accessed 2019, September 23).

Fistola, R. (2009). *GIS. Teoria ed applicazioni per la pianificazione, la gestione e la protezione della città*. Roma: Gangemi editore.

Geertman, S., Stillwell, J. (eds.). (2009). *Planning Support Systems: Best Practice and New Methods*. Dordrecht: Springer.

<http://cityform.gsd.harvard.edu/videos> (accessed 2019, September 26).

<https://morphocode.com/visiting-mit-senseable-city-lab-singapore/> (accessed 2019, September 10).

<http://senseable.mit.edu/> (accessed 2019, September 23).

Llopis Verdú, J., Serra Lluch, J., Torres Barchino, A. (2019). Digital diagrams and urban and territorial cartography. Contemporary schematic depictions of immateriality. In *DisegnareCon*, vol. 12, n. 22, pp. 12.1-12.18.

Maantay, J., Ziegler, J. (2006). *GIS for the urban envrionment*. California (U.S.A.): ESRI Inc.

Marotta, A., Novello, G. (a cura di). (2015). Atti del *37° Convegno internazionale dei Docenti delle discipline della Rappresentazione "Disegno & Città." Cultura, Arte, Scienza, Informazion*e. Torino, 17-19 settembre 2015. Roma: Gangemi editore.

Martone, M. (2007). *La rappresentazione per la conoscenza dell'ambiente e del territorio*. Roma: Kappa editore.

Messina, B., D'Agostino, P. (2011). A GIS approach to monitor territorial transformations: digital assessment of the cycle paths in Paestum. In Proceedings of the *IMProVe 2011. International conference on Innovative Methods in Product Design*. Venice, 15th-17th of June 2011, pp. 913-919. Padova: Libreria Cortina.

Mingucci, R., Moura, A.C.M. (a cura di). (2013). *DisegnareCon,* vol. 6, n. 11, "GIS & Disegno urbano."

Moura, A.C.M. (2013). Progettazione paesaggistica o parametrizzazione? Recenti tendenze in geo-tecnologie per la rappresentazione e pianificazione del territorio urbano. In *DisegnareCon*, vol. 6, n. 11, pp. 3-10.

Muzzarelli, A. (2016). GIS e strumenti innovativi dell'analisi del territorio. In *Ingenio*, gennaio 2016, pp. 1-11. <https://www.ingenio-web.it/5241-gis-e-strumenti-innovativi-dellanalisi-del-territorio> (accessed 2019, April 10).

Novello, G. (2002). Nuove forme e modelli per la conoscenza dell'ambiente e del territorio: metodi e pratiche di rappresentazione. In *Disegno e Design digitale*, pp. 5-9.

Passigato, M., Pedroni, C., Dalla Venezia, A., di Bussolo, R. (a cura di). (2008). *Reti ciclabili in area mediterranea*. Dolo (VE): Grafiche Leone, Dolo (VE). <http://www.isfortopmus.it/Opmus/Studi/Vademecum%20Regione%20Puglia.pdf> (accessed 2019, July 29).

Picon, A., Ratti, C. (2019). Mapping the Future of Cities: Cartography, Urban Experience, and Subjectivity. In *New Geographies,* n. 9, pp. 62-65.

Piga, B.E.A., Salerno, R. (2019). Non-conventional Representation for Urban Design: Depicting the Intangible. In L. Cocchiarella (a cura di). In Proceedings of the *ICGG 2018. 18th International Conference on Geometry and Graphics*. Milano 3-7 agosto 2018, pp. 1694-1705. Berlin, New YorK : Springer.

Ratti, C., Sommer, C. (2012). Approximating Shortest Paths in Spatial Social Networks. In *SocialCom/PASSAT 2012*. Proceedings of *2012 ASE/IEEE*

International Conference on Social Computing and 2012 ASE/IEEE International Conference on Privacy, Security, Risk and Trust. Amsterdam (Netherlands), 3-5 September 2012, pp. 585-586. Piscataway, NJ: IEEE Computer Society.

Rybarczyk, G., Wu, C. (2010). Bicycle facility planning using GIS and multi-criteria decision analysis. In *Applied Geography*, vol. 30, n. 2, pp. 282-293. <https://doi.org/10.1016/j.apgeog.2009.08.005> (accessed 2019, July 22).

Rosi, M. (2001). *La cartografia tematica per l'architettura e l'urbanistica*. Napoli: Giannini editore.

Santana, S.A., Moura, A.C.M. (2013). Geodesign Information Management and Parametric Modeling of Territorial Occupation: New Paradigms and Challenges in Territorial Representation. In *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XL-4/W1, pp. 109-112.

Semeraro, F., Fonsati, A., Rapetti, N., Osello, A. (2019). Technologies and techniques offering new interpretations of the landscape evolution. In *DisegnareCon*, vol. 12, n. 22, pp. 25.1-25.9.

Shin Huoy Terh, S.H., Cao, K. (2018). GIS-MCDA based cycling paths planning: a case study in Singapore. In *Applied Geography,* n. 94, pp. 107-118.

Vanky, A. (2016). Make Data Make Sense: The Importance of Visualization in Data Analytics. In *IQT QUARTERLY*, vol. 7, n. 4, pp. 17-19.

Wu, Y. (2018). *Modifying and Extending the Geodesign Framework for Eco Campus Design Project.* Applied Research Paper, Master of City and Regional Planning, advisor: Dr. Perry Yang. School of City and Regional Planning, College of Design, Georgia Institute of Technology.

Yin, L. (2010). Integrating 3D Visualization and GIS in Planning Education. In *Journal of Geography in Higher Education*, vol. 34, n. 3, pp. 419-438. <https://www.tandfonline.com/doi/abs/10.1080/03098260903556030> (accessed 2019, September 29).

Between Absolute and Fluid Space: the Representation of the Oasis

Paola Raffa

Abstarct

At the edge of the desert, near the wetlands, the palm grew in small wild spots that reproduced by the action of the wind, forming a favorable environment for human settlement.
The landscape of the oasis is a composition of natural elements whose combination transforms the place into artificial nature; the water, the knowledge of agricultural techniques together with hard daily work overwrite to the arid deseret ground the traces of site configuration.
The oasis is a homogeneous system structured in the repetition of the elements of which it is composed and which generates a figurative unit given by the neatly arranged parts A homogeneous plant mass that becomes a defined and balanced system.
The image of the oasis is built between the space of the desert, in which there is no presence of stratified signs but is configured as a natural absolute, and the fluid and symbolic space of vegetation that is defined as a figure in the surrounding backgouund.
The representation begins by palm drawing, it is, in fact, the measure of the oasis and its representation contains sacredness and symbolis. It is also a point of union between the world of forms and the world of the spirit.

Keywords: survey, landscape representation, vision, image, desert.

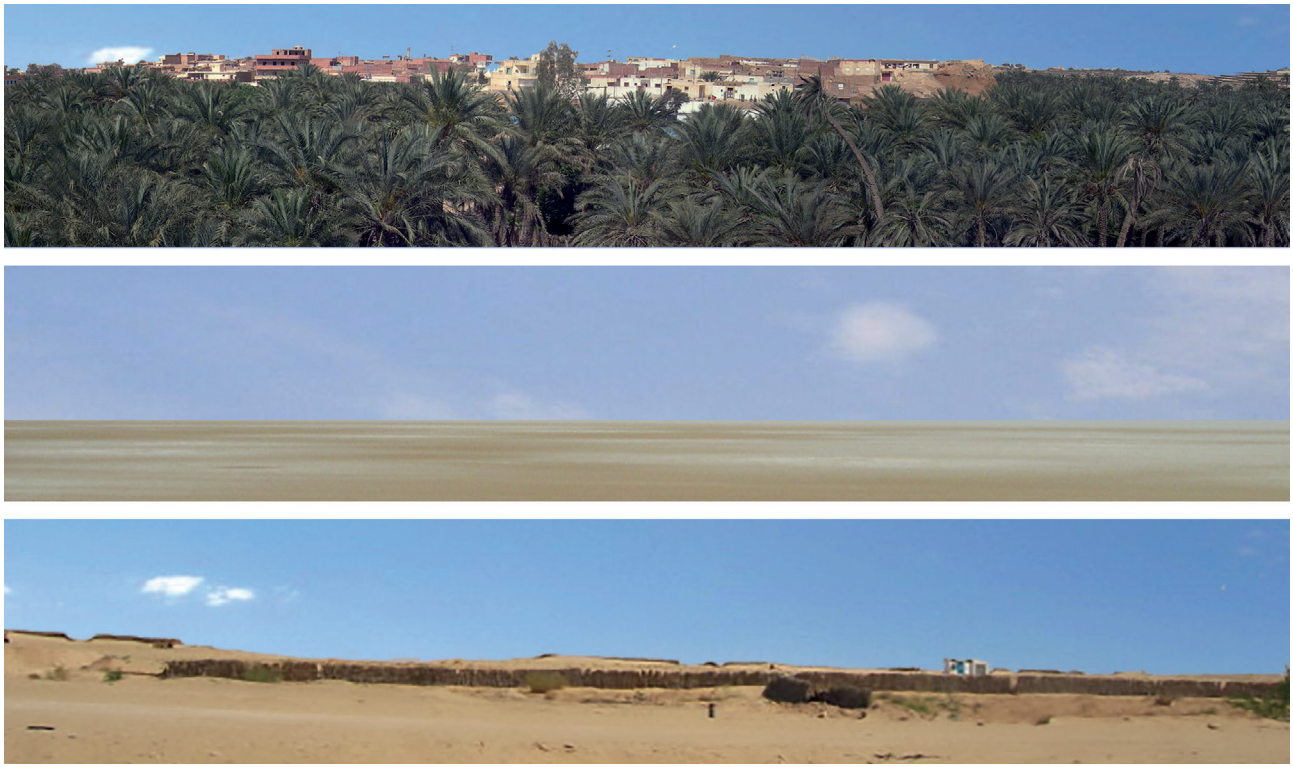
Introduction

The Sahara desert, vast plain of sand, is the palimpsest of cultures, encounters, exchanges and contaminations. In the maps of the ancient geographers it was represented until the XIX century as a white spot, an emptiness, bordered to the South by tents and lions; in current maps and in satellite views it is recognizable as a large yellow oval, in any case an endless limit, a place without references.
The desert is a place of sand, of wind, of light between two predominant elements, the ground, infinite expanse of sand, and its parallel plane, the sky, "compared to which all the other skies seem timid attempts" [Bowles 1999, p. 12]. In the intermediate space, men live in a succession of opposites that mark time, establish the direction and orientation.

In the desert, nearby small depressions, created by the water outcrop, micro-systems, that trigger dynamics favorable to life, are generated. They are green spots called *n'akal* (palm) or *jazira* (island) which even before becoming an oasis were wild spots that reproduced under the action of wind and rain. It was the water provision, meeting and exchange points for the nomad caravans that crossed the desert and exchanged gold, skins and fabrics with the precious salt.
These islands of palms, indicated by travelers, pilgrims, geographers and soldiers as 'oases' were the origin of stable settlements in the desert. Herodotus in the V century BC, when crossing the Sahara from Egypt to the Gulf of Sirte, meets at a distance of ten days of walking, water springs

surrounded by palms (*oasis*), in large numbers at the edges of which lived the men; Strabo speaks of inhabited places surrounded by vast deserts and lands without water (*ayàseis*), like islands in the open sea; Sallustio, in the war against Juba, reports of Saharan nomads near palm groves.
Oasis is the term of Egyptian origin which means "fertile neighborhood", in Greek it is *oasis*. The Arabic terminology defines the oasis as opposition to the desert, *khla*, with a term that indicates a resource of water, *ouah* (*waha*). In the definition of western dictionaries, the oasis is in the desert, an inhabited place, cultivated, green and provided with water, with a sedentary population [Brunet, Ferras, Théry 1999].
The almost total lack of written sources in Arab culture has confirmed the importance of oral tradition. The chronicles of those who walk the desert, intellectuals, geographers and religious pilgrims, are the main documents of the history of the Sahara, and of the whole Arab World in general, widely describing the oases, the kind of life and the organization of particularly fertile crops [Kassah 1996].
Among the dream descriptions of travelers and the reality of those who live there, the oasis is not a natural place, it exists because of the strong will of men who protect it from silting up and who watch over water distribution. Where the climate is particularly arid, scarce and irregular rainfall, excessive temperature and sunshine, water becomes an indisputable necessity, represents the main resource, constitutes a source of power for those who control it. Through a long process of adaptation to the hostile environment, the oases are the result of a delicate balance between man and his habitat.

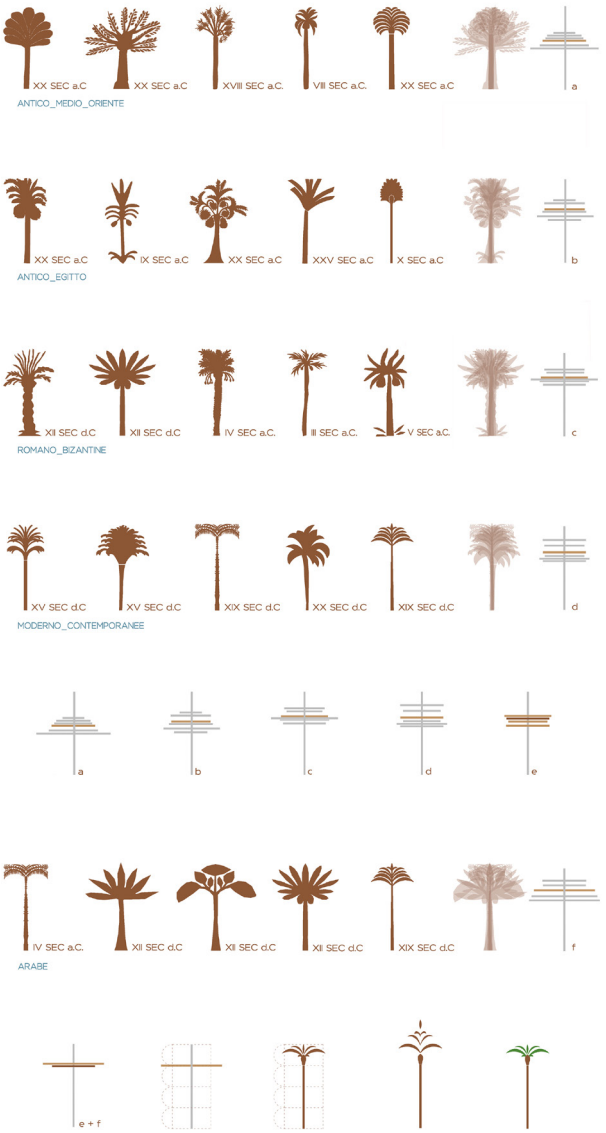
Fig. 1. View of the city-oasis of Nefta from desert; view of Chott el Jerid and desert from medina (photo by the author).



Palma, *palmae*: short elougy of the palm

The date palm *–n'akal*, the female palm and *dokkâr*, the male one– sacred panreligious tree, is the oasis tree par excellence. In the Islamic tradition it is the tree that Adam brings from heaven to the earthly world and plant in Mecca. The palm tree makes a territory as sacred place, it is the symbol between the world of forms and the world of the spirit, symbol of the triumph of life over death.
In Mesopotamia under the palm trees, inside enclosures, water tanks and irrigation systems were built to create splendid productive and floral gardens. The Egyptians channeled the waters of the Nile into water basins to irrigate gardens in which ornamental plants and productive plants coexisted. As the technique of drained tunnels, for the transport of water, was assimilated by the sedentary populations, the process of cultivation of the oases advanced from East to West.
"Around the *Phoenix dactylifera* gravitates the whole existence of the oasis […] In the desert an entire oasis can be realized starting from a single palm tree […] The preparation of each plot always begins with the introduction of small palms that, with growing, will guarantee crop protection with their hair" [Laureano 1989, p. 202].
With its ring-like growth, the palm, marks the course of time and becomes a reference for agricultural years, moreover every part of the plant is used.
The representation of the oasis starts from the palm drawing (fig. 2). In fact, this is the measure of the oasis and its representation contains sacredness and symbolism in a code that finds its connection between the world of forms and the world of the spirit. It participate in the topology of the desert, becoming a connecting element between natural architecture and architectured nature.
The palm drawing found in ancient graffiti or reproduced by Assyrians and Egyptians conveys its symbolic value through the force of the image. Tree of life, of reproduction, expression of harmony is an object of veneration. Its sacred character is expressed in the graphic repetition of ornamental motifs, in the dimension that dominates all the other figures and emphasizes the connection between the earthly world and the celestial world. Straight and stylized it often becomes the axis of representation, a metaphor of the *axis mundi*.
In the XVII and XVIII centuries, in scientific expeditions, in which botanists also take part, the palm is represented in its scientific aspect, dressed for the Enlightenment West, of a new symbol, it becomes the emblem of exoticism and

Fig. 2. The drawing of the palm: graphic transcription and synthesis of the sign (graphic elaboration by C. Romato).

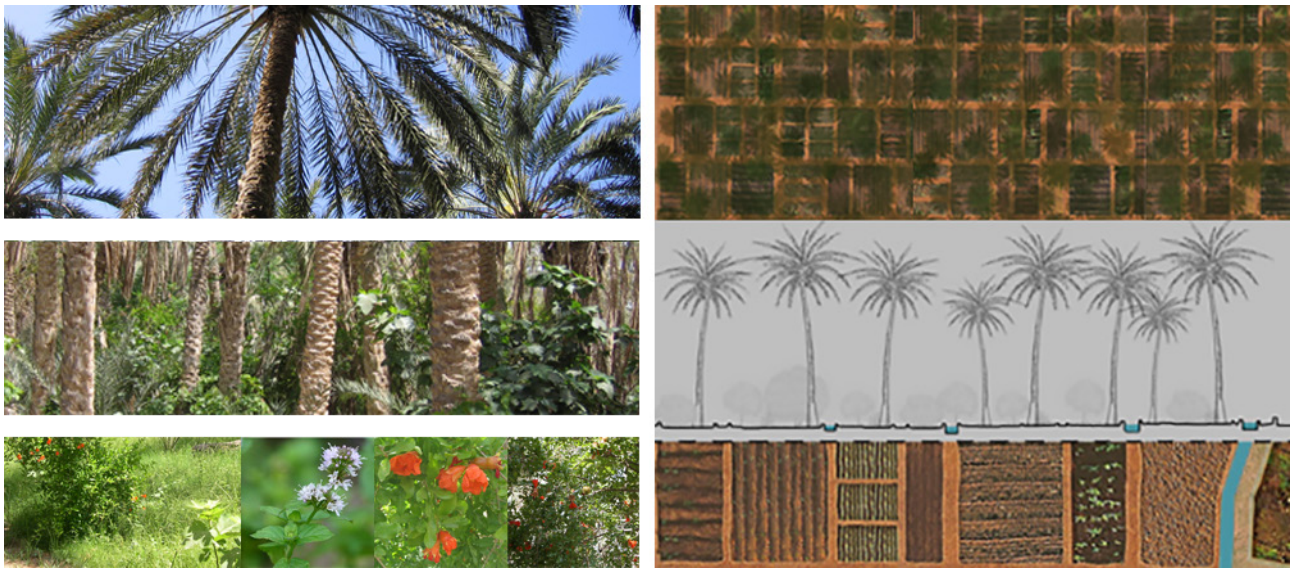


represents the nature of a climate mild with the task of identifying the places [De Micheli, De Sanctis 2001, p. 131].

Taht saqf al n'akal: the space of the oasis

At the origin of the oasis "there is often a single palm planted in an excavation of the ground and surrounded by dry branches that protect it from the sands […] the plant generates its own protection against the rays of the sun, concentrates the steam […] construction of the soil from which it in turn feeds" [Laureano 2001, p. 28].
The cultivation of palm trees creates a built environment in which the foliage, which serve as a screen for solar radiation, constitutes a vegetal roof. Below the cultivation of the gardens is entrusted to the rigorous discipline of technical and symbolic procedures, in which the rigid structure, consolidated and repetitive, guarantees its existence.
South of the meridian that connects Gafsa to the Gulf of Gabès, in a strip of about forty kilometers wide, from the Algerian border to the Mediterranean Sea, lies the Region of the Tunisian oases, a semi-arid area, a time point of inflection between nomadism and sedentarism.
Defined by Ibn Kaldoun the "palm region" was considered by the Romans the impassable *limes* beyond which to confine the nomadic populations. Nefta, along with Tozeur and Douz, is one of the main oasis towns on the edge of the Chott el Jerid, an extensive saline depression that guarantees the surfacing of the groundwater stratum.
The landscape of the oasis town of Nefta is characterized by compact units and horizontal continuity (fig. 1): the landscape of the palm, fluid, uniform with an intense green color, forms a plane parallel to the sky in which there are no significant emergencies; the compactness of the medina, which maintains the same color as the desert, is emphasized by the impetus of the mosques minarets and the white domes of the *marabouts*; flat, white and crystalline is the reflection of the salt lake that connects to the low sand dunes in a continuous sequence. In addition to the economic and commercial function, the oasis has the function of a thermal equalizer towards the town, since the humidity given off compensates for the aridity coming from the desert winds.
The physical unity of the oasis that contains the dual aspect of real and symbolic cosmos is added to the unity of cyclical time, agriculture and the seasons, and the linear time

Fig. 3. Categories of "nature" of the oasis.



of the flowing water, measured in a graduated scale. These are also associated with the ritual time in which the movement configures the universal direction.
It is usual to bring the categories of nature that make up the oasis into three levels (figs. 3, 8). Under the curtain of pinnate leaves, there is a level of fruit trees, pomegranates, oranges, figs, olive trees, almond trees, apricot trees; further down in well-delimited lots with narrow ditches of running water, a level of bushes, vegetables, wheat, legumes, henna and forage for animals, but also roses and fragrant flowers. The water channels divide the fields into defined units and divide the soil into quadrangular plantation enclosures. Elementary artifacts for sheltering tools and rest set up hierarchical and organized spaces so as not to invade the cultivated space; the fence and the entrance gate, in palm leaves or in pressed bricks mark the limit of ownership.
Drawing the shapes of the oasis the structure relationships between all the elements that participate in the composition of the space emerge; in particular, the relationships that are established between the forms of nature and the elementary forms of the anthropic transformations organized for the production of an essential system of sustenance.

The construction of the image of the oasis

Man thinks "at the same time by words and images" in literary descriptions the images are constructed by "accumulation" with the figure, instead, a "totality" is communicated [Friedman 2011, p. 12]. In the construction of the image of the oasis the description of those who have experienced the space has often anticipated figurative reproduction in solemn verbal expressions. Narration becomes imagination of a place and perception is independent of placement in space, but absolutely able to select elements and construct synthetic schemes for graphic transcription. Among the many there are three short narratives whose authors belong to different cultures.
Cesare Brandi describes the oasis of Zanzur in the journey to Sabratha, in Libya: "An oasis, it was the first I saw, I understood what it is. There are palm trees, thick enough like a pine forest, all about the same height, and underneath there is nothing, or barely, between the trees, almost wild olive trees. Then, from time to time, wells, and water" [Brandi 1990, p. 18].
André Gide walks among the gardens of the Biskra oasis in Algeria: "beyond the walls palm trees rise […] it was a place full of shadow and light, quiet, which seemed to be sheltered from the weather […] the murmur of flowing water, quenches the plants and escapes from tree to tree […] the water distributed with prudence and parsimony, satisfies the thirst of the plants, then is immediately withdrawn [...] to the feet of each palm is dug a narrow pit that collects water to quench the tree an ingenious system of locks regulates the water […] those gardens were all the same; and yet each was different from the other" [Gide 1999, p. 34, 35].
Isabelle Eberhardt, stays in the oasis Zenaga city-oasis, today, on the border between Morocco and Algeria: "the palm grove of Zenaga made its immense wave flow, swayed, the Djorf came crashing […] the compact tops of the dates palms took on the colors of light blue velvet in which silvery reflections glided […] As I descended the wall of date palms rose, rustling and gradually hiding the light of the horizon. Below, under the blue shade of the palm grove a *seguia* flowed over the moss. The gardens displayed the luxury of their bluish greens. Of their golden greens […] and very close they opened delicious paths, full of shade and coolness. Under the arched palms of the fig trees they leaned towards the light […] to which the reddish leaves of the vineyard were mixed next to those of the pomegranates and peach trees […] a delicious penumbra implements the lines and colors in that labyrint of streets without dwellings" [Eberhardt 1998, p. 133, 134].
Literary descriptions and travel impressions load the landscape of objectuality and make it recognized as a figure, it is in this sense that they were paradigmatic for the graphic representation of the oasis. Returning the narrative reality to a figurative reality was one of the main phases of the search for a method of representation conceived as a tool for knowledge and analysis of space.

Representation of the oasis

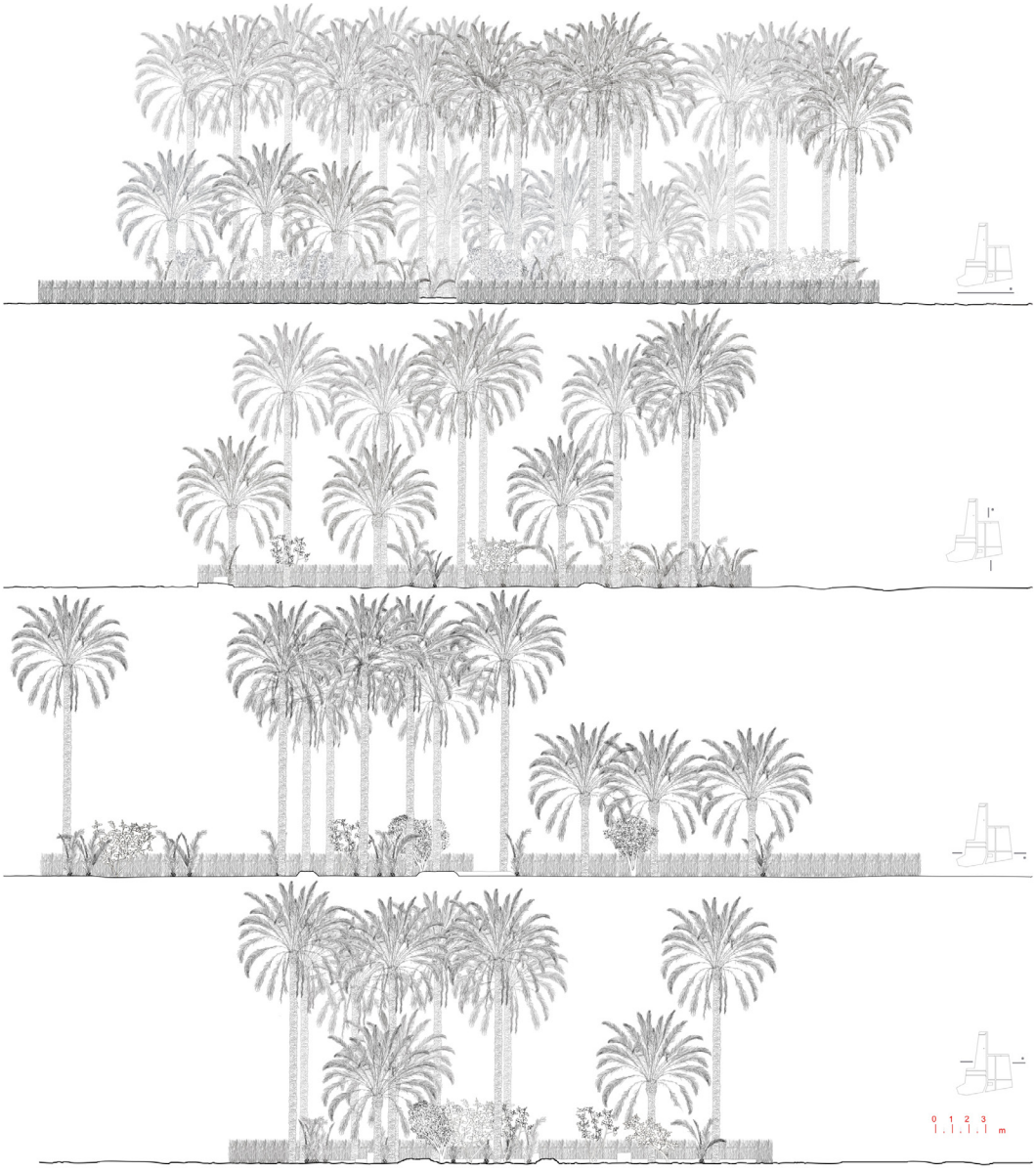
The image of the oasis is built between the space of the desert, in which there is no presence of stratified signs but is configured as a natural absolute, and the fluid and symbolic space of vegetation that is defined as a figure in comparison to the surrounding .
From this, two modes of perception derive. Seen from the desert, the oasis of Nefta is a cohesive and structured unit that defines an area opposed to the medina, a compact city of land, and to the Chott el Jerid, a white expanse of salt. It is the limit of a boundless horizon.

From the inside we can see visual fields defined by twisting frames, circumscribed observation points, contiguous environments of scenes in which the elements are repeated in their hierarchical and orderly disposition.
In a historical time of modification of the tools of representation and seduction towards techniques of reproduction and manipulation of images, mediation choices were necessary between exaggerated realistic representations, given by primitive rendering software, digital collage techniques, mediation of images photographic and graphic abstraction processes of the sign, in order to render the vision systems of the vegetal landscape graphically unitary.
The knowledge of the oasis starts from the homogeneous system that is structured in the repetition of the elements of which it is composed and which generates a figurative unit given by clearly structured parts. The strict order is lead by the hierarchy of the compositive laws of the productive space, by the configuration of the irrigation channels, by the variation of the shaded areas, by the religious reasons that regulate the daily actions of the Muslim fellah.
The representation of the Oasian space implies, among other things, the decoding of the allegories that derive from the symbolic narration of the elements: the fence encloses the private area and isolates it from the impure world; the water that flows in the canals is a symbol of life; every species of tree evokes its symbolic meaning, in Genesis and in the Koran, of an element that belongs to the real world and to the religious world; the palm connects the earth to the sky and is the symbol of union between the terrestrial world and the divine world.
In the representation three main figures appear, they merge into a single homogeneous system and which in turn become paradigmatic of the representation of wider extensions.
The water traces overwritten on the ground delimited the fields and draw a network of equivalent quadrilaterals, depending on the lift of the water. Soil is subdivided into a geometric grid that acts as a control and measurement scheme for the organization of space (fig 4a). Geometry is not the result of a theoretical concept but imposes itself as a perennial necessity of agricultural activity, as an indispensable tool for the survival of the oasis. The fruit trees, placed inside the fields, without an apparent order, materialize the symbolic space of Eden and the directional space towards the global religious center (fig. 4b). The shelters, made of palm leaves and set up with benches and carpets, are the resting and prayer points, they are often placed near the entrance so as not to occupy the fertile space. The palms are arranged at the edges of the

Fig. 4. Plan of a compartment of the oasis of Nefta: a) ground level, b) fruit trees level, c) palm trees level; (graphic elaboration by M. Comisso, D. D'Agostino, A. Malfitano).

Fig. 5. Section of a compartment of the oasis of Nefta (graphic elaboration by M. Comisso, D. D'Agostino, A. Malfitano).

Fig. 6. Section of a compartment of the oasis of Nefta (graphic elaboration by M. R. Caniglia, M. T. Capone, M. Covello, C. Lacapria).



fields, at the useful distance so that the foliage does not overlap but are tangent to each other by filtering the sun's rays (fig. 4c).
The recording of the measurements and the transcription in figurative codes in which, the sign is the main referent, has highlighted the geometric organization and the spatial relationships of the palm garden. The subdivision into compartments for the survey made it possible to facilitate the measurement operations and to highlight the formal and symbolic characters of each cultivated garden.
The representation of the section depicts horizontal bands divided into themes: the strip of soil and cereals, the strip of fruit trees, the fence and the huts, and the strip of palm leaves (figs. 5, 6). Each strip seems to be independent of each other, each element, each tree drawn seems to take on a main configuration. It is in the spelling of the sign, in the homogeneity, in the thickening and thinning of the line that the space generated by these absolute forms is configured. The thick line of land follows the modeling of the soil in the succession of canals, paths, and the field of the trees. The ground level is also that of small cereal shrubs, henna and roses that cover the fields and color them in seasonal alternations.
In the second strip, the fence of palm leaves becomes background or front curtain and indicates from time to time the limit between internal (*al-harâm*) and external (*al halâl*), the accessible and the inaccessible, the sacred and the profane .
Inside the fence and under the palm roof there are the fruit trees, which preserve the canonical structure of their species in which the stem, the branches and leaves outline the general profile of the silhouette [Maestri 2009, p. 113]. The fruit trees drawn, stable in their configuration, return in a proportional schema of between height and width, the formal balance between its different parts. The linear traits define the radial branching around the stem and a texture of more or less dense signs and textures makes up the sparse or thick zonal masses of the foliage. "The particular shape of a trunk, a latent geometry found in many leaves, even the choice of point of view become secondary facts […] what has value is to capture that special sensation, that poetic effect" [Maestri 2009, p. 63] in which the system of signs is able to translate the image of reality. The tree (fig. 7) is drawn starting from a process of interpretation and selection of the salient aspects manifested in its bearing, in this way the choice of position has become the primary condition capable of highlighting, in the graphic

Fig. 7. The drawing of the trees.

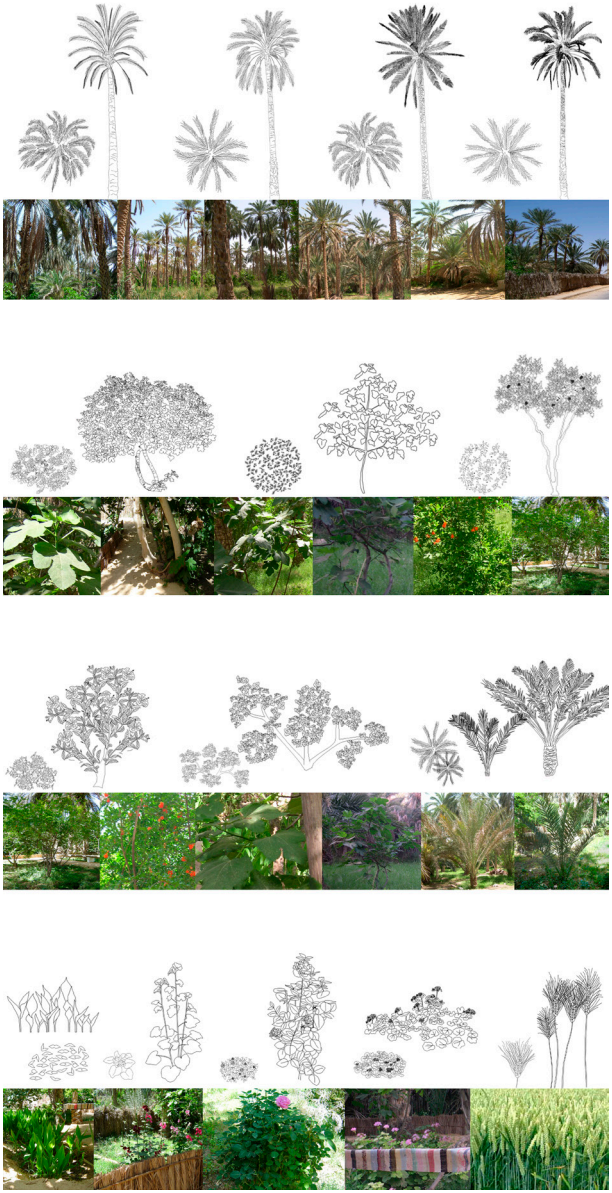
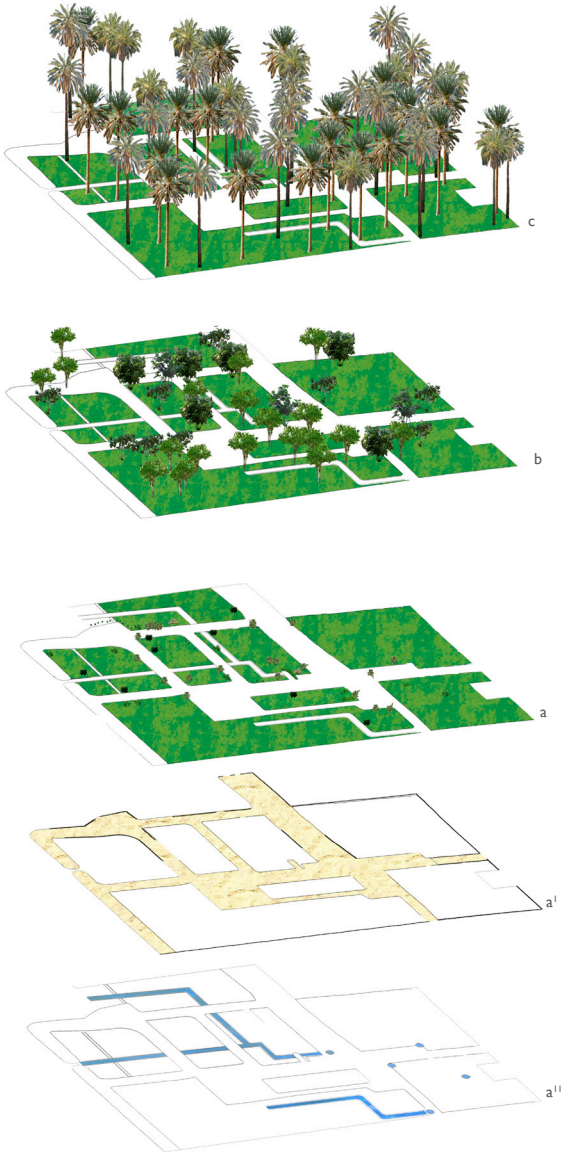
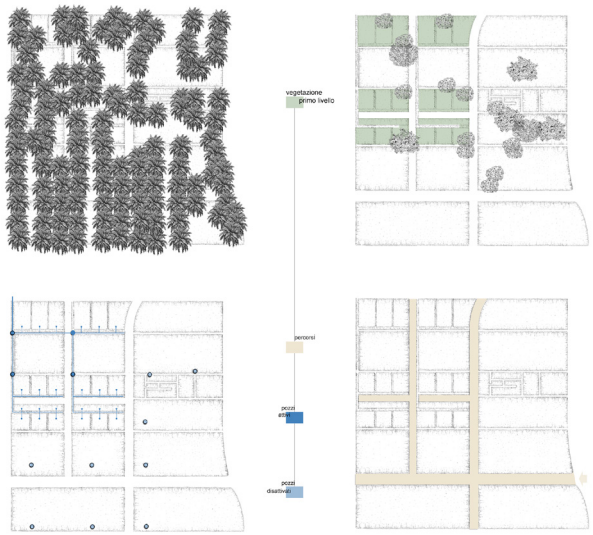


Fig. 8. Three-dimensional processing: homogeneous levels deconstruction: (graphic elaboration by M. R. Caniglia, M. T. Capone, M. Covello, C. Lacapria).



synthesis, the characters of the tree and the characters of space configutation.
In the third band, the tall palms turn the foliage towards the prevailing winds; each palm has been represented with the gait that highlights the sinuous movement of the stem and of the foliage stimulated by the wind.
The figurative value of the oasis is thus realized in the drawing of each individual tree and in particular the palm that is its archetype, the fundamental form of the figurative structure of space.
Knowledge of the oasis takes place from interior, that is to say, within the boundaries of the fluid, delimited, defined, fenced space. The representation of this interior materializes in the transcription of information whose data has been discretized in space analysis models.
The first phase of knowledge, perception, tends to assimilate a homogeneous but complex continuum, a vegetal mass that becomes a single defined and balanced system. It is a phase of description, in which the graphic transcription is the result of the syncretism of modes and codes of representation.
In the second phase, of interpretation and analysis, a deconstruction of the space is carried out and the complex system is broken down into simpler units, in which to investigate the signs and grasp the identity of the parts.

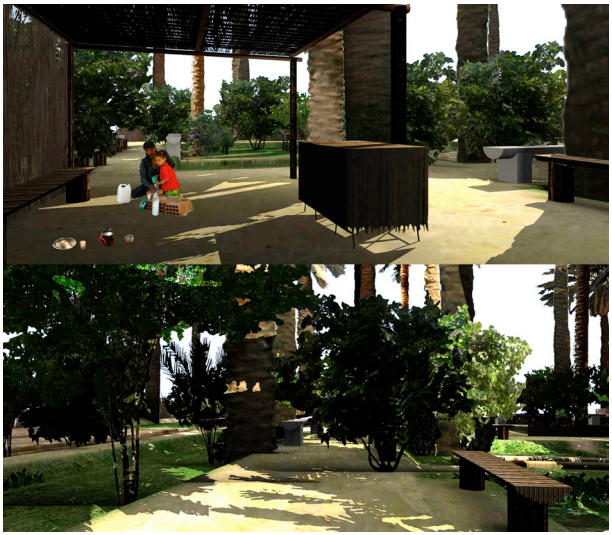
Fig. 9. Configuration of the productive space for thematic areas (graphic elaboration by G. Cannizzaro, G. Tebala).



The deconstruction operation allows to separate the elements into homogeneous categories and to implement reading levels that lead to the interpretation and verification of the configuration of the vegetal space.
The decostruction into layers, in which similar thematic units are grouped, combines the knowledge phase with the conceptual status capable of adding semantic value to the construction of the image (fig.8). Categorizing the homogeneous configuration of the oasis by themes means producing synthetic and selective schemes of the three levels of vegetation, the boundary between them and the spatial relationships they produce. Not least they show the stratifications of landscape in which the anthropic categories are opposed to the absolute natural of the desert.
The possibility of manipulating digital images together with the ancient system of photomontage has brought an evolution in the representation of the landscape in which the transposition of place and scale prefigures scenarios in which the tree regains its formal configuration and stimulates the imaginary towards real ambience. The techniques of photomontage and render overcome, in a certain sense, the disciplinary barriers and enter into the field other disciplines of vision, including the narration of places, in a process in which the temporal variation is highlighted (figs. 10, 11).

Fig. 10. Three-dimensional processing with the render technique (graphic elaboration by M. Comisso, D. D'Agostino, A. Malfitano).

Fig. 11. Three-dimensional processing with the photomontage technique (graphic elaboration by grafica di M. R. Caniglia, M. T. Capone, M. Covello, C. Lacapria).



The renders tend to cancel the distance between reality and its figuration and the three-dimensional space is reported on the flat surface in a dialectical context that replicates or simulates the real space above all, in the material and metric connotation [di Luggo, Zerlenga, Pascariello 2016].
In the dissolution of the classical models of observation, perception is no longer given by solicitations dependent on the real space but by superimposition of visual levels, textures that filter reality and highlight, from time to time, different aspects.

Conclusion

The landscape of the oasis is a composition of natural elements, soil, water, vegetation whose combination transforms the place into artificial nature. The eternal debate between natural architecture and architectured nature. The landscape is strongly characterized by the anthropic intervention in which water, knowledge of agricultural techniques and work overwrite the arid desert soil with signs capable of characterizing the formal aspect of the place and compiling the plot of memory.

The oasis is therefore the product of man's transformative efforts, the union between two landscapes "whose being material and aesthetic is the result of a production process in which those that were previously simple things of nature become aesthetic objects" [Gregotti 1990, p. 2].
It is really on the aesthetic perception of immersion in an interior space, which limits the visual field in relationship to the boundless external panorama, that the image of the oasis is constructed. We move from a wide perspective to a vision through fragments in which the relationship with the space full of elements refers minde to the vast surrounding landscape.
Outside "from the paths of the palm grove there is always a last wall, a last hedge and then, suddenly nothing but the space in front of you, where you have to dive, which you can no longer refuse, even if turning away, we will see again, very close in the shadow outlined by date palms, blue and laughing shapes: so we will not turn" [Monod 2002, p. 17].

*The survey of the Nefta oasis was carried out between 2008 and 2010 with the students of the Course of Survey and Representation of the Territory and the Environment (Final Synthesis Workshop of the Mediterranean City) conducted by prof. Massimo Giovannini with Marinella Arena and Paola Raffa.

Author

Paola Raffa, Department of Archicture and Territory, *Mediterranea* University of Reggio Calabria, paola.raffa@unirc.it

Reference List

Bowles, P. (1999). Il battesimo della solitudine. In *Sahara viaggi d'autore*. Anno 3, n. 18 p. 11-21.

Brandi, C. (1990). *Città del deserto*. Roma: Editori Riuniti.

Brunet, R., Ferras, R., Théry, H. (1999). *Les mots de la géographie. Dictionnaire critique*. Paris: Reclus.

Di Luggo, A., Zerlenga, O., Pascariello, M.I. (2016). Rappresentazione e comunicazione del paesaggio tra tradizione e innovazione. In F. Capano, M.I. Pascariello, M. Visone (a cura di). *Delli Aspetti de Paesi. Vecchi e nuovi Media per l'Immagine del Paesaggio*. Tomo secondo, p. 29-33. Napoli: Cirice.

De Micheli, G., De Sanctis, F. (2001). *Palma Palmae*. Bologna: Edizioni Pendragon.

Kassah, A. (1996). *Les Oasis Tunisiennes*. Tunis: Ceres. Séries Gèographique.

Eberhardt, I. (1998). *Nel Paese delle Sabbie*. Como: Ibis.

Friedman, Y. (2011). *L'ordine complicato*. Macerata: Quodlibet Abitare.

Gide, A. (1999). *L'immoralista. La porta stretta*. Milano: Garzanti.

Ginex, G. (2017). *Nefta. Nefta e le città oasi di Tamerza, Mides e Chebika*. Campo Calabro (RC): Iiriti Editore.

Gregotti, V. (1990). Progetto di paesaggio. In *Casabella* n. 575-576, pp. 2-4.

Laureano, P. (1989). *Sahara. Oasi e deserto un paradiso perduto ricco di storia e civiltà*. Firenze: Giunti.

Laureano, P. (2001). *Atlante d'acqua. Conoscenze tradizionali per la lotta alla desertificazione*. Torino: Bollati Boringhieri.

Loidl, H. Bernard, S. (2003). *Opening Spaces. design as Landscape Architecture*. Berlin: Birkhäuser.

Maestri, D. (2009). *Arborario grafico*. Roma: Aracne.

Monod, T. (2002). *Il viaggiatore delle dune*. Torino: Bollati Boringhieri.

Toraldo di Francia, C. (2007). *Trees/alberi*. Firenze: Alinea.

Sullivan, C. (1997). *Drawing the Landscape*. New York: John Wiley&Son.

RUBRICS

Readings/Rereadings

Readings/Rereadings

A City with a Sense
Back to Kevin Lynch's *The Image of the City*

Carlos Montes Serrano

Three Challenging and Remarkable Books

At the beginning of the 1960s three of the most influential books on the topic of the analysis and design of cities were published. These were *The Image of the City* by Kevin Lynch [Lynch 1960], *Townscape* by Gordon Cullen [Cullen 1961], and *The Death and Life of Great American Cities* by Jane Jacobs [Jacobs 1961]. These three books contained critiques of the approach to town-planning adopted after the Second World War, proposing a new way of understanding cities and intervening in them [1].

All three became essential readings for anybody with an interest in town-planning. They remain relevant down to the present day thanks to fresh editions in various languages. Anyone who has recently read any of these books will realize that perusing them still causes a strong emotional impact, with a decisive influence over day-to-day perceptions of cities. This is true to such an extent that when one moves through streets, squares and districts, one is conditioned by the ideas developed by their authors. Nonetheless, despite having many features in common in their observations, critiques and proposals, the three books have very different starting points.

Gordon Cullen studied architecture, but specialized as a draughtsman for other architects, also holding the post of artistic director of the *Architectural Review (AR)* for many years, and as a professional consultant in the area of town-planning. Cullen saw the city as an artist, as a champion of city design, attentive to the small details that might improve the quality of a given place. *Townscape* constituted an entire manifesto, drawn up on the basis of graphical analysis of a series of prior studies, or modest strategies for urban design, that Cullen allowed to bubble out in a somewhat random fashion. Indeed, it is more the plans and drawings full of suggestions that give this book particular value [2], and less the text, which is somewhat disorganized and occasionally unintelligible, being the result of improvisations and bright ideas from the editorial team of *AR*.

As is well known *Townscape* was an anthology of articles that had appeared in *AR* between 1947 and 1956. The publishers of this journal intended to stir up debate and promote a long campaign (the Townscape movement) in favour of more humane urban design, at the service of individuals living in cities or in country towns [3]. Their ideas took shape in two monographic issues of *AR*, entitled *Outrage* (1955) and *Counter-At-*

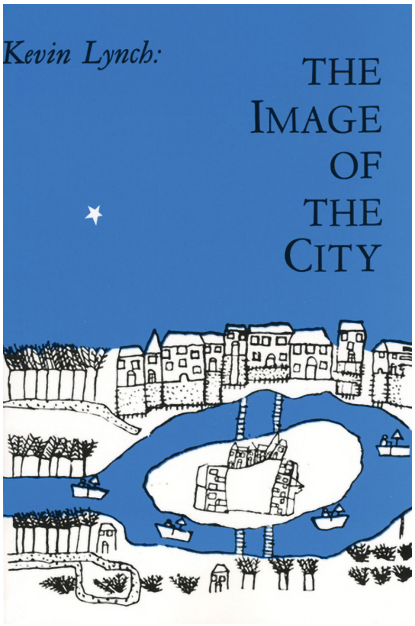


Fig. 1. Cover of the first edition [Lynch 1960].

https://doi.org/10.26375/disegno.5.2019.20

diségno ISSN 2533-2899

tack (1956). In these, they put forward criticisms of the planning of the New Towns and the urban sprawl whose uncontrolled growth was destroying the English countryside, both having a negative effect on established towns and cities.
The book *Townscape* was set within the English tradition of the picturesque. Gordon Cullen makes this plain when he refers to cities as an urban landscape, and to *townscape* as the *art of environment*, the art of linking and intertwining parts to achieve an urban scene that is more attractive, pleasant and satisfactory for the inhabitants of the place.
Kevin Lynch was familiar with, and set value on, the Townscape Movement promoted by *AR*, and in fact there are main points in common between his ideas and Cullen's one. All the same, Lynch pointed to the lack of a broader, more theoretical and academic study of cities as a whole.
Jane Jacobs was also self-taught, guided by her common sense and her sharp observational skills at street level. She was a social activist and an influencer of opinion from the time in 1952 when she joined *Architectural Forum*. Despite her not being linked to any academic institution, her criticisms of the destruction arising from the urban renewal that had been promoted in working-class districts of New York from the 1930s onwards were decisive in putting a brake on several projects for internal reconstruction of large areas of the city. Her activist stance in favour of participation by citizens and residents, her articles, and her contribution to the Conference on *Urban Design* held at the Harvard University in April 1956 (included in the August issue of *Progressive Architecture*), where she participated on an equal footing with figures like J.L. Sert, R. Neutra, G. Kepes, L. Mumford, E. Bacon and others, brought her to great prominence [4].
Two years later, her article *Downtown is for People* came out in *Fortune* magazine in April 1958, causing a strong impact on the directors of the Rockefeller Foundation through its sharp criticisms of city design. They awarded her a grant in September of that year so that she could develop her ideas, which took concrete form in *The Death and Life of Great American Cities*, published in October 1961 [Jacobs 1961].
Jane Jacobs studied Lynch's book in detail, commenting on many of his ideas in the draft of her own book. However, under pressure from her publisher, who wanted to reduce the manuscript to half its initial length and stress criticism more than theory, she had to leave out all these passages. The points Jacobs had in common with the ideas of the *Townscape Movement* are clear, especially when it came to questions of residential density, contact between people, crowded spaces, the need to avoid visual monotony, the intensity and vitality of activities, the diversity and mix of uses, organizing complexity, and similar matters.
Unlike Gordon Cullen and Jane Jacobs, Kevin Lynch (1918 to 1984) was above all a university teacher, a researcher into the theory of urban design as seen from an academic viewpoint and using a methodology based on case studies, public surveys, interviews, and the like (fig. 2). *The Image of the City* is his best known book, and undoubtedly his best and most lasting contribution to the field. It may be that his great keenness for academic rigour and conceptual models was a drawback for some of his later publications. To a present-day reader they may seem cumbersome, because of their insistence on exhaustive treatment of every topic, examining matters from every point of view and subjecting them to critiques.

Fig. 2. Kevin A. Lynch.

The Image of the City was published in 1960, but its origins went back a lot farther than might be supposed, and a crucial role was played in them by the impact of his being able to live in the city of Florence for the academic year 1952 to 1953 (fig. 2). It was there that many of his intuitions on how to perceive urban form finally crystalized. These were ideas that he had gradually built up since his joining the School of Architecture and Planning of the Massachusetts Institute of Technology as a teacher in 1948. He continued to deepen these ideas from 1954 onwards thanks to a research project funded by the Rockefeller Foundation's Program for Urban Design Research.
In general terms, Lynch's research may be described as the seeking for a method that would allow understanding and analysis of how people perceive the physical form of their city, its character and urban atmosphere, and how they find their bearings within it, live in it and

value it. Overall, the aim was to find principles permitting the description of these experiences. These principles were also useful for urban designers in organizing and giving a visible, coherent and clear shape to the surroundings.
He wrote of all this in *The Image of the City*. However, there were further books published over the next twenty years by the M.I.T. Press: *Site Planning* [Lynch 1962], *What Time is this Place?* [Lynch 1972], *Managing the Sense of a Region* [Lynch 1976] and *A Theory of a Good City Form* [Lynch 1981].

Florence: Discovering a Good City Form

At the present time, the best source for becoming acquainted with Kevin Lynch's academic career, apart from the works quoted above, is the book *City Sense and City Design: Writing and Projects of Kevin Lynch* [Lynch 1990]. This is an anthology of scattered texts that includes many references and pieces of biographical information in the presentations to its various sections [Banerjee, Southworth 1990]. Additional sources may be found in the architect's records available in the MIT Institute Archives [MIT Institute Archives and Special Collections 2009].
Lynch's earlier life, like that of many architects of his generation, was marked by the interruption of studies caused by the Second World War. However, in his case the hiatus of the war served to clarify his ideas after a somewhat erratic university experience.
Lynch was born in Chicago in 1918. In 1935 he began studying architecture at Yale, but gave up after two years, disappointed by the excessively academic and conservative style of teaching. Encouraged by hopes of an alternative approach, in Autumn 1937 he joined the Taliesin Fellowship, where he remained for just a year and a half, because he came to realize that the methods used by Frank Lloyd Wright boiled down to shaping his disciples in his own image. It is striking that in an early letter sent by Lynch from Yale to Wright in relation to the programme of studies at Taliesin he asked him about the training he would receive in city-planning. The answer he received was not very convincing, as was borne out by his experiences at Taliesin. After this unsatisfactory experience he decided to study construction engineering during the 1939 to 1940 academic year at the Rensselaer Polytechnic Institute located in Troy in New York State, but he did not persevere with this new attempt, either, and ended up by taking work as a draughtsman in an architectural office in his home town.
In 1941 Kevin Lynch was conscripted and he had to serve in the Engineer Corps of the Army until the end of the war. After being demobilized, influenced by the book *The Culture of Cities* by Lewis Mumford [Mumford 1938], he read for a Bachelor's Degree in City Planning at MIT, this time a good decision for him. In 1947 he presented his final year dissertation on *Controlling the Flow of Rebuilding and Replanning in Residential Areas,* which was given an excellent mark by the board of examiners.
Although Lynch had no Master's Degree, the recently created Department of City and Regional Planning (nowadays of Urban Studies and Planning) offered him a teaching post, since it needed new staff to cover the increasing demand for such programmes. Lynch joined MIT in 1948, and began a line of research into the form and visual environment of cities, aided by collaboration from his students in seminars and fieldwork.
The aims of this work were too ambiguous and were hard to develop, since Lynch was trying to cover a vast spectrum of topics aimed at achieving an in-depth knowledge of a city. However, from the very first drafts still extant of this potential research programme it is possible to pick out what would be the main thrust of study. It would be a question of assessing the degree of satisfaction or well-being of individuals relative to the visual qualities of urban forms, and investigating how different forms had satisfied these demands over the course of history [5].
In the academic year 1952 to 1953 Lynch was able to try out many of his ideas while living in Florence, thanks to a grant from the Ford Foundation that permitted him to visit other cities during his stay: Venice, Rome, Pisa, Lucca, Siena and Bologna. His notebooks show his interest in analysing in detail the mode of life of average dwellers in a city, how such people live and utilize their public spaces, how they move from place to place, how they find their way and enjoy their surroundings, along with other similar features. The contrast between Florencia and the bland environments where he had resided during his youth in Chicago left a lasting impression on him, as would emerge from his later works.
Hence, it was in Florence and other Italian cities that Lynch came to appreciate what he later termed *a good city form*. A city having a distinctive character with which citizens can identify; showing great vitality, since it permits a variety of functions; with a clear structure that is at once inclusive and complex; easy to get around, because it has recognizable visual form, routes and access paths. All of this is covered

by an unpublished text, written on his return from Italy, entitled *Notes on City Satisfaction*. In this many of the intuitions that were to appear in *The Image of the City* may already be seen. Consequently, it is possible to state that the ideas about *legibility*, *imageability*, *structure*, and *identity* of cities, as perceived by city-dwellers, were forged during his stay in Tuscany.
According to his students, Lynch came back completely changed and with a clear framework for later research work. As often happens in the intellectual trajectory of many scholars, these early studies were to mark all of his later career as a researcher, so that the same set of ideas were to appear developed in one way or another in his books.

The Perceptual Form of the City

In late 1953, György Kepes and Kevin Lynch, the first lecturing in *Visual Design* and the other in *City Planning*, put forward a project for research into *The Perceptual Form of the City* to the Rockefeller Foundation [6]. They were given a grant for this in April 1954, to run over three academic years. In the end, the project continued for a further two, despite no further funding being provided, from 1954 to June 1959.
It should be remembered that after the Second World War quite a number of European academics with strong interests in psychology emigrated to the United States. The consequence was that analyses with the starting point of visual perception became commonplace in many disciplines, giving rise to widely circulated books, such as *Language of Vision* by György Kepes [Kepes 1944], *Vision in Motion* by László Moholy-Nagy [Moholy-Nagy 1947], Art and *Visual Perception* by Rudolf Arnheim [Arnheim 1954], or *Meaning in Visual Arts* by Erwin Panofsky [Panofsky 1955].
The Rockefeller Foundation had just approved a new line of research into Urban Design Studies, within its section for studies in the Humanities and Social Sciences. The main aim of this new programme was to contribute to the development of the new discipline of Urban Design, bringing together aspects hitherto unrelated within the professional practice of Architecture, City Planning and Landscape Design. This was a reaction to the increasingly discredited theories of urban design adopted during the decades prior to the Second World War and thereafter. These had been applied with disastrous results in plans for inner reconstruction of many American cities, which had been carried out on the basis of what a few years later was to be termed *ingenuous functionalism*. This gave pride of place to travel by car, zoning for a diversity of uses, health and hygiene, economics and other purely technical factors [7].
The documents preserved in the MIT archives show that Kevin Lynch was the prime mover in the research work, whilst Kepes, having many other commitments, played a more secondary role, on the lines of a consultant. For instance, it was Lynch who drew up the long *Progress Report and Plan for Future Studies* dated June 1955. He first sent this for assessment to Kepes, who returned it at the end of the month with several valuable suggestions, some of which were to be decisive in shaping the development of the work by Lynch.
In April 1959 Lynch drew up a final report, twelve pages long, for the research project, entitled *Summary of Accomplishments*. In this he explained the results achieved, initial objectives that had been abandoned for various reasons, and others that had still not been attained, but which should continue to be a topic for study. Among the achievements, he listed the following three: "A comparative analysis of the visual form of various city areas. An understanding of the perceptual effects of the city, and of the individual's psychological orientation to his environment. The development of analytical tools for examining the urban visual scene, as well as techniques for use in urban design." [Lynch 1959b] [8]
As specific results of his research, Lynch included his articles *Some Childhood Memories of the City* [Lukashok, Lynch 1956] and *A Walk around the Block* [Lynch 1959a], as well as appending a typescript thirty-nine pages long entitled *The Image of the City*, composed in February 1958. He stated that this was a summary of the major questions on orientation in cities, to be published in a more extensive version by the end of the year by the MIT Press. This indeed happened, as the preface of the book is dated December 1959.
The final report mentions other matters arising from the project, relating to the perception of visual sequences and the communication of meaning in a cityscape, whether intentional meanings or deeper senses. Lynch states that Professor Kepes would continue looking into these questions.
All of this goes to confirm that the greater part of the conclusions drawn from the project are due to Lynch, and that *The Image of the City* should be considered his work entirely. This is despite the fact that in the book's preface Lynch wrote that alongside his name on the cover there should also be written that of György Kepes. These words must be understood as an elegant gesture of academic generosity.

The Image of the Physical Urban Environment

There are certain intuitions in Lynch's book that seem to lie at the heart of his thinking and relate to two basic features of visual perception of urban surroundings: orientation and the reduction of complexity to simple, comprehensible schemes [9]. In the final version of the book these questions lose a little of their relevance through turning into legibility, imageability and mental maps. Without any attempt at summarizing the content of the book, some of the ideas that are of lasting value will be discussed below.

In view of the fundamental principle of the degree of satisfaction received from cities (one of the concepts most often repeated in Lynch's early works), the main criterion for recognizing a city with a "good form" would be the ease with which it is possible to find one's way about it. Orientation, the feasibility of recognizing places and one's situation within them, not only offers the deep satisfaction arising from a feeling of security, but also gives a sense of belonging, of roots and identity.

A city, or a recognizable part of a city, should have a clear and legible shape, which those living there can perceive from a scheme of orientation that is very simple in its origins. It begins with the easiness of finding routes and knowing one's way from one place to another. However, it should be capable of enrichment as time goes by, yielding an image or mental map of the locality that is ever more structured. As Lynch wrote at the end of the central chapter in his book: "We are continuously engaged in the attempt to organize our surroundings, to structure and identify them. Various environments are more or less amenable to such treatment. When reshaping cities it should be possible to give them a form which facilitates these organizing efforts rather than frustrates them." [Lynch 1960, p. 91]

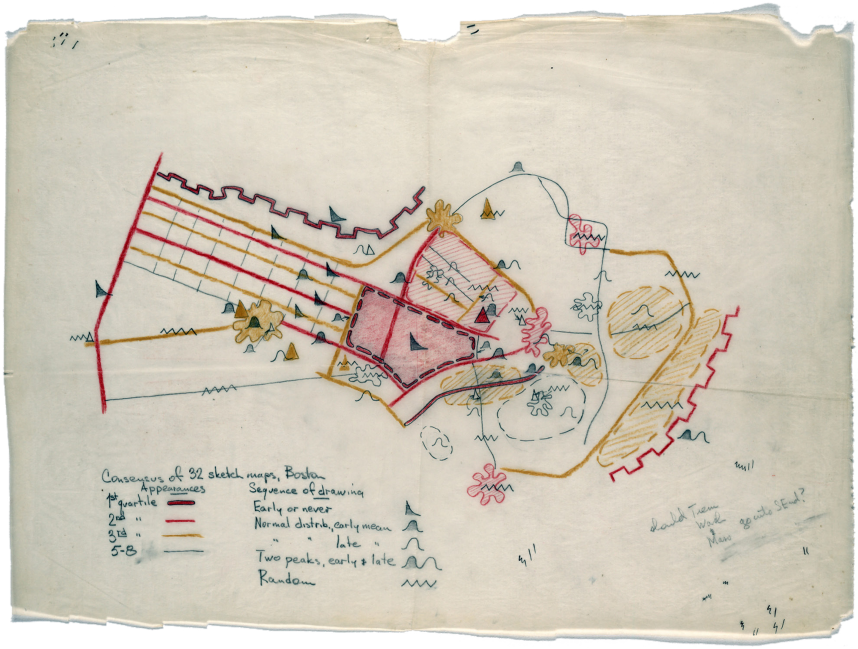
When these qualities are attained, it becomes possible to speak of a sense of place, or of familiarity with a location. This is because residents can clearly identify the image or physical structure of their surroundings, and can perceive differences between this image and that of other cities. In brief, a city with a clear structure and its own identity favours the emotional well-being of those who dwell there and allows them to anchor in it meanings, stories, recollections and experiences.

Cities that are bland and colourless by reason of their urban layout, or amorphous cities, in other words those lacking a recognizable shape, impede orientation and cause profound disquiet, dissatisfaction and lack of roots. This is because they make it hard to organize, structure and identify the urban surroundings and consequently hinder the building up of a coherent mental map from perceptions. Likewise, a city with an excessively ordered and monotonous pattern or design may be dull and boring, curbing the faculty of perception and making it difficult to form a suitable mental image of them.

Thus, a good urban form should be varied, complex, capable of incorporating zones differing strongly one from another into an easily identifiable structure. More than orderliness, what a city needs is a good organization of complexity, interconnecting disparate parts and unresolved zones. In Lynch's words: "True enough, we need an environment which is not simply well organized, but poetic and symbolic as well. It should speak of the individuals and their complex society, of their aspirations and their historical tradition, of the natural setting, and of the complicated functions and movements of the city world. But clarity of structure and vividness of identity are first steps to the development of strong symbols. By appearing as a remarkable and well-knit *place*, the city could provide a ground for the clustering and organization of these meanings and associations. Such a sense of place in itself enhances every human activity that occurs there, and encourages the deposit of a memory trace." [Lynch 1960, p. 119]

Although the perception of an urban image is a subjective act, in his surveys and interviews Lynch was able to demonstrate that sets of city-dwellers, belonging to a given homogeneous group, coming from the same part of town, and so forth, have a pretty coherent image or mental map of their city, with many features in common (fig. 3). They recognize the main routes, borders, focal points, different zones, and the like. This collective mental image of a city (or part of a city), which has an impact on urban dwellers' sensations of emotional well-being or unease, is what Lynch addressed in his book. It is one that should interest any town-planner having the intention of intervening in, or modifying, any given place by reinforcing its image. In the second chapter of *The Image of the City* he put these ideas to the test by analysing the images or mental maps of Boston, Los Angeles, and Jersey City.

On the basis of this study, Lynch proposed five elements by means of which it is possible to structure the image of a city and give a shape to



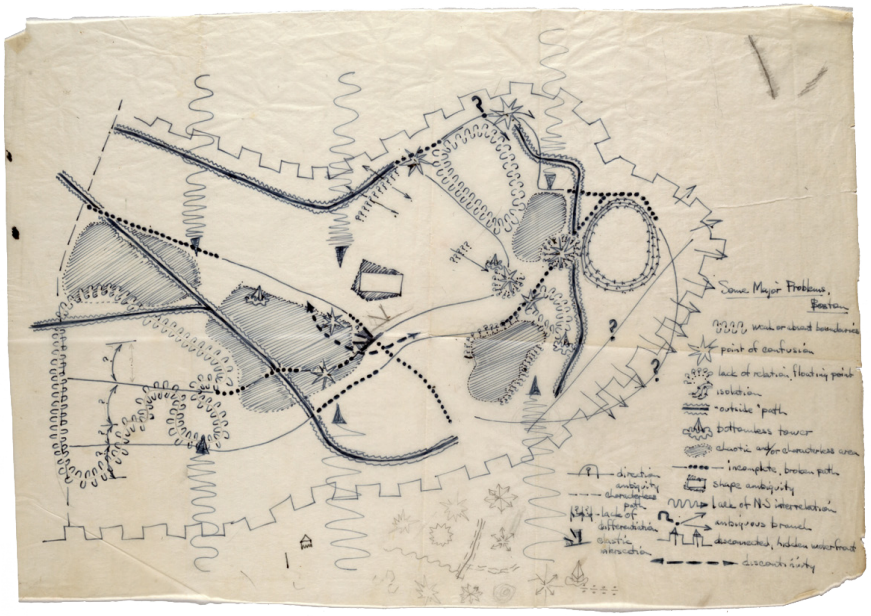


Fig. 3. Kevin Lynch, Consensus of 32 sketch maps of Boston, 1959 (MIT Institute Archives, MC 208, Box 6).

Fig. 4. Kevin Lynch, Some major problems of Boston, 1959 (MIT Institute Archives, MC 208, Box 6).

the mental maps going to make it up: *paths*, *edges*, *districts*, *nodes*, and *landmarks*. These are five elements that will appear in any description of the image of a city or a pathway through it. The importance of these elements for an urban designer is that they can be specified in easily understood diagrams, as may be seen from the sketch plans drawn up by Lynch after these surveys and interviews (fig. 4).
In 1984 Kevin Lynch published his article *Reconsidering the Image of the City* [Lynch 1984]. In this he noted how the five elements used to specify and explain the image of a city had been welcomed by urban designers and by academics. However, this was not the case for the working method he had prosed, based on surveys and interviews of residents of the place concerned. Carrying out this sort of work to obtain a map or mental image from residents is without doubt a long and laborious task. More than this, though, in most cases those involved in projects for urban renewal had no wish for the townspeople to take any part in what they were doing [10].
To end this review of the book *The Image of the City*, it is worth recalling once more that at its origin, and in Kevin Lynch's later academic career, the emotional impact of having lived a year in Florence can be clearly felt. In the fourth chapter of the book, which covers the form of a city, Lynch goes at some length into an explanation of the unique qualities of the image of Florence: "To take a single

example, Florence is a city of powerful character which has deep hold on the affection of many people [...]. To live in this environment, whatever the economic or social problems encountered, seems to add an extra depth to experience, whether of delight or of melancholy or of belonging [...]. But it is also a highly visible city. It lies in a bowl of hills along the Arno River, so that the hills and the city are almost always intervisible. On the south, the open country penetrates almost to the heart of the city, setting up a clear contrast, and from one of the last steep hills a terrace gives an 'overhead' view of the urban core. On the north, small distinct settlements, such as Fiesole and Settignano, are perched visibly on characteristic hills. From the precise symbolic and transportation center of the city rises the huge and unmistakable dome of the Duomo, flanked by Giotto's campanile, a point of orientation visible in every section of the city and for miles outside of it. This dome is the symbol of Florence. The central city has district characters of almost oppressive strength [...]. Within this area are many strong nodes, whose distinctive forms are reinforced by their special use or class of user. The central area is studded with landmarks, each with its own name and story. The Arno River cuts through the whole and connects it to the larger landscape. To these clear and differentiated forms people have made strong attachments, whether of past history or of their own experience. Every scene is instantly recognizable, and brings to mind a flood of associations. Part fits into part. The visual environment becomes an integral piece of its inhabitants' lives. The city is by no means perfect, even in the limited sense of imageability; nor does all of the city's visual success lie in this one quality. But there seems to be a simple and automatic pleasure, a feeling of satisfaction, presence, and Tightness, which arises from the mere sight of the city, or the chance to walk through its streets." [Lynch 1960, p. 92]

To the memory of Professor Vito Cardone

Notes

[1] I wish to express my sincere thanks to Juan Luis de las Rivas Sanz, Professor of Town-Planning at the University of Valladolid, for all the assistance he generously gave while I was writing this paper. My thanks also go to the late Professor Vito Cardone who with his habitual enthusiasm commissioned this text from me for the journal *diségno* in September 2018.

[2] His initial idea of "serial vision" is probably one of his most valuable contributions. It has become a powerful tool for analysing cities.

[3] *The Townscape Movement* began in December 1949 with an article, *Townscape*, by the journal's editor, Hubert de Cronin Hastings, under the pen name Ivor de Wolfe [De Wolfe 1949]. This was followed by Gordon Cullen's article *Townscape Casebook* [Cullen 1949].

[4] José Luis Sert was the Dean of the Harvard Graduate School of Design, where he set up the first university degree programme in Urban Design. It is often claimed that the 1956 Conference was the moment at which urban design became an academic discipline; this is why the consolidation of this expression is attributed to J.L. Sert. However, in Great Britain the phrase "urban design" had already been used by P. Abercrombie and F. Gibberd. Even before this, it had been in use as a more or less generic term; for example, Gibberd had given his famous 1953 manual the title *Town Design* [Gibberd 1953].

[5] Various drafts of his proposals are held at the MIT Libraries: *A study on the visual forms of cities* [Lynch 1951], *Research in city form* [Lynch 1953a].

[6] This is the *Research Proposal* dated 4 December 1953 held in the MIT archives [Lynch 1953b], Lynch was always keen for his work to have a scientific basis, as was normal in Social Science studies. He was attracted by possible applications of psychology in assessing the visual impact of a city on individuals, consulting his academic colleague György Kepes on this point.

[7] The expression *funzionalismo ingenuo* (ingenuous functionalism) was used by Aldo Rossi [Rossi 1966].

[8] See *Kevin Lynch's papers* at the MIT Libraries Archives, MC 208, Box 1, General Statements [Lynch 1959b].

[9] This is not the point at which to look at the more original aspects of Lynch's research relative to theories on town-planning that had been built up since the beginning of the century. For this purpose it is advisable to consult the Raynsford's contribution on the topic [Raynsford 2011].

[10] Nowadays a great deal more importance is attached to participation by city-dwellers, and Lynch's method is indeed used in a good many town-planning exercises. The same has happened, for example, to the idea of a language of patterns put forward by Christopher Alexander and his colleagues [Alexander et al. 1977], which for a long while was ignored by planners.

Author

Carlos Montes Serrano, Department of Urbanism and Architectural Representation, University of Valladolid (ES), montes@arq.uva.es

Reference List

Alexander, C. et al. (1977). *A Pattern Language: Towns, Buildings, Construction*. Oxford: Oxford University Press.

Arnheim, R. (1954). *Art and Visual Perception. A Psychology of the Creative Eye*. Berkeley: University of California Press.

Banerjee, T., Southworth, M. (eds.). (1990). *City Sense and City Design: Writings and Projects of Kevin Lynch*. Cambridge, Mass.: The MIT Press.

Ceccarelli, P. (2006). Quarantenni ancora molto attraenti e in ottima salute. In P. Ceccarelli (a cura di). *Kevin Lynch. L'Immagine della città*, pp. 7-16. Venezia: Marsilio Editori.

Cullen, G. (1949). Townscape Casebook. In *The Architectural Review (AR)*, Vol. 106, No. 636, pp. 363-374.

Cullen, G. (1961). *Townscape*. London: The Architectural Press.

De las Rivas, J.L. (1992). *El espacio como lugar: sobre la naturaleza de la forma urbana*. Valladolid: Secretariado de Publicaciones de la Universidad de Valladolid.

De Wolfe, I. (1949). Townscape. In *The Architectural Review (AR)*, Vol. 106, No. 636, pp. 355-362.

De Wolfe, I. (1963). *The Italian Townscape*. London: The Architectural Press.

Gibberd, F. (1953). *Town Design*. New York: Reinhold.

Kepes, G. (1944). *Language of Vision*. Chicago: P. Theobald.

Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.

Laurence, P.L. (2006). The Death and Life of Urban Design: Jane Jacobs, The Rockefeller Foundation and the New Research in Urbanism. In *Journal of Urban Design*, Vol. 11, No. 2, pp. 145-171.

Lukashok, A.K., Lynch, K. (1956). Some Childhoods Memories of the City. In *Journal of the American Institute of Planners*, 22, No. 3, pp. 142-152. DOI: 10.1080/01944365608979354.

Lynch, K. (1951). *A Study on the Visual Forms of Cities*. Cambridge, Mass.: MIT Libraries Archives. April.

Lynch, K. (1953a). *Research in City Form*. Cambridge, Mass.: MIT Libraries Archives. August.

Lynch, K. (1953b). *Research Proposal*. Cambridge, Mass.: MIT Libraries Archives.

Lynch, K. (1959a). A walk around the block. In *Landscape*, 8, No. 3, pp. 24-33.

Lynch, K. (1959b). *Summary of Accomplishments: Research Project on the Perceptual Form of the City*. Cambridge, Mass.: MIT Libraries Archives.

Lynch, K. (1960). *The Image of the City*. Cambridge, Mass.: MIT Press.

Lynch, K. (1962). *Site Planning*. Cambridge, Mass.: MIT Press.

Lynch, K. (1972). *What Time Is The Place?*. Cambridge, Mass.: MIT Press.

Lynch, K. (1976). *Managing the Sense of a Region*. Cambridge, Mass.: MIT Press.

Lynch, K. (1981). *A Theory of a Good City Form*. Cambridge, Mass.: MIT Press.

Lynch, K. (1984). Reconsidering The Image of the City. In L. Rodwin, R. Hollister (eds.). *Cities of the Mind: Images & Themes of the City in the Social Sciences*, pp. 151-161. New York: Plenum Press.

Lynch, K. (1990). *City Sense and City Design: Writing and Projects of Kevin Lynch*. Cambridge, Mass.: MIT Press.

Lynch, K. (2015). *La imagen de la ciudad*. Barcelona: Gustavo Gili.

MIT Institute Archives and Special Collections (2009). *Preliminary Inventory to the Papers of Kevin Lynch MC.0280*. Cambridge, Mass.: MIT Libraries.

Moholy-Nagy, L. (1947). *Vision in Motion*. Chicago: P. Theobald.

Mumford, L. (1938). *The Culture of Cities*. New York: Harcourt Brace.

Panofsky, E. (1955). *Meaning in the Visual Arts*. Garden City. NY: Doubleday Anchor Books.

Raynsford, A. (2011). Civic Art in an Age of Cultural Relativism: The Aesthetic Origins of Kevin Lynch's Image of the City. In *Journal of Urban Design*, Vol. 16, No. 1, pp. 43-65.

Rossi, A. (1966). *L'architettura della città*. Padova: Marsilio.

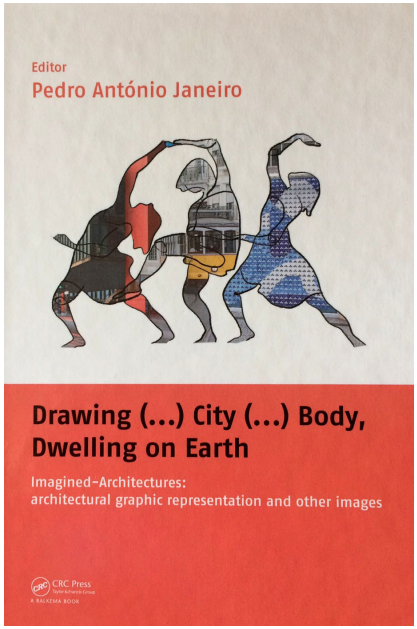
Reviews

Reviews

Pedro António Janeiro (Editor)

Drawing (…) City (…) Body, Dwelling on Earth. Imagined-Architectures: architectural graphic representation and other images

CRC Press Taylor & Francis Group, London 2019
pp. 220
ISBN 978-0-367-02602-8
eBook ISBN 9780429398773



Firstly, what is the body? The definition of *fluctuating signifier* given by structuralist ethnologists, and especially Lévi-Strauss [Lévi-Strauss 1965],, is powerful in arguing the linguistic evanescence that no approach, meaning, metaphorical use, can force or block. A *mediator between codes* who violently imposes its ability to "exercise symbolic thought". One could say that the body does not mean anything but it speaks the language of others, it is *trans*-formed, allowing to *trans*-late various codes, to enter through a passe-partout in different levels (natural, artificial, abstract, ...). So always *partial* but, for its energetic power, incredibly *universal* and *polyvalent*. Thanks to its plasticity, the body can "articulate itself to the articulation of language" [Gil 1978] and be the substance in the enigma of the Oedipus Sphinx (Borges). Or the space/food formula of Alice's fall in Wonderland, the frightening profile of the Little Prince's snake, the representative evocation of the "false tokens" for "biological locks" of which Gombrich spoke [Gombrich 1971], the allegorical dream of Dante's reincarnation of Dick's *electric sheep [Dick 1968], or a transfer of the forces of death as Baudrillard writes.*

In fact, everything seems to form a body and the volume *Drawing (...) City (...) Body, Dwelling on Earth* is an example of this. The book is the result of the fifth edition of the International Seminar focused on the research theme *Arquitecturas Imaginadas: Representação Gráfica Arquitectónica* e *"Outras Imagens"*, active since 2009 at the CIAUD - Centro de Investigação em Arquitetura Urbanismo e Design - of the Faculty of Architecture of the University of Lisbon. The fifth edition of the Seminar, focused on the topic *Desenho (...) Cidade (...) Corpo, Habitando a Terra* ("Drawing (…) City (…) Body, Dwelling on Earth"), was held at the Maria Antônia University Centre of the University of São Paulo in Brazil from 5 to 9 March 2018, as a joint activity between the CIAUD, the University of São Paulo and the Faculty of Architecture and Urbanism of the Federal University of Juiz de Fora. The five days of study in which the seminar was divided were dedicated to the topic of the drawing of the city linked to the body. Among the main objectives of the seminar:

- to discuss how drawing the city and the elements that identifies it are represented and identified through the presence and/or action of the body (gestures, movements, displacements, etc.);
- to critically analyse the association between Drawing and City, starting from the perception of the Body, assuming this mediation as a condition for the particular construction of that relationship;
- to identify the presence of the Body in the Representations/Drawings of the

City, submitting this event or phenomenon to analysis, aiming for cognitive production.
Just by listing the objectives of the seminar, it is increasingly evident how the subject is being "touched" in a way that appears very similar to that which Jean-Luc Nancy defined beyond the sensory boundary, as in a *proxemics* [Hall 1988] that looks at space and memory through the body. There is, in fact, a human spatiality (intimate, personal, social, public) not geometric but experienced and made up of ethnological and psycho-sociological characters in which the body components of the human sensory apparatus are the receptors of distance toward the *distant* (eyes, ear, nose) and the immediate receptors on *neighbour* and *surrounding* (skin, membranes and muscles). Considering what is happening through an extensive analogy, it might be possible to grasp a shift towards an atomized model in which sensory components float by hybridization on computer consoles and mouse, as well as on enclosures and power supply networks. The body, therefore, in its perennial being essentially *outside itself*, develops its own non-geometric, non-neutral, non-indifferent space. The body, as Heidegger said [Heidegger 1927], has a *range*, which, unlike matter, which "stops" at the skin (that is, that which in German is expressed by *Körper* that deals with *Leib*) in the living constantly changes, has no limit, boundary, geometric measure. The *lived* space, today incessantly livable in digital, immediately leads to an idea of distance *lived* in a *proximity* alternating between phenomenology and ethics. Here, then, is how twenty-three contributions present as many possible *bodily fluctuations*, inserting in the topics a *red thread* that links the legacy of Camillo Sitte (between art and morphology) with drawing as a key element of the creative process (in Architecture). This finds a relationship with the (para)metric representation and urban indicators in decision-making processes in urban design, which Hundertwasser proposed in the relationship between the human body and architectural design. But also the "Brazilian body reserve" [De Masi 2015] becomes part of this relationship, following the interpretative paths that make the city and its models of megalopolis the main field of experimentation. From collective/social spaces in the housing in Recife to the urban analysis of the city of São Paulo through the body (in the didactic experience at the FAU), passing through the "bodily shots" by Eduardo Gageiro, up to a counterhegemonic project for Rio de Janeiro.
Then in these intersections (or apparent overturning) of points of view (bodily mergers of approaches) it is possible (as Deridda writes rereading Nancy) [Derrida 2019] to cite also the Cartesian division into *res cogitans* and *res extensa*. Descartes (to whom are constantly referred the geometrical constraints on which even the greatest space representative abstraction in the orthogonal model is based), conceived a wall in the separation between thought and matter (or between mind and body). A wall that will find reinforcements over the centuries and fertile territories in technological development, in scientific hyper-specialisation, in the tenacious mechanistic tendency still at the base (for example) of moderate medicine. Much catastrophic imagery (*allogeneic, transgenic, hybridized, cloned*) translated on the most disparate (and desperate) forms of expression in the last forty years probably refer to this never healed wound. It is an intolerant universe in which the guilty slip between the schizophrenia of science, the cataclysmic violence of nature, the misunderstood (and perhaps impossible) self-awareness of matter. The tactile dimension, precisely in the Cartesian reinterpretation of the tangible and the intangible, is among the twenty-three topics and it is proposed in the "tactile museum" (through the masks of classical theatre) as in the idea of "skin-city", which simulates the tactile identity of the place, acquired also through the kinetic, dynamic and physically measurable action of "walking". An act capable of drawing the city with the body. At the end, as in a journey, translated into the "...flowing of time inside the body, ..." [Delillo 2001, p. 201], that the action of drawing (through the analysis of travel notebooks, of perceptive modes in the teaching of drawing from life as well as in cinema and comics) still allows extraordinarily to understand.
The many contributions make the book highly interdisciplinary, interweaving the theme of drawing with the areas of art, urban planning, architecture, philosophy, sociology, and design.
It would take one of Gombrich's false tokens to trigger this biological lock.
Maybe it's still missing.
it's not sure if it's anywhere.
If it could be possible to find it around the wish for invention and discovery, between the bodies dreamed of by Swift and Rabelais...

Marcello Balzani

Author

Marcello Balzani, Department of Architecture, University of Ferrara, marcello.balzani@unife.it

Reference list

De Masi, D. (2015). *Mappa mundi. Modelli di vita per una società senza orientamento.* Rizzoli: Milano.

Delillo, D. (2001). *Body Art*. Einaudi: Torino.

Derrida, J. (2019). *Toccare, Jean-Luc Nancy.* Marinetti: Bologna.

Dick, P.K. (1968). *Do Androids Dream of Electric Sheep?*. New York: Doubleday [Italian translation, *Ma gli androidi sognano pecore elettriche?*. Fanucci: Roma 2000].

Gil J. (1978). Corpo. In *Enciclopedia*, vol. III, Einaudi: Torino, pp.1096-1160.

Gombrich, E.H. (1971). *A cavallo di un manico di scopa.* Einaudi: Torino.

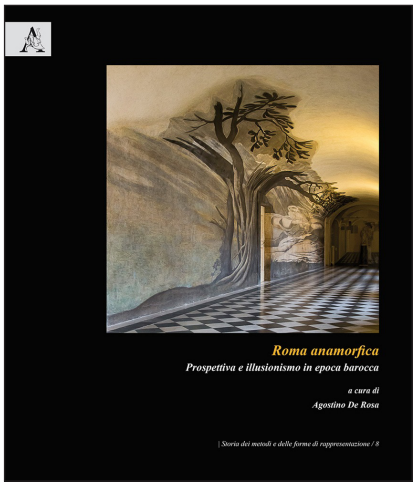
Hall, E.T. (1988). *La dimensione nascosta. Il significato delle distanze tra i soggetti umani.* Bompiani: Milano.

Heiddeger, M. (1927). *Sein und Zeit*. Niemeyer: Tübingen [Italian translation, *Essere e tempo,* Longanesi: Milano 1976].

Lévi-Strauss, C. (1965). Introduzione all'opera di Marcel Mauss. In M. Mauss, *Sociologia e antropologia*, Einaudi: Torino.

Reviews

Agostino De Rosa (a cura di)
Roma anamorfica. Prospettiva e illusionismo in epoca barocca
Aracne editrice,
Canterano (Roma) 2019
pp. 252
ISBN 978-88-255-2455-0



The book *Roma anamorfica. Prospettiva e illusionismo in epoca barocca*, edited by Agostino De Rosa, has recently been published by Aracne. It contains eighteen essays by scholars of different disciplines on the subject of anamorphic projection, a sophisticated intellectual game that takes perspective to its ultimate consequences by applying the method literally in what we could call 'extreme' projective conditions. The book also has an extensive bibliography and short biographies about the authors.
Anamorphic projection is an important part of De Rosa's scientific production; he previously tackled the subject in his book entitled *La vertigine dello sguardo. Tre saggi sulla rappresentazione anamorfica* (authors Agostino De Rosa and Giuseppe D'Acunto, Cafoscarina, Venice 2002). In this current book he picks up the threads of that discourse and proposes an more in-depth review of several artefacts in Rome.
The book is one of the products of the PRIN 2010-2011 coordinated by Professor Riccardo Migliari and entitled *Prospettive Architettoniche: conservazione digitale, divulgazione e studio* [1]; its objective was to use current technologies and instruments to document, study and disseminate several examples of large scale wall perspectives and solid perspectives throughout Italy.
In his Introduction to the book Agostino De Rosa reminds us that perspective, especially architectural perspective, plays an import illusory role (the term 'to illude' comes from the Latin *in* + *ludere*, to involve in a game), while anamorphosis appears to take this unique exchange between artifice and observer to new heights, where the spectator becomes in turn the creator since he is the one who establishes, thanks to the presence of the decorated environment, the occurrence of the illusion, i.e., a successful deception. In a game of cross-references, the latter is based on the exasperation of the rules of perspective, leading to a perspective theory taken to the limit, one in which the observer himself is included unless he assumes the position imposed by a constrained view that has exhausted all its margins of flexibility: "The *anamorphosis* is a warning written in the gentle language of art, which instead recalls a painful existential situation; it emerges as a corrosive perspective theory of what is pre-established, except when it reveals itself to be created by exaggerating the rules so abhorred and ridiculed" [p. IX]: in this sense, insofar as direct or catoptrical anamorphic projection is a reversal obtained by slavishly using the perspective tool, i.e. by not denying perspective and its theoretical structure, but rather finding its limits within perspective theory, it is a projection that emerged between the Renaissance and the Baroque. Its roots date to the fifteenth century, but it was perfected and disseminated more extensively in the sixteenth and seventeenth centuries through excellent pictorial and architectural works and the creation of solid perspectives

that deserve accurate, modern surveys and major, in-depth scientific studies.
So it's not surprising that the book focuses on a large number of Roman works, since Rome can be considered the engine behind the extremely interesting dissemination of Baroque architecture, paintings and decorations. The book reads almost like a guide to the precious, sophisticated artefacts of Rome, unknown to most; it provides detailed data regarding the location of the works and their accessibility, including addresses, telephone numbers, email addresses, and websites. The information conveyed in the book is useful for anyone who wishes to organise a visit; in fact the author is convinced that this subject can and should satisfy the interests of a much wider audience rather than a restricted number of professionals.
De Rosa is well aware that the current situation regarding anamorphic projective technique, currently revived in media and digital systems [p. IX], is destined to become part of a communication that will reach the spectator anywhere, whether it be for enjoyment, information or even as publicity, i.e., when the recipient of the message does not choose to be encumbered by the illusion, but the illusion itself reaches him in contexts where he is an easy 'prey' (e.g., in the 'three-dimensional' ads that appear along the sides of a football field, or in many television stage sets).
The book provides extensive information about the monastic complex of Trinità dei Monti: authors include Alessio Bortot (who studied the meridian in Convent), Francesco Bergamo and Antonio Calandriello (*trompe l'oeil* paintings in the refectory), Massimiliano Ciammaichella (Architectural Perspectives in the monastery's pharmacy), Giuseppe D'Acunto and Gabriella Liva (library), Agostino De Rosa (anamorphosis of St. John the Evangelist by Jean François Niceron), and Gabriella Liva (anamorphosis of the portrait of St. Francis of Paola by Father Emmanuel Maignan).
In Palazzo Barberini the studies focus on the catoptrical anamorphoses by Niceron (Isabella Friso) and the accelerated perspectives in Borromini's windows (Giulia Piccinin).
As regards Palazzo Capodiferro, Cristina Cándito concentrates on the colonnade and the clock, Cosimo Monteleone focuses on the catoptrical meridians by Emmanuel Maignon, and Leonardo Paris examines the famous solid perspective of Borromini's gallery.
In the Jesuit complex in Rome the studies concentrated on the perspective trompe l'oeil and illusory images on the vault of the Church of the Holy Name of Jesus by Giovan Battista Gaulli (Giuseppe D'Acunto and Stefano Zoerle) and the corridor painted by Father Andrea Pozzo in the adjacent Casa Professa of the Jesuit Order (Jessica Romor). The decoration with the Glory of St. Ignatius (Matteo Flavio Mancini) and the fake dome on canvas (Leonardo Baglioni, Marta Salvatore), again by Andrea Pozzo, are the images studied in the church of St. Ignatius de Loyola
The decorations and architectural context of all these examples were first surveyed using contemporary instruments. The study then focused on their geometric-illusionistic plans and projective structures in order to reveal the illusory design and how it functioned emotionally. Where necessary three-dimensional models were made either of the real space around the artefact or the implied illusory space, suitably recreated and connected thanks to the presence of the observer. In fact an anamorphosis "works" if the projective rules are know by both the author and user of the space, a space which, if freely exploited, can simultaneously either be enlarged or transformed by the perspective work, or reveal the mechanisms of the illusionistic diversion and thereby trigger immediate disenchantment. Perspective is at its greatest in trompe l'oeil images; it becomes a dangerous but extremely effective game, beyond which the method no longer appears to be in a phase of enlargement and transformation of its projective algorithms, but sediments its applications in theatrical art and stage settings.

Laura Carlevaris

Notes

[1] The PRIN was participated by several Research Units: Sapienza Università di Roma (coordinator Prof. Riccardo Migliari, national scientific coordinator of the PRIN), Politecnico di Torino (coordinator Prof. Anna Marotta), Politecnico di Milano (coordinator Prof. Michela Rossi), Università degli Studi di Genova (coordinator Prof. Maura Boffito), Università IUAV di Venezia (coordinator Prof. Agostino De Rosa), Università degli Studi di Udine (coordinator Prof. Roberto Ranon), Università degli Studi di Firenze (coordinator Prof. Maria Teresa Bartoli), Università degli Studi di Salerno (coordinator Prof. Vito Cardone), and Università della Calabria (coordinator Prof. Aldo De Sanctis).

Author

Laura Carlevaris, Department of History, Representation and Restoration of Architecture, Sapienza University of Rome, laura.carlevaris@uniroma1.it

Notes

[1] The PRIN was participated by several Research Units: Sapienza Università di Roma (coordinator Prof. Riccardo Migliari, national scientific coordinator of the PRIN), Politecnico di Torino (coordinator Prof. Anna Marotta), Politecnico di Milano (coordinator Prof. Michela Rossi), Uni-versità degli Studi di Genova (coordinator Prof. Maura Boffito), Università IUAV di Venezia (co-ordinator Prof. Agostino De Rosa), Università degli Studi di Udine (coordinator Prof. Roberto Ranon), Università degli Studi di Firenze (coordinator Prof. Maria Teresa Bartoli), Università degli Studi di Salerno (coordinator Prof.Vito Cardone), and Università della Calabria (coordinator Prof. Aldo De Sanctis).

Author

Laura Carlevaris, Department of History, representation and restoration of architecture, "Sapienza" University of Rome, laura.carlevaris@uniroma1.it

Reviews

Jorge Llopis Verdú

Dibujo y arquitectura en la era digital. Reflexiones sobre el dibujo arquitectónico contemporáneo

Editorial Universitat Politècnica de València, València 2018
pp. 480
ISBN 978-84-9048-682-5

Jorge Llopis Verdú's book begins with a Hadot and Heiddeger's quote, defying the reader to recognize the usefulness in the useless, so that he could keep pursuing this useful exercise boldly. This reflection on drawing starts from an investigation into its own usefulness and its historical role as a privileged scientific language. It has indeed been used as a powerful tool to record the travel experiences–since the first explorations–ending up generating the computer graphics and some of the new visual arts. This is the reason why the present book is particularly appropriate for the times: it proposes an updated report of the issues related to the architectural representation and how to teach it, based on the analysis of previous studies that define the bibliographic *pantheon* of our academic field.

The first section of the book contains a few considerations about drawing as a language that allow us to analyse the surrounding reality so to directly address the design process. Then the author observes how the conceptual and perception related aspects of architectural drawing are taking a great advantage of the most recent contributions coming from the Neurological and Education Sciences. Having the chance to diagram the visual process of our principal tool–our brain, which is analytical and digital at once–will lead us to make new assumptions about the generation of our personal perception of the physical world surrounding us (this reflection could be extended to the creative process later on).

The second section is dedicated to drawing seen as a tool to understand the world and the space, therefore, the reader is taken back to the origin of this art. Drawing let us observe, see past the tangible and understand more than just the architectural space. Then we move on to the, initially ostracized, 'new' digital techniques, which contributed greatly to ignite our imaginary and to increase our graphic experience (even though they still require some time for us to really understand their full potential and the possible technical impacts). The digital era is so revolutionary that it has been equated with same of the fundamental moments that characterized the history of drawing, such as the introduction of perspective and the codification and dissemination of descriptive geometry, as stated by Chías and Cardone (cited by Llopis Verdú on pages 5 and 177).

The third section deals with the impacts of the infographic representation on drawing and architectural design, stressing two specific aspects: on one hand, there is the established reality of the new graphic models, in the way they have been transformed by the so called digital drawing; on the other hand, there are all the outstanding issues related to the impending necessity to see the digital imagery more as a–maybe virtual–simulation than as a

representation in itself. Despite this, the author confirms that hand drawing can still be useful nowadays; so, although it could look like a paradox, his aim is to point out that the very action of drawing leads to the definition of thought and the segmentation of space, other than being directly linked to the attention span. In conclusion, this section contains an invitation to reconsider the amount of the time necessary to understand the physical world around us, due to the mediation of drawing between the world and our hands. The author follows and exhaustive and constructive path from the past to the future. He quotes Zygmunt Baumant more than once to remark that it is impossible to foresee the future, because of the uncertainties of the modern world and the vocational crisis in the architectural and civil engineering fields, therefore it is advisable to rely on the modern culture, which urges us to constantly reinvent ourselves, while still looking for the usefulness even in the apparent useless.

Eventually, let us not forget some of the author's personal reflections. Llopis Verdú takes stock of his academic experience, his didactic activities–characterized by the change in the graphic means–and above all the importance of sharing with our employers, the students, as they were often referred by Vito Cardone.

It appears that Llopis Verdú wants the drawing community to make a self-assessment based on the actual scenarios and the past cautious response to the digital innovation; we could find the basis of this discussion in a 2011 Edoardo Carazo's article (cited on page 394) about the so called "digital issue" and how it is dealt with at the EGA International Conferences and in the EGA journal edited by Ángela García Codoñer. As stated, the digital revolution was initially withheld, opposite to a strenuous defence of the analogical drawing, to the point that, at the apex of this debate, it was even declared the *muerte del dibujo* (death of drawing). We are specifically referring to the initial considerations about the implementation of the digital techniques as just a practical mean to systematize and standardize the outputs, while the scientific world was sceptical, almost funeral, about really making the "digital model" part of the design process. All these considerations were quantitative than qualitative and probably due to a misunderstanding, which was later sorted out by the deep methodological, cognitive and professional implications of the digital drawing found out during the early 21th century.

The author clarifies that even though the main intent of this book is to defend the ongoing utility of the hand drawing, it is equally necessary to stress its importance within the digital field; the ones, which agree about giving a new role to analogical drawing, are indeed the same that work with computer drawing. We actually need to answer to the urge of our students, the so-called digital natives, by rearranging the courses of study in order to take into account all the types of representation, being it manual digital or even physical, and for it to become a decisive part of the formal processes adopted to comprehend, conceive and transmit architecture. The message here is not to follow the contemporary path of considering a model useful only if it is profitable and immediate; we should instated direct our curricula to the hard core of Drawing, as a way to overcome the residual resistances and embrace the novelties that are inevitably yet to come. We hope that the architects and engineers will continue to oversee the design process, instead of losing their power to, maybe useful, software developers. Perhaps, this could represent the first step to develop our new curricula, that could even include a reading of *The usefulness of useless*, a book by Nuccio Ordine, which is quoted by Jorge Llopis Verdú already on page 13 "[…] the usefulness of useless knowledge is radically opposed to the dominant usefulness that, in the name of exclusively economic interest, is steadily killing the memory of the memory of the past, the classical disciplines and the languages, education, free research, imagination, art, critical thinking, and the civil horizon that ought to inspire all human activity". By concluding his introduction in the said way, Llopis Verdú is maybe pushing us to take new responsibilities in our university classrooms.

Salvatore Barba and Massimo Leserri

Authors

Salvatore Barba, Department of Civil Engineering, University of Salerno, sbarba@unisa.it
Massimo Leserri, Department of Civil Engineering, University of Salerno, mleserri@unisa.it

Reviews

Michele Calvano
Disegno digitale esplicito. Rappresentazioni responsive dell'architettura e della città
Aracne editrice,
Roma 2019
pp. 168
ISBN 978-88-255-2484-0

The great wonder of the word "drawing" lies in the ability to understand in its meanings a vast heterogeneity of phenomena and activities, belonging to the sphere of perception, knowledge, imagination and communication. Noble meanings, able to specialize when the word is accompanied by adjectives that specify the application field. With *Disegno digitale esplicito* (Explicit digital drawing), Michele Calvano suggests to the readers to focus attention on a particular quality of drawing, which is prevalent in the digital meaning, consisting in the "explicitness" of the geometric-formal genesis: the synthetic and conceptual communication of the realization process of the drawing. This "narration" process takes place through indirect digital modeling tools, which are the modeling aids provided by the Visual Programming Language. These offer on the one hand the creative and expressive freedom characteristic of programming languages, and on the other hand the organizational and communicative capacity of flow charts.
Of the many technological innovations that have transformed the drawing over the past thirty years, the Visual Programming is certainly the most important and destined to be the most manifest. It is the most important because, unlike other transformations, it centers on the essence of digital innovation–that is information processing–and therefore it is the only one that did not exist before in any form. It is the most manifest because more than the rendering and any other representation produced with digital aid, as well as influencing the visual culture, it has come to materialize into an architectural form.
The indirect digital modeling, performed through visual programming tools [1] is the origin, present and future of digital design. Underestimating its role, or even worse, relegating it to a non-pertinent technicality of the architect and more generally the designer, is an error far greater than that, which many of us have witnessed, of "passive resistance". This term wants to represent the form of cultural contrast and consequent slowing of the change that has characterized the beginnings of the drawing and the digital design in the faculties of architecture.
In fact, in addition to the already mentioned values of the explicit form of digital drawing, there are many others. Among all, what concerns us more closely both as researchers and as teachers in the area of drawing, is the ability of this aid to be a twofold tool for organizing and verifying knowledge. It is an organizational tool because it allows to structure and communicate (visually) the methodology of formal analysis and every determining factor that we know about the architectural form through study, observation and survey. It is a verification tool since, being a rigorous process narrative, it allows an in-depth evaluation of the quality of

the path that our students follow, facing the same activities. The book *Disegno digitale esplicito* also presents a subtitle that has considerable importance: *Rappresentazioni responsive dell'architettura e della città* (Responsive representations of architecture and the city). The adjective "responsive" requires attention that goes beyond the simple association with a concept of mutant and dynamic form. Instead it assumes the role of discriminating quality to discern between an experience of digital architecture representation and a simply digitized one. In the first experience the role of the elaboration is essential prerogative of the architecture existence and of its continuous manifestation. In the second experience the processing is finalized to the architecture generation, but once generated it will no longer be useful to its manifestation. Digital technology in the first experience is therefore essence, while in the second experience it is instead only a tool.
The contribution offered by Michele Calvano to this innovative, complex, fertile and interesting scenario is clear and well calibrated. Therefore it appears useful for researchers and scholars who want to delve into the logic and potential of indirect modeling. The book *Disegno digitale esplicito* is in fact structured on three macro-topics: the theoretical framework in Chapter I, the principles of explicit design in chapter II and some application scenarios in Chapters III, IV, V and VI. The latter chapters range from survey procedures and data restitution, both on the architectural scale and on the urban scale, up to experimental procedures that test the interoperability between the BIM process and the Visual Programming Language.
In the first chapter, *Pensiero algoritmico e modelli* (Algorithmic thinking and models), the author summarizes the origins of thought that are the basis of what he defines Explicit Digital Drawing (EDD).
Founding principle is the attention to the drawing process, rather than the result alone. A reasoned, controlled, finalized and optimized drawing: a drawing for knowledge (survey) or for communication (project). One of the starting points is the concept of the "drawing as a model", with reference to the work of Riccardo Migliari et al. This is understood in particular: in the quality of a heterogeneous drawing that is transformed with continuity in its different expressions; in the ability to integrate the information characteristic of digital drawing and above all–today–to be geographically distributed, shared and interoperable.
The first chapter is also dedicated to the three basic declinations of the drawing that the author identifies as: "drawing to think", expressive and evocative as are the conceptual sketches; "drawing to communicate", plausible and suggestive, as rendering images are today; finally, "drawing to realize", with a pragmatic value and technical content. The first chapter closes with a quick look at the recent past, in the particular work by Frei Otto, with the aim of highlighting how the primary concepts of DDE were already a need and research in a period that we can consider pre-digital.
The second chapter, *Principi di disegno esplicito* (Principles of explicit drawing), is dedicated to taking up the theoretical and operational principles of digital modeling and showing how they can be reproduced, controlled and displayed, in the form of a process, with the help of the Visual Programming Language. Ample space is given by the author to the concept of mathematical model and numerical model and it is clear the association of the first one with Nurbs geometries and the second one with polyhedral geometries (mesh). The reading of this chapter is essential to gain access to the understanding of the processes that govern subsequent applications.
In the third chapter, *Analisi dei Web Data Set* (Web Data Set Analysis), in the fourth chapter, *Rappresentazioni esplicite del paesaggio urbano* (Explicit representations of the urban landscape), and in the fifth chapter, *Procedure geometriche nei panorami sferici* (Geometric procedures in spherical panoramas), as already mentioned, the author analyses problems and proposes solutions regarding the indirect survey and modeling of urban space, through the presentation of original, pertinent and conducted research results up to a mature testing phase of the methodologies. Particularly interesting are the examples of integration between direct and derivatives data: the first one understood as a product of a specifically planned survey campaign; the second one extracted through normalization procedures, operating on the datasets made accessible online by the multiple databases dedicated to the territory. Equally it is interesting the definition of specificities, the descriptive areas and the relative classification of the various tools that are useful to model urban space (GIS, SIM, BIM, DIM). These are summarized in the workflow of defining the RUM, namely the Responsive Urban Model: a set of models able to change as a result of the progressive variation of the data defining them. Concludes the set of application chapters related to urban space, an application to the small scale of architectural detail, where the DDE becomes a fundamental aid for navigating and measuring spherical panoramas.
In the last chapter of the book Michele Calvano explores the relationships and

synergies between the DDE and the BIM, and does so by illustrating a remarkable experience in the design of a responsive façade, an example with which it reaches the synthesis of all the concepts up to that moment exposed. *Disegno digitale esplicito* is the first volume of a new series called *..dL digital Landscape* [2] which aims to publish scientific papers on digital processes for the representation of the city, architecture and product: Michele Calvano's book is therefore also useful in understanding the approach and utility that the series will have in the near future.

Graziano Mario Valenti

Notes

[1] We have to imagine them in their natural and predictable future transformation and innovation.

[2] The directors of the series are: Massimiliano Lo Turco and the same author Michele Calvano.

Author

Graziano Mario Valenti, Department of History, representation and restoration of architecture, "Sapienza" University of Rome, grazianomario.valenti@uniroma1.it

Reviews

Alessandra Pagliano

Le ore del sole. Geometria e astronomia negli antichi orologi solari romani

Edizioni Paparo,
Napoli 2019
pp. 312
ISBN 97888-31983-01-6

The book by Alessandra Pagliano grew out of research for the exhibition "Le ore del Sole" which took place from September 21st 2018 to January 31st 2019 at the Archaeological Museum of Naples (MANN), where twelve Greek-Roman sundial clocks were displayed. The sundial of the Great Hall of this Museum is also described in the book, showing an eighteenth-century astronomical instrument belonging to an uncommon type of camera obscura sundial.

The text was created from the theoretical and practical knowledge the author acquired on gnomonics thanks to the research carried out over the past years. In her studies, the fusing of the historical relationship between geometry and the representation of space and time is not only of theoretical interest, but it also has practical value. The knowledge described is, in fact, essential to the recovery of ancient sundials, which would otherwise remain devoid of their instrumental meaning.

The first part of the text collects and illustrates the fundamentals of gnomonics in their complexity as they involve a number of different disciplines. Pagliano introduces the themes linked to geometric models and the technology used for the survey and reproduction of the archaeological finds subsequently examined. In the first paragraphs, the author describes the historical importance of gnomonics, a method used since ancient times to regulate the timing of human activities and she points out its use in illustrating certain astronomical phenomena that would otherwise remain confined to the theoretical field, such as the identification of the 'true' solar time of a place, and the direction and speed of the apparent motion of the Sun. Interest also lies in the link between the single sundial and the place for which it was conceived, not only because of the ability to define the cardinal points, but also because the accurate functioning is linked to the latitude that determines the inclination of the solar rays. Another noteworthy topic discussed in the book is the deep connection that these specimens have with coeval culture, as shown by the interest in astrological elements in general.

The paragraphs by Luca Santoro about the historical and scientific framework of gnomonics and the analysis of the Farnese Atlas lead the reader from a general field to a more specific one, which is related to one of the most representative elements of where the exhibition takes place. The Farnese Atlas, which arrived in Naples in 1734, is a copy of a Hellenistic statue depicting the figure of Atlas holding the celestial globe–its representation constitutes a precious testimony on the astronomical knowledge of the time. It is possible to identify the celestial parallels of the equator, the tropics and the polar circles, as well as the main constellations. The solar ecliptic (apparent path of the Sun along the celestial sphere) has an inclination of about 24 ° with respect to the

celestial equator, which approximates the results of the coeval measurements. The results of the photogrammetric survey of the Farnese Atlas are illustrated by Pagliano who contextualises them in a convincing way not only with respect to the knowledge at the time of its realisation, but also with regard to its techniques and purposes of realisation of this work that generate and allow for an approximation compatible with an object not intended for scientific purposes. Pagliano also describes the role of photogrammetric survey in studying the sundials in the exposition which, in some cases, allowed the probable origin of the objects themselves to be established and the knowledge on these archaeological finds to be broadened. Thanks to 3D printing, it was also possible to integrate the missing parts of the sundials, without irreversibly affecting the original version.
This first part ends with a paragraph on digital technologies applied to enhance the cultural heritage by Claudio Cammarota–this shows how digital technology can be put at the service of the dissemination of the knowledge acquired in this category of subjects. Beside 3D printing, virtual models of the finds were generated to provide a better simulation of the luminous phenomena, and to allow users to interact autonomously thanks to the functions of Augmented Reality. Panoramic photography is used to explore the hall that hosts the camera obscura sundial.
The second part of the book is dedicated to cataloguing the sundials that were restored and exhibited in the aforementioned MANN exhibition and that previously laid in the museum's warehouses. The twelve cards for the solar clocks illustrate how these objects receive a better historical context precisely thanks to an appropriate cognitive apparatus that shows the complexity and the role that these essential tools had in the everyday life of ancient times. An essential step was to obtain the accurate findings using the processes already described. In fact, these integrated and corrected the information in the nineteenth-century catalogues, which sometimes contained misunderstandings and approximations about the geometric characteristics of the surfaces of the quadrants. The detected elements were also used to identify or confirm the possible origin of the sundial itself, as the dials are designed to work in a particular location, so much so that they would be rendered useless at a different latitude.
Each sundial is described in its formal characteristics, but above all in its functions and meaning within its historical context. The conical sundial A, found at the Stajan Baths of Pompeii, for example, confirms it was designed to work precisely at the place of its discovery, since the conical portion of the dial has a circular lower section contained in a plane whose inclination is equal at the latitude of Pompeii with respect to the vertical celestial meridian passing through the points E and O (40.75°). In the virtual model, the missing stone parts of the quadrant were integrated and a pyramidal gnomon with a triangular section was added, as was apparent by the hole that contained the lost one. In this way, the hour lines and daytime lines relative to the different moments of the year (solstices and equinoxes) have allowed this ancient instrument to perform its regulatory role in timing the functions that took place inside the baths. There is also an interesting contextualization with respect to the gnomonic culture of the Greek Roman era that stems from the exposure of Vitruvius and the invention and improvement of this specific type of quadrant, called *hemicyclium*. The text shows clear images of the original specimens and their models, with the addition of graphic elaborations capable of simulating and fully describing the functioning of the different sundials.
The last two paragraphs of the book deal with the description and survey of the camera obscura sundial in the Great Hall of the National Archaeological Museum of Naples. A camera obscura sundial (also known as gnomonic hole or pinhole sundial) consists of a meridian line (north-south oriented) usually positioned in an interior space with a narrow opening (smaller than the apparent image of the sun) through which solar rays pass and are able to project the solar image that, in the midday 'true' local, will be exactly on the meridian line. The projection occurs during the year with inclinations that are placed between the farthest limit to the hole of the winter solstice and the nearest one of the summer solstice. The projection of the solar image to the equinoxes takes place at a distance equal to the geographical latitude multiplied by the height of the gnomonic hole.
There are several sundials of this kind in Italy [Mesturini 2002], including two of the most famous, namely the one made in 1655 by Gian Domenico Cassini in San Petronio in Bologna and the one built in 1702 by astronomers Francesco Bianchini and Giacomo Filippo Maraldi at the church of Santa Maria degli Angeli e dei Martiri in Rome. These tools are still used today to study astronomical phenomena, such as the measurement of the delay of the earth's rotation, as shown by research carried out with the sundial of Santa Maria degli Angeli in Rome [Sigismondi 2010].
The specimen of the National Archaeological Museum of Naples was realised by Giuseppe Cassella in 1791. The line consists of 181 brass strips embed-

ded in marble slabs for a total length of 27.40 meters and the pinhole is located at 15.10 meters. The book displays the complex cognitive framework of gnomonics that would be difficult to frame without the interdisciplinary contributions of astronomy and archaeology, and without the clear graphic apparatus that accompanies each section of the text in a timely and appropriate manner. Pagliano's text claims the role of representation not only as a means of communication but also in sharing the projective foundations of optics and astronomy. The book illustrates a complete path that starts from a clear overview of the theme of sundials, to then further analyse case studies able to communicate the variety and value of the objects themselves and the disciplines that must be involved to protect this significant cultural heritage.

Cristina Candito

Author

Cristina Candito, Department of Architecture and Design, University of Genova, candito@arch.unige.it

Reference List

Mesturini, G. (2002). Viaggio attraverso le meridiane italiane a camera oscura. in *Atti del Seminario Nazionale di Gnomonica*. Verbania, 22-24 marzo 2002. <http://www.mesturini.com/pubblicazioni/meridiane italiane a camera oscuracompleto.pdf> (accessed 5 December 2019).

Sigismondi, C. (2010). Misura del ritardo accumulato dalla rotazione terrestre, ΔUT1, alla meridiana clementina della Basilica di Santa Maria degli Angeli in Roma. In M. Incerti (a cura di). *Mensura Caeli. Territorio, città, architettura, strumenti*, pp. 240-248. Ferrara: UnifePress.

Events

Events

The 18th ICGG in Milan, Italy, hosted by Politecnico di Milano

Frank M. Croft

The 18th International Conference on Geometry and Graphics was held from August 3 – 7, 2018 in Milan, Italy [1]. The host institution was the Politecnico di Milano, at the Milano Leonardo Campus. There were many significant and unique occurrences which this review will attempt to highlight.

First, there was a double dedication for this Conference. It was dedicated to Leonardo Da Vinci, after whom the Campus is named and to whom homage should be paid as a genius among the greatest showing the widest power of Geometry and Graphics in investigation and creativity between Science and Art, and to Giulio Natta, professor at the Politecnico di Milano and Nobel prize recipient in Chemistry in 1963, together with Karl Ziegler, as a mentor of the profound function – and the beauty! – of Geometry and Graphics in Science and Technology, even at the invisible scale of the molecular world.

Next, the design and dedication of the Conference Logo must be mentioned. In the graphic synthesis of the logo, starting from a spatial version of the Leonardo's *homo ad circulum* diagram, the sphere (symbolizing the macro cosmos) appears covered by the molecular pattern of the Natta's *isotactic polypropylene* and inscribed inside an ideally cubic frame (symbolizing the micro cosmos), and the outline of the *homo* (the man) meets the two mentioned structures at the base, where the first carbon atom of the chain is located, as a metaphor of the basic brick of organic life, while due the designated viewpoint the overall outline of the logo alludes to the letter "M" of Milan (fig. 1).

Regarding the conference logo, *Concept and Design*: Luigi Cocchiarella, *Digital Parameterization and Animation*: Matteo Cavaglià, *Digital Branding*: Umberto Tolino and Andrea Manciaracina. Crystall cubes with the conference logo etched in three dimensions were distributed to all attendees and were very well received.

The Opening ceremony under the leadership of the Chair Yasushi Yamaguchi (The University of Tokyo, President ISGG), the Honorary Chairs Otto Röschel (Graz University of Technology, outgoing President ISGG), Vito Cardone (Universitá degli Studi di Salerno/Italy, President of the Unione Italiana Disegno UID), and the Executive Chair Luigi Cocchiarella (Politecnico di Milano) occurred on Friday afternoon, August 3 at the Triennale Di Milano Design Museum. A number of welcoming addresses and invited speakers got the conference off tremendous start and it continued over the next five days. It is noted that the conference chairs provided the Society with a coordinated program consisting of over 230 technical papers presented by 10 invited speakers and some 200 lecturers from 35 different countries representing all five continents. And that there were 30 presentations in the poster session; thus the co-chairs were responsible for an outstanding forum for the exchange of stimulating ideas, methodologies and conviviality among the 250 attendees and for the first time the Proceedings have been indexed as Scopus records by Springer. All of the technical presentations took place with the five day window and were extremely stimulating (fig. 2).

On Sunday, August 5, the Conference had an Exhibition Opening in Building 11 Spazio Mostre "Guido Nardi". The exhibition was unique in that it was a display of "40 Years of Geometry and Graphics" and "ICGG 2018 Posters on Show". The exhibition showed every Proceedings from the previous 18 Conferences which spanned 40 years. A copy of the first Proceedings from the 1978 Conference on Descriptive Geometry held in Vancouver, British Columbia, Canada was on display. The 1978 Conference was sponsored by the Engineering Design Graphics Division of the American Society for Engineering Education in celebration of 50 years as a Division within ASEE and the EDGD is credited with getting

https://doi.org/10.26375/disegno.5.2019.26

the International Society of Graphics and Geometry started. Of major significance with regard to the 18th ICGG in Milano, is that two attendees at the Vancouver Conference in 1978, were in attendance at the 2018 Conference. Paul Zsombor-Murray from McGill University, Montreal, Canada, Frank Croft from Ohio State University, USA were in attendance in Vancouver.
Following the exhibition, attendees participated in the Conference Excursion. They had a choice of touring the City of Milano and visiting the Last Supper, or touring Upper Bergamo with its historical city center and spectacular view of the Po Valley. Both excursions were unique and provided attendees with great memories of the Conference.
The Conference Social Dinner was held on Monday, August 6 at City Center Restaurant, "Le Banque". It is located close to Duomo di Milano and Teatro alla Scala in the trendy and cheerful atmosphere of a former Eclectic/Baroque-like bank hall of the beginning of the twentieth century. A great time was had by all. Wine glasses were filled continuously and it was a great social evening.
The Closing Ceremony was on Tuesday, August 7, at the National Museum of Science and Technology "Leonardo Da Vinci", and was Chaired by Yasushi Yamaguchi, President of ISGG and Conference Chair from Japan. Of major significance was naming the recipient of the Steve Slaby Award and announcing the date and location of the 19th ICGG. Otto Röschel from Graz University of Technology in Austria has made significant contributions to the development of graphics and has demonstrated outstanding leadership within the ISGG and was the recipient of the Steve Slaby Award (fig. 3).
The site for the 2020 ICGG is São Paulo, Brazil. The following excerpt is from the ICGG 2020 website promoting the conference [2]. After 42 years of many

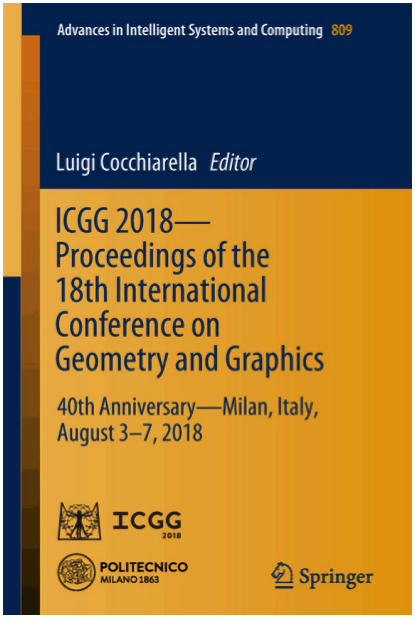


Fig. 2. ICGG2018 Cover of Book of Proceedings.

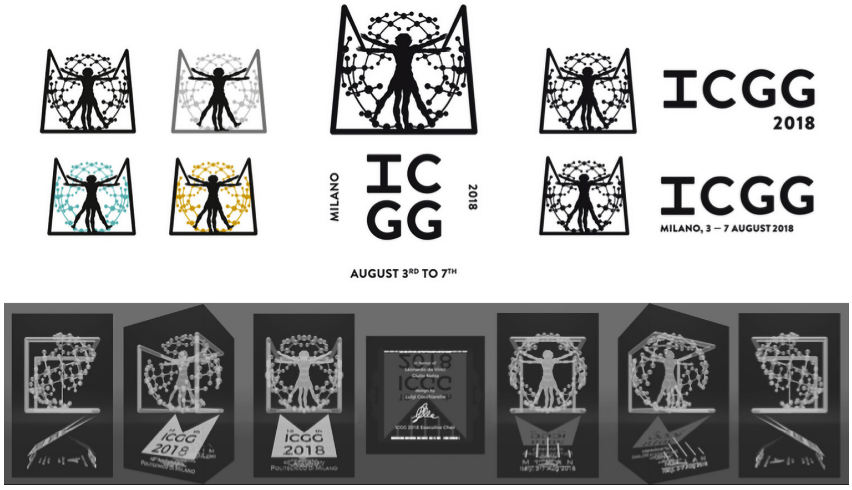


Fig. 1. Conference Logo: graphic version and rendered views of the crystall cube.

successful conferences at different venues around the world, the 19th edition of the International Conference on Geometry and Graphics (ICGG 2020), which is promoted by the International Society for Geometry and Graphics (ISGG), will be held at the University of São Paulo (USP) on August 9-13, 2020. São Paulo is the largest city in South America and the most important economic and cultural center of Brazil. Home of the largest Arab, Italian, and Japanese diasporas, it is a cosmopolitan melting pot city that offers a variety of entertainment, cultural attractions and gastronomy, and also the main hub for the tourism spots of the country.
Following the past successful conferences, in the forthcoming ICGG we will encourage the expansion of the scope to new, interdisciplinary researches and

Fig. 3. Attendees meeting at the Great Dome of the "Vittorio Emanuele II Crystal Gallery" (Photo by Federico Brunetti).

active technical interchange and discussion on theoretical and applied, analogue and digital geometry and graphics and related fields between professionals, researchers, professors and students in architecture, engineering, industrial design, mathematics and arts. As an excellent opportunity to strengthen the tie with the international community, we cordially invite the researchers and educators to present their recent results and experiences at the conference, and believe that it will be another successful event in the long history of ICGG.

Last but certainly not least, a hearty thank you must be extended to the student staff workers who made certain this Conference was a huge success. The time they spent over the span of the conference was enormous and it must be recognized. All the dedicated workers ensured a great conference. It was organized by Luigi Cocchiarella, as the Executive Chair of the Conference.

Notes

[1] Much of the material shown in this review was taken from the ICGG 2018 website <www.icgg2018.polimi.it> (accessed 1 December 2019) and is not original material from the author. Therefore, this statement reflects a citation with regard to where the material originated.

[2] See: <www.icgg2020.pcc.usp.br> (accessed 1 December 2019).

Author

Frank M. Croft, Department of Civil, Environmental and Geodetic Engineering, The Ohio State University, croft.3@osu.edu

Events

XIV International Conference on Graphic Expression Applied to Building APEGA 2019. *From the Line to the Point Cloud*

Stefano Chiarenza

The XIV International Congress of Graphic Expression applied to Building, promoted by the scientific association APEGA (Association of Teachers of Graphic Expression applied to Building) was held this year in Seville on 21, 22 and 23 February.
The Congress–organized in synergy by the Department of Graphic Expression and Building Engineering as well as the Department of Graphic Engineering of the University of Seville–had a strong scientific-technological s lant a nd was aimed to collect the main experiences, projects and ideas in the field of graphic expression and related new technologies. It was an opportunity to exchange and share reflections and experiments, aimed at telling the state of the art of Drawing in the fields o f architecture and engineering and to lay the foundations for exploring possible research scenarios even beyond the limits of the questioned issues. With fourty-eight communications and eight sessions, this year's Conference recorded a significant interest, which was matched by a considerable number of presences.
The underlying theme of the congress was expressed the main statement '*From the line to the point cloud*' whose ambivalence allowed on the one hand to set the extremes of an interval able to accommodate a wide category of contributions, on the other to highlight the development path of contemporary graphic expression with its scientific and technical implications (fig. 1).
On the specific reflection subject defined, the organizers had the task of bringing together a wide variety of topics and themes that well reflect the wealth of the work undertaken by scholars, at an international level, in the disciplines of architectural and engineering Drawing. In particular, the contributions were collected in three thematic areas, each of which assigned to a coordinator and including five key topics supervised by as many experts.
Area 1, dedicated to the *Line* and coordinated by Emilio Ramirez Juidias, has collected all the contributions specifically oriented to architectural design, cartography and topography, remote sensing and GIS, innovation in teaching and technical design; area 2, dedicated to the *Volume* and coordinated by Santiago Lloréns Corraliza, has instead collected contribution focusing on heritage survey, interior and industrial design, graphic analysis of buildings, design in historic buildings and BIM technology. The third and last area, called *Point Cloud* and supervised by Andrés Martin Pastor, has instead collected the articles related to virtual and augmented reality, ICT applications, parametric and generative design and digital laboratories, as well as visual communication issues and smart cities up to multimedia production and artistic animation including interfaces and devices related to them.
Among the eighty-two contributions, selected by a panel of expert reviewers of different nationalities, twenty-nine were received in Area 1, forty-four in Area 2 and nine in Area 3.
The Congress began on February 21 in the precious setting of the Paraninfo of the University of Seville, the historic Assembly Hall in the Palace of the Rectorate (fig. 2). After the official welcome greetings, the inaugural speech was the keynote by professor José María Gentil Baldrich, of the Department of Graphic and Architectural Expression of the Seville, School of Architecture. Focused on the *Architecture and Building Research*, the contribution skilfully outlines a general framework of research in the architectural-engineering field, tracing its origins and recent history through some of the most significant doctoral theses in Spain, in which the aspects related to graphic expression represented a fundamental element.
In the afternoon, the first two work sessions started with the keynote contribution by professor Vito Cardone, from the University of Salerno, exposed by Barbara Messina (University of Salerno).

https://doi.org/10.26375/disegno.5.2019.27

Gaspard Monge and the birth of graphic technical representation–this is the title of the paper–was a significant contribution to Monge and his work, written by one of his most careful contemporary scholars. In Vito Cardone's contribution, through a wealth of rigorous and unpublished documentary references, clearly emerges Monge's role in the definition of the modern system of representation and the actuality of the thought of a master, who can rightly be considered the father of contemporary engineer.

The panel of the two sessions then saw a series of short speeches focused mainly on the areas dedicated to the *Line* and *Volume* in which professors and researchers shared their experiences. Among the contributions presented, three were representative of the themes addressed: the graphic re-readings of the 5th book of Vitruvio's architecture, by Carlos Alberto Cacciavillani and Caterina Palestini (University of Chieti-Pescara), which through the use of digital modelling have retraced in a new way the different graphic interpretations of an aniconic literary work, the digital reconstruction of some unrealized projects by Carlo Mollino, presented by Roberta Spallone (Politecnico of Turin), and the studies on the implementation of BIM technologies in the didactic field in Engineering schools, exposed by David Valverde Cantero, Jesús Alfaro González and Pedro Enrique Pérez González of the Polytechnic school of Cuenca.

Beyond the interventions mentioned, the two sessions of the day were a good reflection of the wealth of topics present in the first two areas, from 3D models to graphic-analytical rereadings of the heritage, from three-dimensional reconstructions to the potential of GIS and BIM applications in analysis and information processes.

On the morning of Friday 22 February, the work moved to the Campus Reina Mercedes of the University of Seville, in the Degrees Hall of the Higher Technical School of Building Engineering.

The introductory keynote speech was entrusted to professor João Pedro Xavier, director of the Faculty of Architecture of the University of Porto: *The more Geometry The better* is an apology of geometry and its importance in studies, still a current tool for thought and communication. In the contribution of Xavier, the conclusive statement "long live the Geometry!" appears meaningful. With the acute paraphrase of the monarchic formula *le roi est mort, lives the roi!* he wants to declare, precisely, the continuity of a discipline that, although it may appear today dying and overshadowed by new technologies, maintains its essential function in graphical and design studies.

After the above keynote address then the first two sessions of the morning began. In the discussions, the thematic area relating to *Volume* played a central role. The contributions, still articulated in short presentations, have transversally varied between the different topics moving between new survey technologies, BIM, and geometric analysis of the architectural built at different levels. An example was the paper presented by Alberto Cortés Mendoza, Blas Herrera Gómez and Albert Samper Sosa (Universitat Rovira i Virgili) which highlighted the possibilities offered by the combination of traditional geometric analysis and numerical-computational processes linked to the acquisition of 3D point clouds, to establish whether existing architectural surfaces, for which design plots are lacking, may be hyperbolic hyperboloids. But in the context

Fig. 1. Flyer of the event.

of the discussed topics, also the speech of Antonio Miguel Trallero Sanz of the University of Alcalá, dedicated to the architectural complex called Poblado de Villaflores and its conservation issues, was a significant contribution.
The afternoon sessions instead had the introductory lecture by professor Jaime Rodríguez Pereña from the Department of Agroforestry Engineering of the University of Santiago de Compostela. The subject of his keynote address was the *3D Modeling: the Metric of the Point and its Image*. In a rigorous way he discussed the problems related to the precision of the spatial representation of the built environment and to the integration of the relevant digital methods–functional to the graphic description of complex shapes. Afterwards, the presentations of the various research works through which the speakers compared, with different addresses, the most current issues related to BIM and to the graphic-generative analysis of architectures and decorations. In this regard, two contributions have been illustrative of the themes addressed: the methodological considerations proposed by Pablo Nestares Pleguezuelo and Raquel Nieto Álvarez of the University of Granada, to solve the drawing of the patterns of Islamic square matrix decorations; and the experiments of Lia Maria Papa, Pierpaolo D'Agostino and Carlo Giannattasio of the University "Federico II" of Naples, on the use of BIM within the existing built heritage, applying integrated techniques of CAD to BIM and SCAN to BIM to the case study of a historic building, designed by the architect Luigi Moretti between 1970 and 1973 and later used as a university residence.
On Saturday, February 23rd, the congresses gathered again in the Degrees Hall of the ETSIE. The two final work sessions, which took place in the morning and were punctuated by a meeting of the coordinators of the thematic areas, were characterized by a broader comparison also on the thematic area relating to the *Point Cloud*. In fact, the contributions exposed touched on topics related to ICT applications, virtual and augmented reality, parametric and generative design and artistic animation.
Among the various short speeches of the first session, Andrés Martin Pastor of the Seville University and Francisco González Quintial of the University of the Basque Country presented a significant experience on the use of developable surfaces for the creation of ephemeral architectures, showing a project titled *The Cactus Pavillion*. It is a temporary and itinerant biomimetic architecture in wood, consisting of developable convolutes generated through a parametric algorithm specifically designed and implemented through CAD CAM and CNC technologies. The work is carried out as part of the *Project to Rescue the Architectural and Natural Heritage of Santiago de Anaya in the Mezquital Valley* in Mexico.
The suggestions offered by Alfonso Berroya Elosua and Maitane Echevarria Aguirre on the incursions of architectural and environmental representation in the field of gaming and video art have instead appeared captivating.
In the second session we report the contribution of Pablo Rodíguez Navarro and Teresa Gil-Piqueras, of the Polytechnic University of Valencia which illustrates three works of archaeological importance in the bed of the Thames in London promoted by the MOLA (Museum of London Archeology). The three surveys (in the areas called The Old Swan Stairs and Wharf, Isleworth Eyot and Gallion's Reach) highlight a methodology rich in innovative solu-

Fig. 2. Seville, Antigua Real fabrica de tabacos, University Rectorate.

tions that called into play, integrating them, structure-from-motion photogrammetry (Sfm), and laser surveying scanner, to adapt the work to the complex problems posed by the objects of the survey.
In the late morning the conclusion of the conference is marked by the usual assembly of the members of the APEGA scientific society followed by the closing lunch.
As part of the conference, awards and prizes were awarded for the works presented at the 2019 Edigráfica exhibition, aimed at promoting the dissemination of works and publications by scholars and professors, carried out in the two-year period 2016-2018. In particular, the first prize 'Juan Manuel Raya' was awarded to the *Cactus [re]-Action* project by Andrés Martin Pastor of the University of Seville, while two mentions were attributed respectively to the work *Innovación Docente en Expresión Grafica Arquitectónica,* by the authors Concepción López Gonzalez, Teresa Gil Piqueras, Pablo Rodriguez Navarro, Jorge Garda Valdecabres and Rafael Martin Sanchez (Polytechnic University of Valencia), and at work, entitled *Diseño de un prototipo de alojamiento con materiai reciclado,* by the authors Cristina Jiménez Espina and Santiago Llorens Corraliza (University of Seville).
It leaves positive feelings, on the whole, the scientific debate fielded in the three intense days of work. A confrontation of certain interest, which has opened to reflections on the increasingly complex relations between drawing and technological progress, exploring issues often on the margins of the most consolidated study areas.
The attractive themes of the scientific program of the conference were then joined by the cultural ones derived by visits to the host city.
From this point of view, Seville was undoubtedly a welcoming and culturally vibrant city for the conference, offering participants the opportunity not only to learn about the architecture of the historic university building–the theatre of the conference works–but also to visit, with the precious support of professors and researchers, urban spaces and the most significant monuments.

Author

Stefano Chiarenza, Department of Promotion of Human Sciences and Quality of Life, San Raffaele Roma Open University, stefano.chiarenza@uniroma5.it

Events

Conference *The Development of a Digital Cultural Heritage Eco-system*

Massimiliano Lo Turco

Following a twenty-year tradition, March in Ferrara is dedicated to the themes of Restoration and Cultural Heritage: three days of conferences, exhibitions, debates and working tables in an event that precedes the contents of the *XXVI Salone del Restauro, dei Musei e delle Imprese Culturali*, this year scheduled on September, 18th, 19th and 20th. In the framework of palazzo Tassoni Estense, numerous moments of discussion were proposed on the themes of restoration, architectural heritage, design, research and governance of the territories, with particular attention to the Emilia territory affected by the seismic events of 2012. The Department of Architecture of the University of Ferrara [1] organized at its headquarters three intense days of discussion and debate, confirming a territorial vocation for innovation and research on cultural heritage. In the full calendar of events a conference by invitation was organized entitled The development of a digital eco-system of cultural heritage. *Methodologies and technologies for the creation of enabling platforms for knowledge, documentation, management and enhancement of cultural heritage*, with the support of UID – Unione Italiana per il Disegno. The event has brought experiences and testimo-nies on the new role of the disciplines and representation in relation

Fig. 1. Conference cover.

https://doi.org/10.26375/disegno.5.2019.28

to digital cultural resources, increasingly widespread and accessible (fig. 2).
The complexity of the title contrasts with the lucid and linear reflections with which Marcello Balzani opened the conference, thinking about digital ecosystems, in which the value is represented by the structure of an integrated platform of finalized contents and by different browsing and relationships with users and multiple needs, we imagine a universe of coherent and compatible objects. Objects that connect, communicate and react, knowing where they are and what they do, and even learn the behaviour that make them more interesting and useful. However, reality is different. If we identify as a galaxy of this ecosystem the one of heritage assets, we can immediately understand a non-trivial antagonistic feature [Balzani 2019, p. 6].

Another topic of reflection concerned the analysis of the procedures for the creation of high quality 3D models, which are still particularly onerous activities in the field of Cultural Heritage. Today, often the products of digital reconstructions are provided in non-interoperable formats, therefore not shareable and difficult to access, where it is necessary an intense work of standardization on acquisition protocols, the critical se-

Fig. 2. Exhibition space with panels and explanatory videos of the interventions.

lection of information and structured processes to set up information models that can be used in different contexts.
This is the scenario of Carlo Bianchini's intervention, according to which Digital Cultural Resources can play a fundamental role both in terms of the preservation of the identity of places and, above all, as a tool oriented towards the management of built heritage [Bianchini et al. 2019, p. 40].
The case studies presented by Antonella di Luggo and Ornella Zerlenga can be traced back to the same needs. The first, a research project for palazzo Penne, concerned the development of a methodology of knowledge aimed at the conservation and enhancement of a building of great representativeness, implemented according to a multidisciplinary approach, prefiguring new uses and new devices to improve accessibility and use [Campi, di Luggo 2019, p. 66]. The second concerns specifically the research project for the scale of palazzo Cassano Ayerbo d'Aragona in Naples, but it is part of an even broader project that consists in the development of a methodology of knowledge aimed at the conservation and enhancement of buildings of great representativeness, both architectural and urban, also implemented according to a multi-scalar and interdisciplinary approach [Zerlenga, Cirillo 2019, p. 76].
The following interventions summarized below refer mainly to museum assets: the intervention presented by Giuseppe Amoruso examines the museum of Amatrice – razed to the ground by the earthquake of 2016- which collected works from the territory of Amatrice and materials on the history of the building and the city of Amatrice. The project aims to represent and disseminate part of the lost heritage through an immersive and interactive system aimed at involving the experience and dissemination of the contents of the Museum in a mode of visual storytelling [Amoruso et al. 2019, p. 90].
The projects presented by Massimiliano Lo Turco and Roberta Spallone define methodologies to create digital models of some museum collections, creating workflows able of virtually reproducing spaces (container-museum) and objects (content-collections). The theme of communication, sharing and dissemination of cultural heritage is addressed through experiments by Artificial Intelligence, Augmented Reality and the use of Web platforms, in the areas of Cultural Tourism (Digital Interactive Baroque Atria) and the enhancement of documentary and archival heritage (Archivio Mollino and Theatrum Sabaudiae) [Lo Turco, Spallone 2019, p. 52].
The implementation of structured processes to improve the documentation, management, enhancement and accessibility of cultural heritage are the main themes of the INCEPTION European Project – Inclusive Cultural Heritage in Europe through 3D semantic modelling, presented by Roberto di Giulio. The project has developed a platform designed to organize and use in an inclusive way three-dimensional models enriched with semantic information. In addition to the innovative methodologies for the realization of 3D models with an inclusive and interdisciplinary approach to cultural heritage, the popular event was an opportunity to present the open standard platform developed as part of the research project in an exhibition space, which can be visited during the Giornate del Restauro e del Patrimonio Culturale; in a unified framework, through panels and multimedia resources, digital ecosystems were also presented: the works were developed by the Department of History, Design and Restoration of Architecture of the Sapienza Università di Roma; the results obtained by the School of Architecture of the Politecnico di Torino n with regard to integrated digital platforms for Cultural Heritage; the participatory application for the Museo Cola Filotesio of Amatrice realized by the Department of Design of the Politecnico di Milano as an experiential design for the knowledge of Cultural Heritage; the palaces Penne and Cassano Ayerbo d'Aragona in Naples and the royal parks of Caserta, Versailles, Worlitz as case studies for knowledge and enhancement developed by the Department of Architecture of the Università di Napoli Federico II and the Department of Architecture and Industrial Design of the Università degli Studi della Campania Luigi Vanvitelli.
The results of the interventions have been published in the number 1/2019 of the scientific magazine Paesaggio Urbano, in a digital version that can be freely downloaded [2].

Notes

[1] The organizers of the event are the Center for the Development of Integrated Automatic Procedures for Restoration of Monuments (DIAPreM) and the Laboratory of Architectural Restoration – LaboRA of the University of Ferrara.

[2] At the link <https://www.architetti.com/paesaggio-urbano-1-2019.html> it is possible to access the digital copy of the magazine, after registration.

Author

Massimiliano Lo Turco, Department of Architecture and Design, Politecnico di Torino,
massimiliano.loturco@polito.it

Reference List

Amoruso, G., et al. (2019). Design Esperienziale per il Patrimonio Culturale. Un'applicazione partecipativa per il Museo Cola Filotesio di Amatrice. In *Paesaggio Urbano*, n. 1, pp. 90-99; <https://www.architetti.com/paesaggio-urbano-1-2019.html> (consultato il 03 ottobre 2019).

Balzani, M. (2019). Dall'unicità al minimo comune denominatore del patrimonio culturale: la sfida delle piattaforme e degli ecosistemi digitali. In *Paesaggio Urbano*, n. 1, pp. 4-7; <https://www.architetti.com/paesaggio-urbano-1-2019.html> (consultato il 03 ottobre 2019).

Bianchini, M., et al. (2019). Ecosistemi Digitali e Risorse Culturali. In *Paesaggio Urbano*, n. 1, pp. 40-51; <https://www.architetti.com/paesaggio-urbano-1-2019.html> (consultato il 03 ottobre 2019).

Campi, M., di Luggo, A. (2019). Palazzo Penne a Napoli, memoria della città storica. Rilievo e conoscenza per la valorizzazione del patrimonio architettonico. In *Paesaggio Urbano*, n. 1, pp. 66-75; <https://www.architetti.com/paesaggio-urbano-1-2019.html> (consultato il 03 ottobre 2019).

Lo Turco, M., Spallone, R. (2019). Piattaforme digitali integrate per i Beni Culturali. Alcune esperienze della Scuola di Architettura del Politecnico di Torino. In *Paesaggio Urbano*, n. 1, pp. 52-65; <https://www.architetti.com/paesaggio-urbano-1-2019.html> (consultato il 03 ottobre 2019).

Zerlenga, O., Cirillo V. (2019). Un caso-studio per conoscere e valorizzare. La scala di palazzo Cassano Ayerbo d'Aragona a Napoli. In *Paesaggio Urbano*, n. 1, pp. 76-89; <https://www.architetti.com/paesaggio-urbano-1-2019.html>(consultato il 03 ottobre 2019).

Events

Faces of Geometry. From Agnesi to Mirzakhany

Michela Rossi

The 12th of May is the day dedicated to the worldwide celebration of women in mathematics , coordinated by EWM, European Women in Mathematics, and supported by the African Women in Mathematics Association, by the Colectivo de Mujeres Matematicas de Chile, by the Indian Women and Mathematics and finally, by the Women's Committee of the Iranian Mathematical Society, which was founded with the intention of promoting the dissemination of the contribution that women have provided to research in the area of this discipline and its many applications, which unfortunately has not yet been properly acknowledged.

Among the 32 events organized on the occasion of the Women in Mathematics Day in Italy, on May 13, 2019 the International Conference *Faces of Geometry. From Agnesi to Mirzakhani*, was held in the evocative setting of the Aula Magna of the Rettorato of the Politecnico di Milano with the patronage of the Unione Italiana per il Disegno and the support of the Department of Mathematics of the University.

With this initiative, the scientific coordination composed of Paola Magnaghi Delfino, Giampiero Mele and Tullia Norando, wanted to celebrate the day with a new tribute to the contribution of women to mathematical research, particularly in the field of geometry, after the one previously dedicated last year to Maria Gaetana Agnesi, an 18th-century Italian scholar considered one of the greatest mathematicians in history, who in replacing her father at the Università di Bologna became the first woman to obtain a chair of mathematics.

The international conference was therefore intended to promote the interdisciplinary confrontation between mathematics and geometry, in particular, as well s other disciplines, underlining the often neglected importance of the work done by women in this field, through the presentation of theoretical research and concrete applications focused on the many implications that make it an essential reference for many disciplines, especially the projectual disciplines such as architecture, design and engineering, the formal arts and music. The new edition recalled Agnesi's topicality with reference to the figure of Maryam Mirzakhani, former professor of mathematics at Stanford and author of important contributions to hyperbolic and symplectic geometry, and in the field of ergodic theory, which studies the medium- and long-term behavior of dynamical systems.

The intense day of study began with the institutional greetings of Donatella Sciuto, Vice Rector of the Politecnico di Milano, to the participants, of the director of the Department of Mathematics Giulio Magli, who stressed the centrality of the discipline in the culture of the Politecnico and its transversality, of Fiammetta Costa, President of the Guarantee Committee of the Politecnico di Milano, who underlined the importance of enhancing the work done by women, also in academia, and finally, the Vice President of the Unione Italiana per il Disegno, took the floor in place of the recently deceased Vito Cardone, of whom she presented a brief but moving recollection.

After the ritual welcome, the conference entered into the thick of the intense program planned by the organizers. About twenty speakers, with a strong female prevalence, followed in documenting with their presentations the liveliness of research and the variety of scientific and educational applications of the theoretical developments and practical applications of mathematics.

The event opened with a session chaired by Tullia Norando and dedicated to the formal and mathematical nature of patterns, to their organic reference and their renewed projectual interest as an effect of the affirmation of digital tools and computational calculation. Maria Zdimalova of the Slovak University of Technology in Bratislava introduced the topic by illustrating the theoretical principles of the different

https://doi.org/10.26375/disegno.5.2019.29

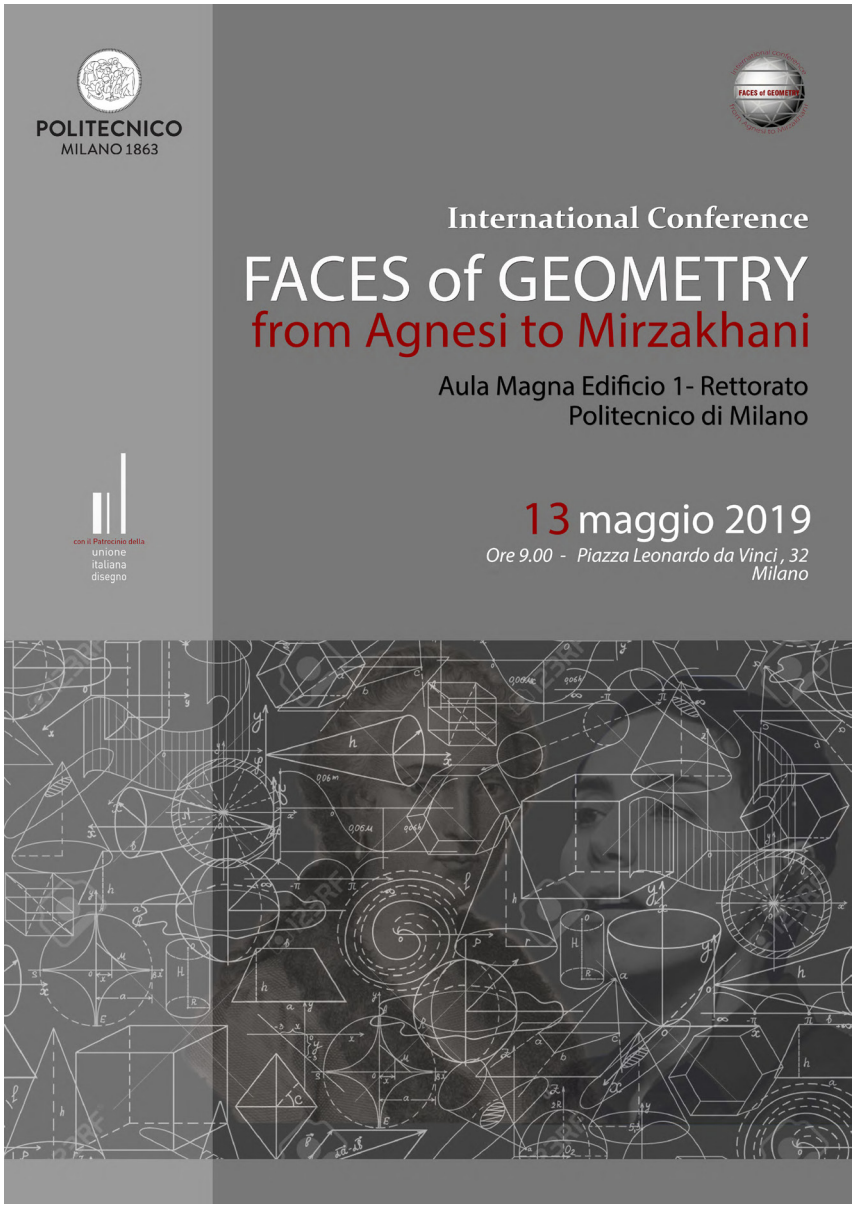


Fig. 1. Faces of Geometry. From Agnesi to Mirzakhany, poster.

groups of symmetries and the articulation of the tessellations of the Alhambra. Michela Rossi then delineated the scientific foundations of the project's references to the imitation of natural models, underlining the evolution over time of the imitative principle, from the external form of antiquity to the responsive processes of contemporary design, through five stages, in parallel with the deepening of knowledge and the refinement of mathematical models developed to explain natural phenomena. Then Giorgio Buratti went on to explain how the computational process translates the principles of form into generative codes directly applicable to the solution of countless projectual problems through the search for maximum efficiency in design. Mine Ozkar and Sibel Ozgan from MEF University in Istanbul closed the session with an application to historical architecture, showing the geometric genesis from the divisions of the sphere in domes of medieval Anatolia.
The second session of the morning was chaired by Giampiero Mele of the Università E Campus and was dedicated to the different roles of Geometry in architecture, from training to projects. Alessandra Capanna opened the session with a reflection on the research of the fourth dimension in architecture which, unlike mathematics, based on the rigor of postulates, is conditioned by the experience of physical space, and then showed the suggestions proposed by Steven Holl and Zaha Hadid. After her, Barbara Messina described the importance of the female contribution in the teaching of Descriptive Geometry in the Italian University. Immediately afterwards, Cristina Candito presented Anne Tyng's contribution to the design of Louis Kahn's architecture, underlining how her role was unacknowledged by both her partner as well as by critics. Kay Bea

Jones of Ohio State University, unable to attend, sent a paper on geometry in Franco Albini's projects, which was read by Sylvie Duvernoy. Chiara de Fabritiis of the Università Politecnica delle Marche then spoke about the use of Geometry in musical composition, while Maria Teresa Bartoli of the Università di Firenze closed the session by illustrating how survey reveals the existence of unexpected geometries in the Gothic city.
The afternoon opened with the welcome of Elisabetta Lorenzetti, President of Mathesis Nazionale and then continued with the session led by Paola Magnaghi Delfino, dedicated to the relationships between the theoretical foundations of Geometry and the design applications that result from it, opened by Biagio di Carlo of the Design Science Studio in Pesaro with an incursion into the world of triangles and geodesic and tensegrity structures derived from the observation of the stability of the triangular conformation in natural structures. After, Giuseppe Conti and Raffaella Paoletti of the Università di Firenze illustrated the applications of the Reuleaux triangle in architecture and engineering, thanks to its particular geometric properties. Emanuela Ughi of the Università di Perugia then addressed the problem of teaching in primary schools, proposing a concrete approach to Geometry for educating in mathematics starting from early childhood and developing creativity, while her colleague Anna Salvadori closed the session by bringing attention back to the theoretical level, speaking about inverse formulas from elementary geometry to differential calculation.
After a short break, there was a parenthesis dedicated to editorial activity which started with the presentation of the book *The Square Root of Life*, written by Lorella Carimali and published by Rizzoli. The author herself, a math teacher at the Liceo Scientifico Statale Vittorio Veneto in Milan, spoke with enthusiasm and abundance of explanatory details about the motivation of the text, the plot of the novel that she has dedicated to young people, schools and teachers, but especially to Mathematics, able to offer a solution to the daily problems we each face, explaining how positive an unconventional approach to the subject can be. A second presentation was dedicated by Sylvie Duvernoy to the story *The Little Prince's Universe* written by the recently deceased Italian astrophysicist Francesco Palla; she also presented the book, first published in Italy and then translated into many other languages, which she herself illustrated.
This was followed by the presentation of the works produced by the high school students in the context of the contest *La potenza compositiva dei poligoni e poliedri* (The compositional power of poligons and polyhedrons), a competition open to secondary school students and university students, for works of sculpture, painting, drawing and graphics inspired strictly by the theme suggested by the title of the competition. The award-winning participants presented works in which they translated into images the reflections of a personal research resulting from geometry, demonstrating to those present how the stimulus offered by their teachers can lead young people to develop original responses.
The day then ended with the afternoon session, resumed with lectures by several other professors of the Politecnico. Federico Brunetti presented his reflections on the relationship between geometry and form in drawing and design. Paolo Dulio reasoned on scaling in vector space. Finally, the two mathematicians Franca Caliò and Elena Marchetti brought attention back to the didactic problem in the university context, with a speech focused on the current methods of teaching Geometry in the schools of Architecture and Design of the Politecnico.
Between one session and the next, the day also offered the opportunity for the presentation of the newly formed International Association in Mathematics and Art - Italy (IAMAI), promoted by Italian scholars from various academic, disciplinary and cultural backgrounds. The association's mission is to promote research and the dissemination of results in the various fields of application, enhancing the interweaving and convergence between areas that link Mathematics to Art and with an openness towards forms of collaboration and involvement of other subjects, bodies and organizations. As the promoters stated in their presentation, Mathematics is, in fact, the result of a thought at once creative and logical, inspired and deeply linked to beauty, recognizable in various manifestations of Art, from architecture to design and fashion, from painting to sculpture, from music to dance and theater, including their digital and virtual forms. The international association was founded in Italy because, over the centuries, the encounter between Art and Science has left a legacy of signs and testimonies here by which the association is inspired.
The success of the event has been emphasized by the announcement of its next edition in May 2020.

Author

Michela Rossi, Department of Design, Politecnico di Milano, michela.rossi@polimi.it

Events

Documentation & Digital vol. 2

Cecilia Bolognesi

As reported in the preface of Massimiliano Lo Turco to this collection of researches, the awakening of a "Sleeping Beauty" can be considered as the main topic of this book. "Sleeping Beauty "is a name that comes from a project promoted by the Italian Ministry of Cultural Heritage, regarding a classification work aimed at civic museums, with the ambition of setting up a database of an important selection of works that do not find space in the exhibition areas accessible to the public.
But while there are many "Sleeping Beauty" reality in our area the increasingly use of Internet and the digitalization applied to cultural heritage allows a satisfying dissemination in which storytelling plays a fundamental role in the creation of content, both with entertainment and educational value.
Explain processes and experiments to disseminate something hidden, bring to light large treasures that are part of collections only partially exposed is an objective of the researches developed here with different in-depth studies.
The book reports a study day in Turin on June 14th 2019, and is made with the contribution of DAD, department of Architecture and Design of Politecnico di Torino, through the "BIM acquisition as Cultural Key To Transfer Heritage of ancient Egypt For many Users To many Users Replayed-Back to the Future Project"; the day reported the state of art of some researches collected by the same aim and its structure is reflected in the book with apparent simplicity: a first part, entitled "Digital & Physical Models", collects the research experiences of the project carried through a collaboration between Politecnico di Torino and the Fondazione Museo delle Antichità Egizie of Turin with the support of Compagnia di San Paolo.
A second part, entitled "Databases, semantics & interoperability", presents a selection of experiences, where documentation is the issue: databases, classified and structured through ontologies, sharing of information using different interoperable platforms, automatic recognition of architectural objects through machine learning techniques. A third part, "Digital Representations for Knowledge, Enhancement & Communication of Cultural Heritage" uses Digital Representation as the main focus, investigating it in its multiple forms: from the most sophisticated theory to the most popular uses.
A first question introduces all the research themes: it concerns the urgency that has become more pressing to digitize and disseminate even what it has, most likely, a lower overall value than what is exposed.
Why our actual cultural condition requests it? There are many reasons.
The digitization of whole cultural heritage sites is often driven by the fear that natural or war events can erase them from our memory; moreover, when we deal with artefacts that are already part of collections or part of a museum, we are mainly encouraged by the desire of a wider circulation in an era of cultural competition among institutions; sometimes digitalization is the last possibility for sharing knowledge. Frequently we face collections that are closed to the public or confined to areas that cannot be visited.
In a country like ours preserving is no more sufficient; we are rich in artefacts but often lacking in dissemination out of our boundaries; we are in an area where historical research is relevant, and it must widen its boundaries, placing itself in relation with other researches and traditions.
The European Commission, the research financed, the organizations that deal with the collection and enhancement of the historical heritage, whether they are artefacts in the open air or museum exhibits, point at the digitization as an essential process for the dissemination of our culture and its transmissibility.

https://doi.org/10.26375/disegno.5.2019.30

diségno ISSN 2533-2899

Fig. 1. Flyer of the event.

The creation of the first digital museum collections databases reveals an articulated and rich panorama, full of attempts, or structure researches, where the hot topics deals with acquisition and reverse modelling themes, such as accuracy of the models and reliability; fast or automated methods of form extraction; semantic enrichment, or modelling for virtual or augmented fruition for dissemination.
So even if cultural heritage is transmitted us with a richness of meanings due to the interpretation of the space-time relations that forged it, its life now is restarted by the possibility that the technique offers to show them and the amount of data that belongs to them, giving development of the way they are used.
As in the next years much physical reality will be largely replaced by a digital reality the historical responsibility that the new digital models assume goes far beyond that of simple contemporary dissemination.
The generation of the - digital twins - of the heritage of the past is the bet on which the preservation of the historical heritage for the next generations is based as well as, in a similar field, the progress of new buildings is based.
The researches here produced brings to light three different lightmotive, ‚emphasizes three research themes that run across three chapters' themes: the method of acquisition and survey procedures as a research theme running; the aim of cataloguing and therefore the semantic enrichment of the objects produced; the possibility to forecast scenarios for future research and development.
The first mainly searched in the chapters by Spreafico, Patrucco, Calvano; Maietti e Balzani; Fanini; Marraffa; Maniello but not only.
The second searched by Maffrici e Giovannini; Niccolucci. The third, crossing all the chapters and
with a prominent presence presence in Palma, Baglioni e Salvatore, Rossi, Oppedisano, Vinti.
The acquisition of the point cloud raises the following themes: assuming the fact that the digital model is a data repository coming from different sources that contribute to the description of the object, the first objective of the acquisition is to produce a metrically accurate 3D model, possibly provided with material representations faithful to the existing one. The point clouds generated by laser scanners or the colorimetric information derived from photogrammetry require skills not easily available, and warn us about issues related to the accuracy of the models. While the lack of accuracy could be negligible in some areas related to the use the survey for entertainment it can't be in the research field. As the accuracy of the point cloud falls proportionally to the number of different acquisitions made post processing phases need high skills to assure good results. More skills in texturizing phases or mesh modelling: reliability is an ambitious goal.
The aim of cataloguing: its structure and organization raises questions from the

earliest stages of model segmentation and semantic enrichment of the objects that are identified within it. The geometric segmentation in itself, sometimes automatically offered by software, may not make sense for some artefacts and implies again the intervention of the researcher that must know the structure of the final database. The enrichment of the model is determined by the materials found as well as by the need for dissemination: sometimes it is necessary to integrate historical information but also managerial or related to the type of maintenance as well as alphanumeric or multimedia data.
The purpose of the database must be defined from the beginning of the segmentation phase being plenty possibilities of its goal. The variables of the single researches offer often tailor-made workflows that demonstrate the state of the art and the difficulty of finding a completely shared procedure or even more model cataloguing standards.
If document digitization procedure of existing paper materials has produced regulations and by now consolidated rules the procedures for the digitization and cataloguing of monuments or artefacts of smaller size is far from such a scenario. A Ministerial decree in 2018 "Adoption of minimum uniform levels of quality for museum and places of public culture and activation of the National Museum System" requires compliance for minimum standards for the correct organization of deposits referring to simple rules for storage of artworks not exhibited. In a foreign context, some large institutions such as the Smithsonian started in defining parametric parameters for the digitalisation of collections, currently offering traces or guidelines to support colleagues to build workflows by creating sustained high speed, high quality digitization processes, by pairing up the digital surrogates they create with the collection records stored in the various collection databases. It is about sharing a responsibility in finding, as Smithsonian says, the best technologies and processes to achieve these goals; to conduct mass digitization projects to test and implement these new technologies and processes; to educate and train ourselves to understand these new approaches; and finally to integrate digitization operations into the day-to-day operations in order to give the world access to the collection sometimes hidden the public. Finally, the topics of future research progress for a wider fruition: as museums have not been immune to the advent of technologies linked to the world of Web-related technologies and generally to first-generation digitization and to the development of Web Pages (and social media in a second stage) the imminent moment invokes research on the development of interaction between digitalization and technologies 4.0. The museums have realized the potentials of digital technologies on reaching a wide public and increase their attractiveness. Now that digital technologies offer some low-cost scenarios, as user-friendly tools, they multiply the way in which "users" use interactive technologies in their everyday life, including visits to cultural places. We slide towards a digital enjoyment that does not therefore lend itself only to scientific research and dissemination but will allow the introduction of a wider public, friendly user, and all kinds of devices.

Fig. 2. Work session of the conference.

All these changes will oblige museums and institutions to think about reinventing themselves in more digital involving ways, where modelled contents accurate and reliable will be probably exported to a wider market; this last one will offer further experiences probably customized by the single user, founded on previous deep and accurate models previously acquired.
The most vivid legacy that the collection of these writings manifests goes back to a close relationship between a strong need for documentation and research regarding some works and the need to weave different types of knowledge, from the more formal aspects to those more related to the contents and on this direction will continue the next research to allow the implementation of digital strategies for cultural heritage.

Author

Cecilia Bolognesi, Department of Architecture, Construction Engineering and Built Environment, Politecnico di Milano, cecilia.bolognesi@polimi.it

Events

IMG2019. Graphic Sciences for a Project with Great Cultural Scope

Elena Ippoliti

Some years ago, Vito Cardone, in the first issue of the renewed *X Y Critical review of studies on the representation of architecture and the use of image in science and art*, in digital form, asked why publication of the journal, "a place of critical and wide thought, not only regarding architectural representation but also on the usage of pictures in arts and science" [Cardone 2016, p. 13], had been interrupted for fifteen years. His answer was this: probably because the scientific design community, folded back on itself in search of a disciplinary identity, was not then ready to address "a cultural opening that exalted the multidisciplinary" with the aim of "recomposition of knowledge, which can be obtained by filling the gap between humanistic and scientific cultures" [Cardone 2016, p. 17].

Due to such considerations, Vito Cardone met with Alessandro Luigini the following year in Bressanone, in the Faculty of Education at the Free University of Bozen-Bolzano. This was not only to extend ritual greetings to the first edition of IMG Immagini. During his presidency, the UID had also strongly supported the creation of this conference–international, interdisciplinary, and itinerant–and with it the network of scholars and researchers that were committed to focusing scientific discussion on the images that we consume, produce, share, transmit and spread on a daily basis; images that are increasingly intertwined with our existence and our research experiences.

Images that, compressing the extremes of the conflict between the apparently irreducible strategies of scientific and aesthetic thought, have assertively traversed the entire twentieth century knowing how to hold together reason and body, thought and desire. This conflict is originally a constituent of design perennially stretched between thought based on the difference and rigour of measurements and thought based on the similarity and uniformity–even perceptual–of forms. For thirty years at least, these images have reopened studies into their centrality, studies united by a methodological approach that holds together icons and practices of viewing and looking, and which comprises both 'making' and 'using' images, incorporating social interaction and cultural phenomena according to a specific viewpoint [Pinotti, Somaini 2016].

The so-called 'iconic turn' regarded a vast body of knowledge that used the image as a category of investigation in and of itself, encompassing imagination and imagery and the inherent double nature of each image–material and mental, thing and idea, truth and error–in the same hive of activity Wunenburger 1999 and 2008]. Paradoxically, this iconic turn was not instead manifested with the same intensity in studies on design, where an awareness of the need to address, understand, and govern this 'multiplication of images' had not been fully established. This lack has been corrected by the IMG conferences, which, with their "radically innovative perspective", have reaffirmed above all a specific aspect of the disciplinary area: it is "not only architecture, but also the elaboration of visual images" whose horizon falls within "an single broader cultural area" [Cardone 2016, p. 25 and p. 19].

The conference could not avoid being interdisciplinary, a place for meta-communicational relationships and pooling of different representatives of knowledge and experience regarding images. It has therefore moved a project of "great cultural scope", that of gathering, into one large cultural area where "all of those that, in the academic field, work on these themes; and of which the current segments can be sub–areas or specializations" [Cardone 2016, p. 25].

The area still needs to be *de-nominated* in order to be able to distinguish and design it, as in all processes aiming at building knowledge and scientific communities. In closing his article, Vito Cardone reflected on this same question:

https://doi.org/10.26375.5.2019.31

diségno ISSN 2533-2899

Fig. 1. The mood of visual identity at IMG2019 – GRAPHICS.

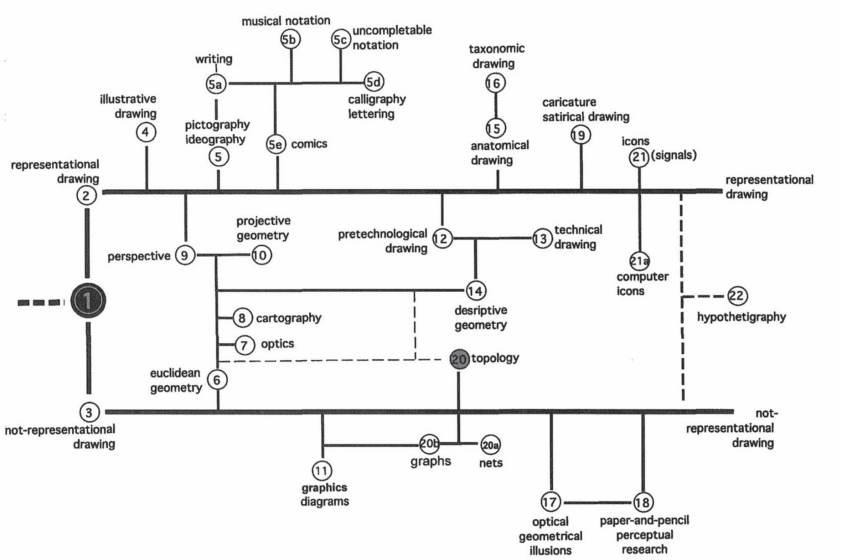


Fig. 2. The tree diagram of graphic productions developed by Manfredo Massironi (from Massironi 2002 p. 3).

"In Italian it could be defined also as *scienza e tecnica della rappresentazione visiva* (visual representation science and technique), or, if someone could be frightened by the word "science", *teoria e tecnica della rappresentazione visiva* (visual representation theory and technique). […] A really like the name "Graphic Science". And I believe that, sooner or later, many will reach it" [Cardone 2016, p. 25].

And thus, Vito Cardone, with the same spirit of Bressanone, would also be in Alghero (fig. 1). The second edition of the *International and Interdisciplinary Conference on Image and Imagination* was held on 4 and 5 July 2019 on the splendid Alghero campus of the Department of Architecture, Design, and Urban Planning at the University of Sassari. Its primary scope was "to recompose the elements present in the international panorama of research in the field of studies focused on the production of images that can be expressed through the expression Graphic Sciences. According to this hypothesis, the Graphic Sciences would not be configured as a single discipline with monolithic methods and univocally and preventively determined objectives, but rather as a set of fields of study with a non-unitary repertoire of interests" [Cicalò 2019, p. 29].

For this purpose, the conference adopted a suffix rather than a keyword which is at once also an extension: *-graphics*, indicating the nature of the subjects where attention would be focused and the domain covering the themes proposed for study and investigation. The suffix *-graphics* was proposed and refined according to multiple meanings and languages through organization into seven focus areas (-graphics for communication, -graphics for visualization, -graphics for description, -graphics for storytelling, -graphics for learning, -graphics for thought construction, -graphics for the project) in order to embrace the fields of architecture, design, representational creativity, the sciences, the arts, pedagogy, and psychology.

In confirmation of its strongly interdisciplinary nature, the conference was supported by the *Unione Italiana per il Disegno* (UID), the *Società Italiana Design* (SID), the *Società Italiana di Pedagogia* (SIPED), the *Associazione Italiana di Psicologia* (AIP), and the *Associazione italiana design della comunicazione visiva*

(AIAP). After the introductory welcome speeches by representatives of the university and department, the conference began with the opening speech by Enrico Cicalò, coordinator of IMG2019. Following this, the two days saw the participation of keynote speakers in the plenary sessions who are internationally recognized but tied to the Region hosting the conference, including Giuliana Altea, Plinio Innocenzi, Gavino Sanna, Baingio Pinna, and Giovanni Lussu, as well as a dense succession of talks in the three parallel sessions.

The call for papers and call for images, the latter an innovation of the second edition, was responded to by about 180 authors from 9 different countries. Of the 120 full papers received, a double-blind peer review led to the selection of around 70 for oral presentation in the thematic parallel sessions, to whose definition the authors themselves unknowingly contributed. In fact, the network of researchers on the programme committee understood the IMG2019 conference not only as a collection, albeit a scientifically relevant one, of papers and images, but as an exploratory research experiment. The goal was to try to define the body of knowledge surrounding a suffix, *-graphics*, therefore defining the knowledge as 'Graphic Sciences', through the method of gathering and analysing data in response to the conference call itself.

With regard to the call responses, the committee was therefore able to refine the suffix *-graphics* by defining six main fields of interest in Graphic Sciences, which were therefore assumed as themes of the parallel sessions: graphic thinking and learning; drawing, geome-

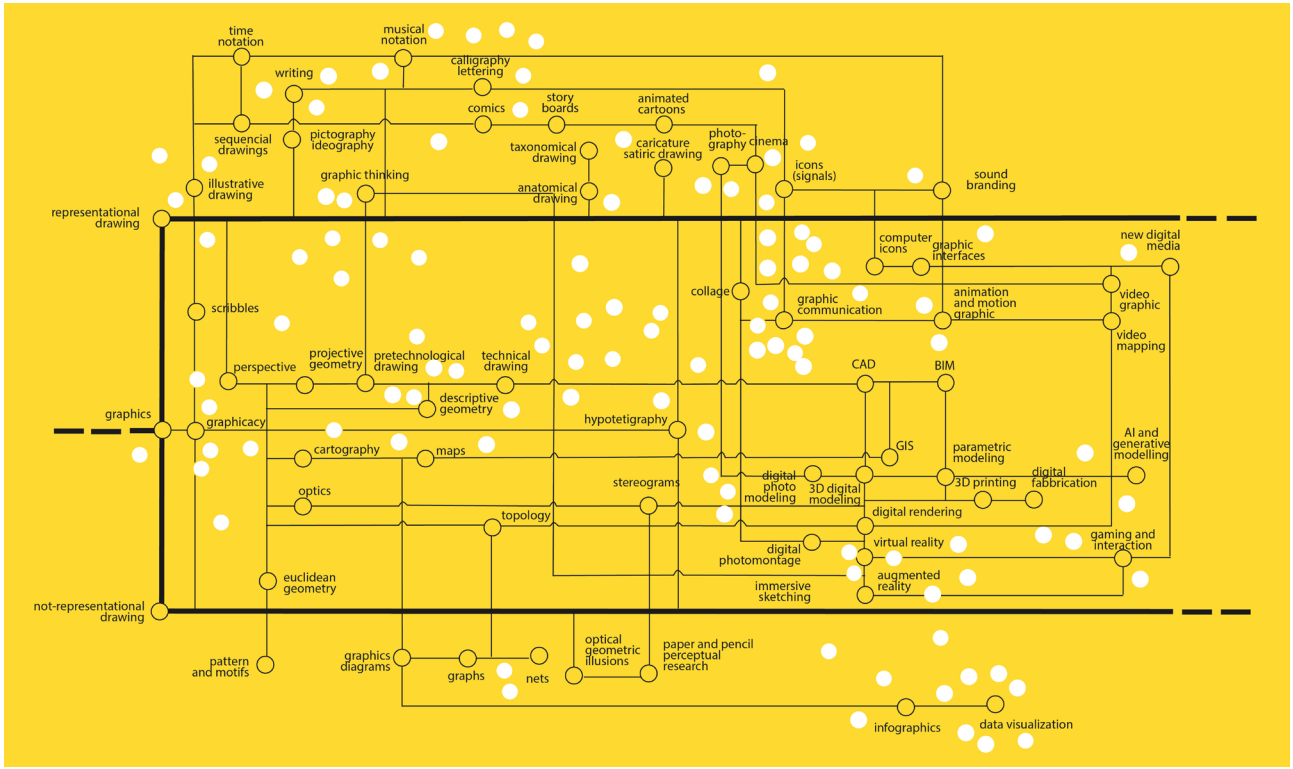


Fig. 3. The map visualizing the taxonomies of the fields and subjects of study of Graphic Sciences, developed by Enrico Cicalò based on responses to the conference call.

try, and history of representation; digital modelling, virtual and augmented reality, gaming; graphical languages, writings, and lettering; graphic communication and digital media; and visualization of data and infographic.
Starting with the themes, united in that they all pertain to the sphere of production, analysis, and interpretation of images in the various fields of application, the experiment made through the conference ended by visualizing the taxonomies of the fields and subjects under the study of Graphic Sciences. The result is a 'geography' of Graphic Sciences, which is at once a hypothesis for its genealogy, and which, inspired by Manfredo Massironi's graphical representation (fig. 2) could result in none other than a map, a diagrammatic image of the hypotheses about the Graphic Sciences of IMG2019 and a visual index of the conference (fig. 3).
The full papers were published in English by Springer and the article abstracts, together with the images sent in response to the call for images, were published on the online editorial and open access platform PUBLICA (publicapress.it). A selection of the best articles presented at the conference will be published in an extended version of the second issue of the scientific publication *IMG Journal* (img-network.it), inaugurated precisely for the conference and whose publication is expected in April 2020.

Author

Elena Ippoliti, Department of History, representation and restoration of architecture, "Sapienza" University of Rome, elena.ippoliti@uniroma1.it

Reference List

Cardone, V. (2016). Immaginare un'area culturale delle immagini visive. In *XY Rassegna critica di studi sulla rappresentazione dell'architettura e sull'uso dell'immagine nella scienza e nell'arte*, anno 1, n. 1, pp. 12-27.

Cicalò, E. (2019). Exploring Graphic Sciences. Esplorando le Scienze Grafiche. In *11 Convegno Internazionale e Interdisciplinare su Immagini e Immaginazione. 2nd International and Interdisciplinary Conference on Images and Imagination IMG2019. Book of abstracts*, p. 29. Alghero: PUBLICA.

Massironi, M. (2002). *The psychology of graphic images: Seeing, drawing, communicating. Mahwah*. New Jersey: Lawrence Erlbaum Associates.

Pinotti, A., Somaini, A. (2016). *Cultura visuale. Immagini, sguardi, media, dispositivi*. Torino: Einaudi.

Wunenburger, J.J. (1999). *Filosofia delle immagini*. Torino: Einaudi.

Wunenburger, J.J. (2008). *L'immaginario*. Genova: Il Nuovo Melangolo.

The UID Library

The UID Library

2018

Amoruso, G., Mironenko, P. (a cura di). (2018). *Ricostruire la bellezza. La rappresentazione per il paesaggio urbano storico*. Milano: Lampi di Stampa.

Argenziano, P. (2018). *J.M.W. Turner. Gandolfo to Naples. Disegni d'architettura e di paesaggio / Architectural and landscape sketches*. Napoli: La scuola di Pitagora editrice.

Avella, A. (2018). *Disegno di moda. Corpo|Abito|Illustrazione / Fashion drawing. Body|Clothing|Illustration*. Roma: Aracne editrice.

Belardi, P. (2018). *Macerie Prime. Ricostruire luoghi, ricostruire identità*. Perugia: ABA Press.

Belardi, P., Martini, L., Menchetelli, V. (a cura di). (2018). *1918-2018 Cento anni di memoria. Rilievo e catalogazione dei monumenti ai Caduti della Prima Guerra Mondiale in Umbria*. Foligno: Il Formichiere.

Bergamo, F. (2018). *Il disegno del paesaggio sonoro*. Milano-Udine: Mimesis.

Bianconi, F., Filippucci, M. (2018). *Icnografie Castiglionesi*. Santarcangelo di Romagna: Maggioli.

Bianconi, F., Filippucci, M. (2018). *Ortografie Derutesi. Rilievo, Catalogazione e progetto per il Piano del Colore di Deruta*. Santarcangelo di Romagna: Maggioli.

Bianconi, F., Filippucci, M. (2018). *Representing Complexity. Finding, Imagining, Drawing and Composing Landscape*. Santarcangelo di Romagna: Maggioli.

Bianconi, F., Filippucci, M. (a cura di). (2018). *Il prossimo paesaggio. Realtà/rappresentazione/progetto*. Roma: Gangemi.

Bistagnino, E. (2018). *Il Disegno nella Scuola di Ulm*. Milano: FrancoAngeli.

D'Uva D., D'Uva C. (2018). *I trabucchi, Macchine da pesca tradizionali tra geometria e tecnologia*. Berlino: Edizioni Accademiche Italiane.

Damiano, S. (2018). *Il moderno a Trapani: due esempi: la Casa del Balilla e la Casa del Mutilato*. Roma: Aracne editrice.

Empler, T., Quici, F., Valenti, M.G. (a cura di). (2018). *3D Modeling & BIM. Nuove Frontiere*. Roma: Dei-Tipografia del Genio Civile.

Giandebiaggi, P., Melley, M., Vernizzi, C., Bontempi, D. (a cura di). (2018). *Gli organismi religiosi nella trasformazione urbana. Analisi e rilievo nella città di Parma*. Roma: Aracne editrice.

Grassini A., Sòcrati A., Trasatti A. (2018). *L'arte contemporanea e la scoperta dei valori della tattilità*. Roma: Armando Editore

Pascariello, M.I. (2018). *Frammenti di Napoli / Naples and its fragments*. Napoli: FedOA Press

Pellegri, Giulia (a cura di). (2018). *De-Sign Environment Landscape City_ 2018*. Genova: Genova University Press.

Porfiri, F. (2018). *Cortili bolognesi tra spazio reale e spazio illusorio. La traccia del tempo che si manifesta attraverso la superficie*. Roma: Sapienza Università editrice.

2019

Amoruso, G., Salerno, R. (eds.). (2019). *Cultural Landscape in Practice. Conservation vs. Emergencies*. Cham: Springer.

Balzani, M., Minakshi, J., Rossato, L. (eds.). (2019). *Between History and Memory, the Blue Jodhpur. Experiences of integrated documentation and survey techniques*. Rimini: Maggioli.

Belardi, P. (a cura di). (2019). *Riflessioni: l'arte del disegno/il disegno dell'arte / Reflections: the art of drawing/the drawing of art*. Roma: Gangemi editore.

Bianchi, A. (2019). *Disegnare Oggi, Elementi di Geometria. Terza edizione ampliata con ombre / Drawing Now, Elements of Geometry. Third edition developed with shadows*. Santarcangelo di Romagna: Maggioli Politecnica.

Bianconi, F., Filippucci, M. (2019). *Landscape Lab. Drawings, Perception and Design for the Next Landscape Models*. Cham: Springer.

Bianconi, F., Filippucci, M. (eds.). (2019). *Digital Wood Design*. Cham: Springer.

Bistagnino, E., Falcidieno, M.L., Malagugini, M., Ruggiero, M.E., Torti, R. (a cura di). (2019). *Waterlines Sketchbook*. Genova: Genova University Press.

Buonfantino, F.F., Pagliano, A. (2019). *Disegnare un mondo migliore. Il Campus universitario di Oscar Niemeyer a Constantine. Dessiner un monde meilleur. Le campus universitaire d'Oscar Niemeyer à Constantine*. Milano: FrancoAngeli.

Calvano, M. (2019). *Disegno digitale esplicito. Rappresentazioni responsive dell'architettura e della città*. Roma: Aracne Editrice.

Castagnolo, V., Perfido, P. (2019). *San Benedetto a Conversano. Storia, rilievo, restauri*. Roma: Quasar.

Cirillo, V. (2019). *Riflessioni e suggestioni fra geometria e forma. Le scale del '700 napoletano*. Napoli: La scuola di Pitagora editrice.

Cirillo, V., Fiorillo, R. (a cura di). (2019). *Stranormanna. Concorso per il design grafico della medaglia*. Napoli: La scuola di Pitagora editrice.

Cocchiarella, L. (ed.). (1919). *ICGG 2018. Proceedings of the 18th International Conference on Geomtry and Graphics*. Cham: Springer.

Corniello, L. (2019). *Il disegno del Parco Reale di Tirana*. Napoli: La scuola di Pitagora editrice.

De Carlo, L., Paris, L. (a cura di). (2019). *Le linee curve per l'architettura e il design*. Milano: FrancoAngeli.

Farroni, L. (2019). *L'arte del disegno a Palazzo Spada. L'Astrolabium Catoptrico Gnomonicum di Emmanuel Maignan*. Roma: De Luca Editori d'Arte.

Ginex, G. (a cura di) (2019). *Reggio e i Miti della Magna Grecia*. Reggio Calabria: Città del Sole Edizioni.

Innocenti, S.M. (2019). *Navi di pietra*. Genova: Sagep.

Lenci, Ruggero (2019). *L'enigma dell'opera poligonale con blocchi concavi e il rilievo delle mura di Amelia*. Roma: Gangemi.

Luigini, A. (ed.). (2019). *Proceedings of the 1st International and Interdisciplinary Conference on Digital Environments for Education, Arts and Heritage EARTH 2018*. Cham: Springer.

Maglioccola, F. (2019). *La patria ritrovata. Le architetture degli italiani a Wuhan*. Napoli: Rogiosi Editore.

Malagugini, M., Ruggiero, M.E., Torti, R. (a cura di). (2019). *Emergenze ambientali e sociali. novi modelli di comunicazione visiva*. Genova: Genova University Press.

Marotta, A., Netti, R. (a cura di). (2019). *The Chappe Telegraph from French Revolution to Napoleone's Empire. Communication from war to peace. Il Telegrafo Chappe dalla Rivoluzione Francese all'Impero di Napoleone. La comunicazione dalla guerra alla pace*. Roma: Aracne editrice.

Mediati, D., Pazzano, S. (2019). *M.C. Escher in Calabria. Memorie incise di un viaggiatore olandese*. Soveria Mannelli: Rubbettino.

Papa, L.M., D'Agostino, P. (a cura di). (2019). *BIM Views. Esperienze e Scenari*. Fisciano: CUA-Cooperativa Universitaria Athena.

Parrinello, S. (ed.). (2019). *Digital & Documentation Databases and Models for the enhancement of Heritage*. Pavia: Pavia University Press.

Parrinello, S., Picchio, F. (2019). *Le Fortezze di Portobello e del Rio Chagres a Panama. Un progetto di documentazione per la tutela del patrimonio e lo sviluppo di Siti Unesco*. Firenze: Edifir.

Pellegri, G., Purini, F. (2019). *Di_Segno*. Genova: Genova University Press.

Ruggiero, M.E. (2019). *La rappresentazione nella cultura del progetto navale*. Genova: Genova University Press.

Ruggiero, M.E. (2019). *Waterlines Boundaries*. Genova: Genova University Press.