diségno

1.2017

english version

THE REASONS OF DRAWING

diségno

unione
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disegno

Cover
Superstudio, *New York Redevelopment. Extension of Central Park,* 1969, particolare.

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The reasons of drawing as narration

RUBRICS

Readings/Rereadings

Events

Editorial

Vito Cardone

The first issue of a scientific journal is an important event, especially when it has been awaited for years: if it is true, as it is, that the UID Statute provides for a publication whose characteristics, according to current UID Regulations, which dedicate a specific chapter to this topic, are those of a proper scientific journal. It is true that in our area a great ferment occurred during the last decade, after a long period that saw only the activity of *Disegnare. Idee, immagini*, the only journal that has continued to publish uninterruptedly since its first issue, in 1989. In 2006, the online, open-access journal *DisegnareCon*, which regularly publishes two issues per year, was founded and immediately met with great success among ICAR/17 researchers, to the point of becoming the second journal for number of published articles, submitted to the VQR 2004-2010 (Evaluation of Research Quality) by researchers of the aforesaid disciplinary sector.

Last year, after almost fifteen years, *XY*–the oldest Italian journal of the sector, being founded in 1986–resumed publishing thanks to internet (even if some paper-based copies are planned) and is now totally open-access. *XY digitale* immediately aroused great interest and the initiative is developing with great perspectives, in the context of a very complex project focused on studies of architectural representation and on the use of images in science and art. In the meantime, in Italy and abroad, several non-specialized journals came out, which gave great space or even monographs to the topics of our interest. All this is extremely positive, but not sufficient; especially when considering that, throughout the world, among the oldest and most important scientific societies of our area, the UID was the only one to not yet have its own journal. So, basically, *diségno* has been created to fill this inexplicable gap.

The project phase of the new journal has been long, and thoroughly meditated. It was developed, after the decision of founding the journal deliberated by UID's Technical Scientific Committee in November 2016, by a specific work group of the Committee itself, taking into account the numerous suggestions received from various colleagues after the announcement of the important decision. The TSC discussed the work group's proposals in several meetings, constantly approving them with ameliorative amendments.

In extreme synthesis, the approved project envisages an online, open-access journal with two issues per year, in Italian and in the author's native language (limited to French, English, Portuguese, Spanish, German), with a full English translation. Its direction, in the delicate start-up phase and in full respect of the UID Statute and Regulations, will be assigned to the president of UID: to give, with the greatest possible force, a sign of our commitment to realizing this absolute priority (as decided during last year's meeting in Florence) for our scientific society.

The Scientific Committee is made up of members of UID's TSC as well as several foreign scholars, in a number greater than needed for the journal to aspire to achieving the highest positions in the ranking of scientific journals, in an international perspective.

The foreign members of the TSC are researchers from various countries, in particular Spain, with whom we have stronger and more intense bonds, because the scientific and didactic activity they carry out is closer to that conducted in Italy.

A newsroom committee was nominated (according to Regulations) by the director, after a consultation of the TSC and, in conformity with international terminology, has taken the name of Editorial Board - coordination. It will benefit from the collaboration of a support group—named, in accordance with the aforementioned terminology, Editorial Board - staff—that will report to Alberto Sdegno and is made up by colleagues who, after the communication to all members announcing the beginning of the project, showed interest in offering their collaboration and confirmed it after the project's approval. I would like to thank them very much, because their contribution is precious for the life of the journal. The articles, excluding some written on invitation, will undergo blind peer reviews, with reviewers selected by the Scientific Committee from among scholars who carry out this function for conferences and journals of the scientific disciplinary area, the list of which will be published in each issue of the journal.

The new journal, being an organ of a scientific society, cannot be strictly themed; and not even, considering the development of new means of web-based communication, a general-interest bulletin. Instead, it must find, in an original way, its own identity characterizing it as an organ of the UID and distinguishing it from other Italian journals of the sector, with which it will have to create a true, balanced and collaborative network.

For this reason, it would be appropriate, even from an international perspective, to build a true network of scientific journals dealing with the area of graphic representation: each with its own identity and, if possible, without overlapping, but perhaps reciprocally integrated, covering as efficiently, continuously and completely as possible the vast, boundless space in which our scientific activity takes place. In this network, *diségno* must present itself as a journal that could–or that is meant to–be the reference for original as well as singular studies, that could hardly, if ever, find space in the calls of other journals. These, in fact, for their very nature, mainly embrace well-known topics that can receive several proposals and which are often attributable to applied research or to third parties. Instead, a journal such as that of the UID, differently, gives space to important but neglected subjects and promotes the cultivation of topics, as specialized as they may be, essential to the disciplinary scientific community: such as those linked to basic research or innovative teaching.

The project calls for the journal to be divided into themed and feature sections. The themed sections–theory, history, visual communication, research, modeling, project, survey, innovation, experimentation, applications, didactics, …–will not all be present in every single issue. The feature sections–'Editorial' by the director or an invited guest; 'Opening,' regarding an important event or interview, on invitation; 'Image,' a drawing or graphic work, proposed and commented by a researcher; 'Readings/Rereadings,' articles, not reviews, on books that have been or that can be particularly important; 'Events,' critical points of view on meetings/seminars/workshops carried out for local initiatives; 'The UID Library,' a window of editorial highlights, proposed by the editors–will, instead, all be presented in each and every issue.

Every year, one of the two issues, mainly focused on a specific but broad topic, will be published after an explicit call open to all authors, and will have a strong international character. Therefore, the thematic sections will host articles focused on the most significant experiences completed or

in progress throughout the world… in the world of graphic representation; in a like manner, the feature sections will privilege international books and events.

The other issue of each year, instead, will be dedicated mostly to reflections on the latest annual UID Congress. It will host, besides the feature sections—some of which will be linked to the Congress itself—articles for each of the event's Focuses: one, on invitation, mainly on the critical reading of what emerged from the Focus itself; and others that are the extended versions of some papers that, during the refereeing for acceptance in the Proceedings of the Congress, received the highest ratings from the referees and which, beginning with a new long abstract required of the authors of the papers, were invited to a new anonymous refereeing for publication in the journal.

This is what has been done for this first issue, dedicated to the 2016 UID Congress held in Florence in September of last year. The central part has been structured as previously specified, with introductions for each Focus—respectively by Marco Bini, Pilar Chías, Livio De Luca, Franco Purini—and the two most highly evaluated papers, as mentioned above, for each Focus.

The opening article is an extended version of Adolfo Natalini's speech following his being awarded the 2016 UID Gold Medal.

The 'Readings/Rereadings' section is devoted to the book *La figurazione dello spazio architettonico* published by Gaspare De Fiore in 1967.

The 50th anniversary of this volume is a fortunate coincidence, totally casual, but fully opportune, because if we were to have chosen an important book to launch this sector, there could not have been a better solution than this book, fundamental for our area, and not only in Italy. It has been written about by Andrea Giordano and Francesco Maggio, to whom I will return, but not before I have highlighted some general aspects needed to define the cypher of the work.

Starting from the analysis of the 'architectural fact' in its entirety—form, materials, constructive techniques—in the book we see great intuitions, or shared tendencies that appeared during the mid-twentieth century, on the mutability of the space of human activity over time, on architectural space, on its dimensions, on its enlargement to urban space. The division between science and art is denounced, in the area of the pernicious affirmation of the 'two cultures,' theorized precisely in those years by Charles Percy Snow, and they are instead tied together in a unitary discourse—the same that holds together technical and social evolution, architecture and painting, religious and philosophic thought—as perhaps none of us has been able to do, despite the interdisciplinarity that has become more a slogan than a consolidated positive practice.

The book is full of questions, to emphasize the primacy of doubt over absolute certainties; many of which are left without answers, but are raised almost to indicate future, important lines of research. It opens to studies on the concept of architectural space and its representation, on the peculiarities of methods of descriptive geometry, on the history of graphic representation, on drawing as a primary tool fundamental for architectural design.

With surprising courage, for someone preparing to found a scientific-disciplinary 'drawing' group, De Fiore shares his statement that: "architecture exists as something actually built, and as long as it is on paper or canvas, as long as it is only 'a drawing,' it is not architecture. […] Drawing is just a tool for architecture, it is the tool through which the architectural idea can be expressed" (page 9 of the book).

The book, with extremely dense notes, is more a starting point than a finish: one that ten years later would result in the constitution of the scientific community of graphic representation. In that sense, it totally demonstrates its age: because in it we see our roots as a scientific-disciplinary area; from this point starts the clear cultural and political project for the constitution of the scientific-disciplinary group, that De Fiore began in the following decade and presented in Santa Maria Ligure, at the First National Meeting of Teachers of Representation Disciplines held in May 1979.

Aware that we are living in the 'civilization of images', De Fiore focuses attention not only on traditional tools for drawing, from the *camera oscura* to the tools for perspective, but also confronts and questions the latest means of representation—that is, cinema,—highlighting its importance and the need of keeping up with technological innovation, in all its forms, and with the birth of new forms of expression and languages.

It is therefore a fundamental text for asking ourselves what we are and where we come from, for planning what we should be in order to stay in pace with the changing times and to continue dedicating ourselves, as De Fiore emphasized, to "all drawings."

The *diségno* journal intends to be one of the places in which these reflections can be developed. For this reason, the second issue of the journal, keeping in mind that 2018

will be a 'Mongean year' because it marks the bicentenary of Gaspard Monge's death, will be focused on the history of graphic representation.

It is a theme that belongs to us, that for too many years we have approached in a partial, fragmented and reductive way, focusing attention mainly on the evolution of the methods of representation of descriptive geometry, and not in its entirety. Perhaps the time has come to start a deeper study of the multiple and complex facets into which it is articulated: the fundamental passage for dealing with future scenarios. This represents the best tribute to the man who first, by tying together the threads of millennial practices of graphic expression and of multiple intuitions that have always remained as such, outlined an organic and forward-looking theory for the elaboration of graphic models.

Four Fragments on Drawing

Adolfo Natalini

Fragment 1. On Drawing

In 1954, I began sketching on a very regular basis, as if it were a task I had assigned myself, using the small Fabriano sketchpads with the blue covers. But I used to draw on any kind of paper, preferably on used paper (I used the back of drawing sheets found at school, old forms, and wrapping paper).

I drew my own hand, sketches of classmates, landscapes, portraits. By 1958, I had learnt to draw very well but I am no longer able to make drawings like those I used to sketch on old grey wrapping paper.

I began to paint, then I enrolled at the Architectural Faculty and at University, they taught me another type of drawing, precise and regular, which I had never been able to draw before. I learnt to keep my drawings and ideas in order, like books in a library.

The drawings of other people began to be part of my own. I started to use transparent paper, (tracing paper, butter paper, onionskin paper) to trace drawings derived from others, modifying them to create something new. Transparent sheets could be overlaid like the days of the week: I would have liked to preserve all the others within each drawing, and I hated to lose even a single line. Around 1964, I started to use spiral-backed sketchbooks. I have only kept a few of them, but I have one, dating from 1968-
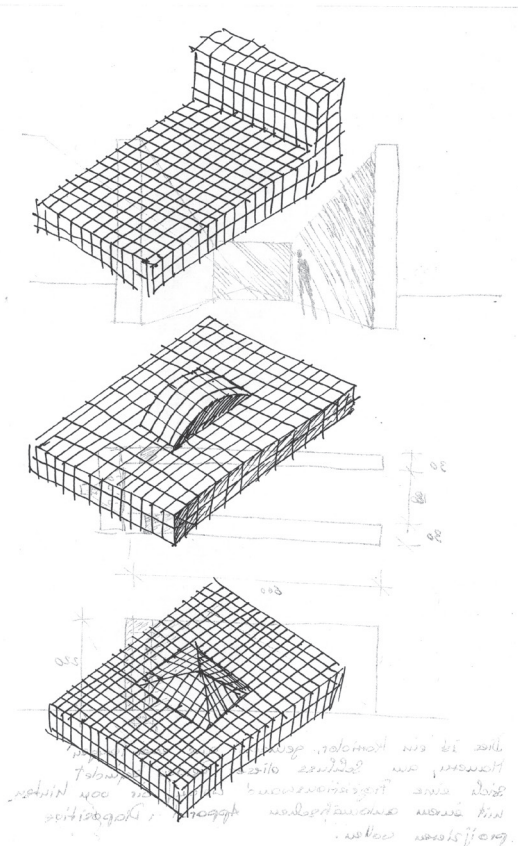
9

Fig. 1. Superstudio, Istogrammi, from Quaderni Neri, 1969.

69, with my first drawings of *Histograms* and the *Continuous Monument*. I also liked big checked exercise books with a hard cover: they were like registers in which I would mix writings, accounts and sketches. In my checked registers, I find a large number of schedules, jobs, drawings to do, letters and texts to write) and inventories (work and drawings I hoped to publish). The registers contained a kind of double-entry book-keeping system with a mixture of money, drawings and ideas.

In 1974, I began to use the "black hard-cover" sketchbooks: I bought the first books from Rowney in London and they were too beautiful to sketch in. They had hard black imitation leather covers and smooth pages in a light ivory colour. The pages were perforated so they could be detached, but I never removed even a single page… I have had them in various sizes: A4, half-size (booklet) and quarter-size (sketchbook). I tried using other sketchbooks covered in Florentine print paper: I loved the red and green covers, and when I made photocopies, the edges formed a beautiful decorative border… Then when I could no longer find Rowney books, I started to use Daler: the pages were not such good quality, but at least they were not detachable, so were not as delicate. Lastly, I bought Vang sketchbooks (that were Flying Eagle books manufactured in China, imported to Munich by Vangerow and then re-imported to Florence by Leoncini). I bought up a stock of them in case they ran out, and then I asked myself: but will I have time to fill them all? I used the *Quaderni Neri* like a portable studio that allowed me to work at home and when I was travelling, without unplugging the receiver from my source of ideas. So I feel that life has been one single uninterrupted workday. I numbered the sketchbooks and each page, almost always adding the date under drawings and writings to form a kind of illustrated diary. In my first sketchbooks I rediscovered the projects for *La memoria invece* (about objects, life, architecture) a series of works between art and auto-anthropology with which I concluded my avant-garde period with Superstudio and started along the laborious journey of my approach to architecture. Then I rediscovered almost all my projects from the studio in via San Galla and the Natalini Architects projects from the studio at the Salviatino. Almost, but not all, because now most of my drawings are on transparent sheets (A3 butter tracing paper) and when I travel (no suitcases only cabin luggage) I take smaller and lighter sketchbooks, lined *Quaderni Cinesi* with a black hard cover and red corners and spine. The projects are mixed with things I have seen: in books, in the mirror, in my rooms, in cities or the countryside. The *Quaderni Estivi* appeared in recent years (I started taking vacations in 1997), with coloured sketches and watercolours. The *Quaderni Estivi* are a blend of sketched figures, landscapes, and architecture, mixed in a kind of childlike contentment. It is as if the boundaries between different things have finally disappeared, like those between one day and another, or between a memory and a project, liquefied by the colours of summer like pigments in water.
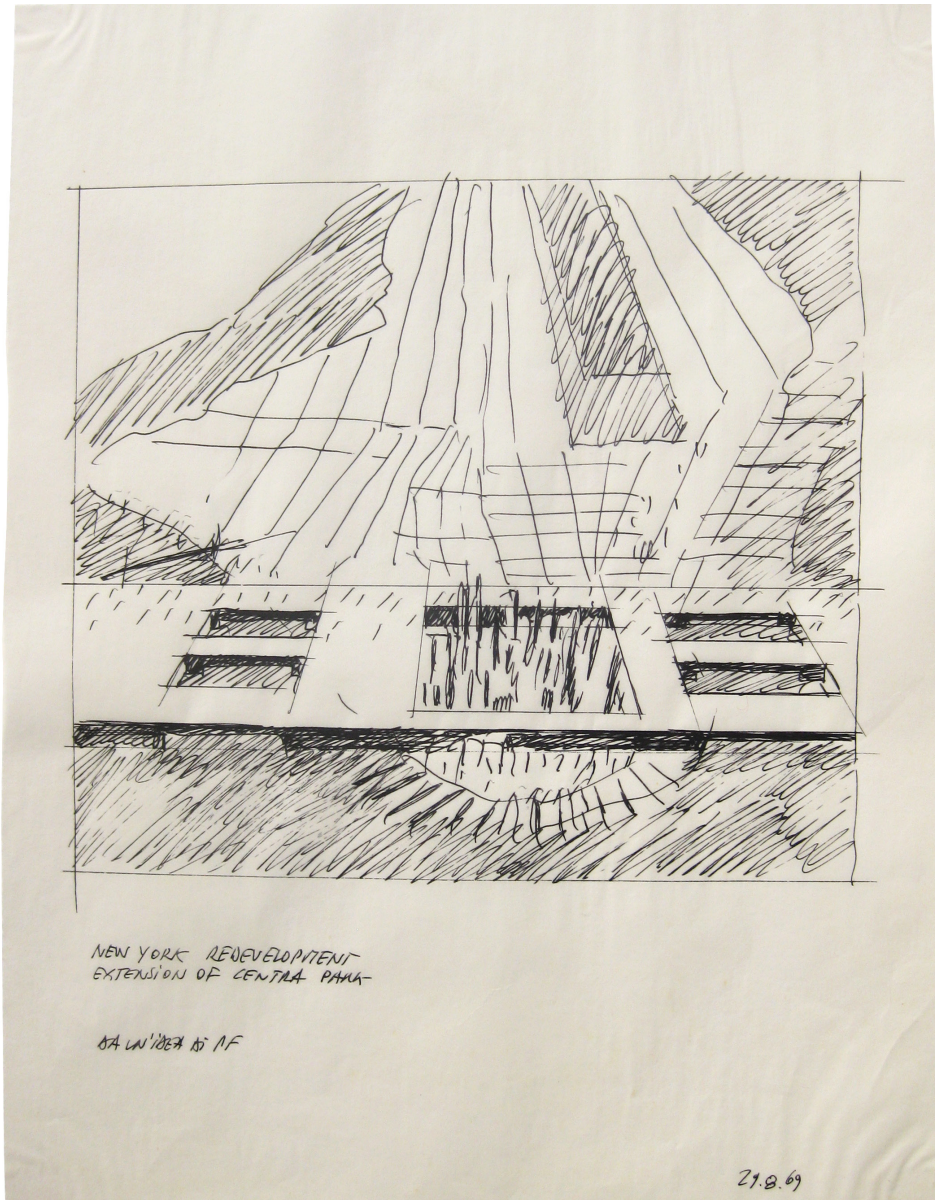
NEW YORK REDEVELOPMENT
EXTENSION OF CENTRA PARK

DA UN'IDEA DI MF

21.8.69

Fig. 2. Superstudio, New York Redevelopment. Extension of Central Park, 1969.

Fig. 3. Adolfo Natalini/Superstudio, Monumento Continuo in volo sul lago, 1969-2015.

Fig. 4. Adolfo Natalini, Addizione urbana a Doesburg, 1999-2015.

The sketchbooks (numbered like their pages) give a certain order to my thoughts, perhaps only a chronological order, but I feel it is the only kind possible, something like the authors in my library ranged in alphabetical order [2].

Fragment 2. My drawing

Drawing is the means that I find most suited to me: I have never been a theoretician and I never manage to pre-figure something in my mind without seeing it on the page, (I never remember any of my dreams except perhaps for some nightmare). I approach a project from several sides, each time engaging in a full body contact with the place, the program, and the limits. In this combat, all means are acceptable: a distorted view of poets and writers who have investigated the area , barefaced copying of what already exists, the chess knight's jump over the adversary, metaphors and allegories, the most efficient arsenal of local constructors to outflank enemy lines… The weapons I have available in this battle (which is more like Jacob's wrestling with the angel or a battle of love) are few, and among these, drawing is the most important. Drawing allows me to be a lot quicker, and at the same time, it forces me to stay rooted to the page and the project for long periods. I draw like a fisherman who casts his net and waits, or a farmer w ho works the soil, plants his seeds and waits… However, I certainly do not expect illumination or inspiration. (It has been a long time since I gave up on my Muses and they have indignantly turned their backs on me). But drawings produce other drawings, and these, other drawings again, and in this way, gradually the labyrinth appears and the project emerges. In short, the drawing leads me to the traces of the project, and while I am stalking the wild game, the project emerges (it is patently obvious that I am no hunting expert). Perhaps my marks are strong because I have a heavy hand (I have never been a refined artist) and the colours are intense because I use only a few bad quality pencils without much colour; the colours are deepened because I change my mind and correct mistakes (my pencils often go back over previous traces or I try to cancel them with new lines). In a certain sense, a project is an entire preliminary sketch of the construction (even though there are tons of executive drawings created with appropriate instruments) and the construction is only the preliminary stage for the life that will exist inside and around it… My lack of certainty always makes it difficult for me to finish a project; I keep working at

it even when it is perhaps too late: this explains the manual interventions that occur at every level and my preference for traditional type constructions that allow me to tamper even during construction on site [3].

Fragment 3. From the black sketchbooks without date of the '80s

If you ask me about drawing, like Saint Augustine I would have to answer: "I know until you ask me; when you ask me, I don't know". Yet. I have spent my life sketching and I cannot imagine architecture without images and figures, and these images become real only through drawing and construction. I have sketched a great deal. I have traced endless little marks and I have watched them line up on pages like tracks left by insects. I remember as a boy I lived near the sea and I would go to the beach to look at the tracks made by dung beetles that we used to call "shit-rollers"… When I lived in the country, after it had snowed, I would go and look for footprints left by animals. Years later, it seems that the marks I leave on these pages look like those tracks. I always have a whole arsenal of pens in my pocket (one fine, one thick) and an Indian ink pen, a soft pencil, and some coloured pencils (four) and even a white wax crayon to cover any disasters, and a mechanical pencil-compass combo that cost me a fortune. I am always afraid I do not have the right equipment… And I take along a sketchbook for sketching, and if I could, I would take another one for writing, and a load of other gadgets… Then maybe, with all this equipment… I don't draw or write anything at all. But I wouldn't like to risk forgetting some idea, if it should come to light… I have used sketching the way a fisherman uses a net. I have spent days weaving these nets, and many more mending them. For many long nights I have cast the nets, waiting until, like unpredictable twisting fish, ideas are caught in the net. I have used drawing like a hunter sets his traps. With the patience learnt from my farmer grandparents, I prepared the soil; with the steadfast patience of a farmer, I continued to work the soil day after day, even when it seemed that the season was not right for harvest. With the patience of a brick-mason, I laid one brick on top of another to build a curved wall, transforming it into an enclosure to collect my ideas.
Then I understood that it was precisely my obsessive operations that were generating these ideas, or rather, making them visible to the world [4].

Fig. 5. Adolfo Natalini, Groningen, 2015.

Fragments 4. From the black sketchbooks: late August 2015

If I look at my architectural works from the distance in which time and places have disposed them, I see them as landscapes and I can try to paint them, like a passionate amateur.

So I assigned myself a task for August 2015, a project of summer paintings, "architecture painted by my rather elderly self".
In the last series of colour images, the nostalgia for painting resurfaces and perhaps the circle, that was opened almost sixty years earlier, is closed.

Notes

[1] The text is published in Adolfo Natalini. "*Quattro quaderni*". *Dal Superstudio alle città dei Natalini architetti*. (2015). Firenze: FormA. It is here published by courtesy of the Editor.

[2] The *Fragment I. On drawing* is taken from Natalini A. (2002). *Giustificazione dei quaderni neri*. In Arrigoni, F., Natalini, A., Adolfo *Natalini-Disegni 1976-2000*. Milano: Federico Motta Editore.

[3] The *Fragment 2. My drawing* is taken from an interview by Pino Scaglione to Adolfo Natalini published in the review d'A of 1990, October 30.

[4] The *Fragment 3. From the black sketchbooks without date of the '80s* is taken from Santoianni, V. (2006-2007). Una conversazione con Adolfo Natalini pittore e disegnatore. Il Fuoco. Rivista poetica e civile, Nos. 12-13.

Maritime Theatre in Hadrian's Villa

Pedro Cano

Pedro Cano and the Maritime Theatre in Hadrian's Villa*

Emanuela Chiavoni

In 1989 the Spanish artist Pedro Cano [1] designed the stage set and costumes for a performance to be held in Hadrian's Villa in Tivoli. The play entitled *Hadrian's Memoirs: portrait of a voice* [2] was based on excerpts from the novel by Marguerite Yourcenar, interpreted by actors Giorgio Albertazzi, Eric Vu An and Maria Carta, and directed by **Maurizio Scaparro** [3]. Cano's very intense and meaningful painting of the Maritime Theatre in Hadrian's Villa is part of his 160 × 100 cm series of watercolours of Greek and Roman theatres and amphitheatres. Although the artist executed this particular painting in 2016, he had already painted the site many years earlier when he created a notebook of paintings of Hadrian's Villa and a series of twelve aquatints in which he included not only the theatre, but also other architectures in the complex. His interest in theatres developed during the journeys he has made throughout his life; theatres are difficult places to portray due to their intimacy with history, with the vicissitudes experienced by communities, art and architecture. In the first part of the performance focusing on *Hadrian's Memoirs* the public waited in front of the Maritime Theatre and only later entered the huge baths where the event took place. Although the painting faithfully depicts the architectural structure of the theatre, it is a personal artistic interpretation balancing measurement, force and geometric precision. The artist wanted to avoid creating a didactic image: his intention was to produce a neutral representation; he initially drew a sketch to study the light sources and define the chromatic contrasts between the browns and grey-greenish sky. He

had examined the most important parts of the shadows and analysed how, by projecting the sky onto the surrounding walls, the colour would have toned to a lilac-violaceous shade while in the more intense parts it was possible to achieve a very distinct reddish hue. Cano emphasised the columns in the foreground so that the parts to the right and left of the canvas would be more intense. The painting's perspective is precise and impeccable; the force with which its composition has been organised captivates the spectator, just like its architecture mesmerises visitors to the site. The round shape of the hemicycle and the water reflected on the columns and openings captures onlookers and recreates the impression of the embracing space. The very slight, geometric line of the railing reveals the enclosure, the enclosed space. The colours are elegant, precious and austere and there are many cultural citations and references to history. The conciseness of the details, for example the marble columns, contains the essence of the architectural order, its plasticity and severity. Cano uses an intense, disciplined method to hatch and paint the various parts. Every pattern is filled with content, nuances, traces, and interlocking elements while the seemingly casual brushstrokes are the end result of skilful expertise and a strict geometric discipline. The use of brushes and the ensuing vibrations turn the painting into a powerful, informative means of expression. Shades of greens, browns, ochre and black; everything collaborates organically to empower the painting. The lightly sketched objects take on a complete form because every small, proportioned, and well-drawn part recalls what's miss-

ing. This is the incredible power of the watercolour technique, so loved by architects because it gives them the possibility to rapidly create coloured areas, recording not only what is visible and tangible, but also what is invisible and implied; it clarifies the details and complex links, and Pedro Cano takes this technique to the highest levels of embellishment and subjective complexity. His brushstrokes study matter in order to discover the points and planes where light meets essence and reveals the organic nature of the volumes, alterations and even the diverse stratifications of the architecture. The technique exploits layers, superimpositions and omissions; the rapid spreading of colour merges with the transparencies, the games of light and shadow, and the mysterious atmospheres. The painting reveals the tonal variations between the parts in the foreground and background; the colours coagulate into blemishes, the elegant graphic effects sometimes ripple and shatter and at times look like spray. All onlookers objectively and personally interpret the image; everyone puts into the painting their own critical ability to select, summarise and construe, and so everyone completes their own interpretation. The painting conveys the balance that is inside the image that goes beyond what is actually depicted.

Notes

[1] Pedro Cano Hernández, a Murcian painter, is one of the most representative artists of Spanish pictorial realism on the international stage. His works, created using every kind of representation technique, have always been characterised by strong artistic expressivity, but with the versatility of a plastic artist. His works are closely linked to the Spanish landscape of the Murcia region, but with an obvious interest in Mediterranean light and the portrayal of the atmosphere of places. His famous travel notebooks, true caskets of ideas, are magnificent drawings that narrate the story of fantastic journeys and communicate creativity, balance and harmony. Pedro Cano is a self-taught painter who began to paint at the age of ten; he studied at the Real Academia de Belles Artes de San Fernando de Madrid and then at the Spanish Fine Arts Academy in Rome. He lives in Spain, Latin America and the United States and has exhibited all around the world. He is a member of the Real Academia de Bellas Artes de Santa María de la Arrixaca and King Juan Carlos has honoured him with the Encomienda de l'Orden de Isabella Cattolica. Since 2013 he is a member of the Accademia dei Virtuosi del Pantheon. In 2010 the new Museo y Centro de Arte de Blanca (MUCAB) was inaugurated in Blanca, his native city, and dedicated to him. The Foundation hosts his works and continues to promote an international artistic, cultural debate.

[2] The French novel by the writer Marguerite Yourcenar, published for the first time in 1951, was awarded the Prix de Critiques. The book describes the life of Publius Aelius Traianus Hadrianus, emperor of Rome in the second century; its new and original text is written in the first person singular, in fact it takes the form of a letter written by Hadrian in which he describes his private and public life.

[3] Pedro Cano repeatedly visited Hadrian's Villa with the director to choose the best place for the various scenes and to be inspired with the design for the costumes. The idea was to create a minimalist stage set and, for the first part of the performance, build sand-coloured tiered seating for the spectators. The public arrived before sunset and was urged by the musicians and actors wearing Roman masks to sit on tiered steps in front of the huge baths. In the second part of the performance the spectators faced the Canopus and were seated on a stepped, dark green platform on the left side of the lake. A wooden raft painted with concentric circles to create the impression of drops of water was positioned in the centre of the Canopus. The earthy colour of Hadrian's Villa inspired Cano with the colour of the actor's costumes making them look as if they rose out of the earth like columns or architectural objects. Only Antinous wore different coloured clothes: a bluish white tunic and a red velvet cloak with black stripes which Giorgio Albertazzi wore at the end of the first part of the performance when he pronounced Marc Anthony's monologue from Shakespeare's Julius Caesar.

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THE REASONS OF DRAWING

The reasons of drawing
as an instrument of study and approach to knowledge

Critical problems and interests that surround the speculative application and use of Drawing are an essential part of "knowledge" that makes the 'built', either manufactured or natural, be construed and understood, in its original relations and ramifications, in the "apparent form" and in the logical and geometrical transformations that can be found in the relationship between the intent of design, the matter and the measure. Such prerequisites deliver the practical purpose of cognitive analysis, in which drawing, as a conceptual and instrumental scientific tool, is considered to have the univocal, consistent power to set the parameters of work, in specific areas.

Considerations on Drawing as a Representation of Space and an Approach to Knowledge

Marco Bini

The values of architectural drawing are multiple: the most immediate is that of drawing as a means for the realization of a work, but perhaps the most important is that of drawing as an instrument for the comprehension of shapes and of the space that is determined by how they follow each other and change.

Indeed, anyone who does not draw cannot recognize and remember, or even understand, the shape of objects, of architecture, of the urban environment, of the territory. I agree with Riccardo Migliari, who wrote: "Therefore, whoever does not draw cannot understand space, nor what it means 'to comprehend space,' and consequently, whoever does not draw cannot even understand the role of drawing in the formation of this intellectual ability

that is so important to the work of an architect" [Migliari 2000, p. 6].

Even Johann Wolfgang von Goethe basically stated: "what I did not draw, I did not see" [Goethe 1875, p. 69].

A large number of papers were presented on this subject at the recent congress in Florence entitled *The Reasons of Drawing. Thought, Shape and Model in the Complexity Management* [1], where one of the issues addressed regarded drawing as a representation of space and an approach to knowledge.

The topics touched on many aspects, ranging from speculative theoretical considerations to formal geometric interpretations, from digital methodologies and graphic codes to three-dimensional evaluations of numerous

monuments, from the role of sketches to augmented virtual reality. Through experimentation on concrete issues, several contributions sought to clarify the terms 'drawing' and 'representation,' establishing what is the possible and proper value to be attributed to them, but rarely do they venture into the vast field of semiotics, which is another interesting point of view from which to treat the topic and to which new lines of research should be dedicated. But it should be remembered, in resorting to the explanation given by Giovanni Klaus Koenig, that the term drawing denotes and connotes "a homogeneous group of images traced or reported on a two-dimensional surface" [2], on a drawing pad but also, in the light of the instruments available today, on a computer screen. Again Koenig, more than half a century ago, in his lectures for the course on *Elements of Architecture and Survey of Monuments*, as Italo Gamberini's assistant, proposed a very effective comparison when he asserted that architects have always used drawing as a mediated means of representation of a predicted and hypothesized reality: "an architect draws something that, at the very moment in which he draws it, exists only in his mind; and that, due to its complexity, needs to be studied, criticized, reworked, deepened, possibly transformed, reduced or expanded before its real execution" [Koenig 1962, pp. 8, 9].

Many speakers at the conference dealt with the complexity of drawing; among them, Antonella di Luggo argued that: "In its different expressions, such as sketches, technical drawings and survey drawings, a representation appears as a tool able to replace reality, and to communicate it although absent, by virtue of the correspondence between reality and representation, where the latter has the role of a story made by signs and a graphical text translating the constructed reality into a new language, which assumes and transcribes its meaning by discretizing its parts and elements, according to an order of artifices different from mere perception" [3].

The analysis of the relationship between image and mind was resumed, among others, by Andrea Casale, when in his report he emphasized the role of perspective that "due to its particular condition of comparing two identities, the artist's self with the viewer's self", takes on a double meaning: on the one hand, as a means with which "to realize the copy image of reality able to recreate the illusion of a phenomenal vision," while on the other, as testimony of a mental process that sees the "depiction as an application of thought" [4]. Horacio José Gnemmi

Bohogú stressed the connection between image and the drawing of ideas, particularly referring to the value of representations in the process of studying architecture [5]. However, at times it is difficult to distinguish between drawing and idea, when ideas merge with architectural drawing [6]. The study of drawing techniques and theories then becomes a means of research, an object of study and, at the same time, a critical and interpretative tool [7].

The meaning of the word 'representation' is certainly wider than that of 'drawing': it is possible to represent something that has taken on a precise form, be it an idea, a project, or any built environment. In the last few years this theme has been widely discussed. We can briefly say that a project is 'drawn' while its definition is being studied and that the final forms can be 'represented': drawing composes, assembles, summarizes, while representation decomposes, decodes, describes [8].

Drawing actually becomes an interpretation of reality beyond the graphic mark and gives evidence of the cultural background upon which it is developed, and because of which it acquires particular formal features. On this subject, Luigi Cocchiarella asserted the cognitive primacy of the image, especially for architecture, engineering and design, as well as its aggregative role inside complex informative structures, emphasizing how drawing is "a privileged field of symbolic or metaphorical synthesis, facilitating the dialog among operators with various specializations."

In this sense, drawing also offers effective access gates to systems of knowledge traditionally based on non-iconic languages, together with extraordinary opportunities for the dissemination of knowledge. We must act on these levers in both research and education, especially in those intrinsically interdisciplinary contexts such as architecture, engineering, and design, also "keeping in mind the need for welding tradition and innovation" [9].

Another contribution to this topic was given by Fabrizio Gay and Irene Cazzaro, who, in several interesting considerations, stated that the aim of drawing is "to give the most effective expression of the 'figural geometries' of visual objects (natural or unnatural)." In their paper, two developing lines of this discipline are suggested: the first is directed towards the definition of a "notion of 'figural geometry' of bodies that can be divided into a figurative level (iconic and analogical) and a plastic level (gestaltic and mereological);" the second is addressed to the study of "new 'shape' categories, more suitable for understan-

ding large aesthetic artifacts –from cities to ornaments– coming from several models of morphogenesis, especially those of Turing and Thom" [10].

There is no need to disturb communication philosophers and theorists to understand that drawing is formative, because of its particular feature of being a conceptual, rather than instrumental, category. For this reason, drawing, having the ability to rigorously correlate image to shape, must be set in the general context of the world of geometries, establishing a connection with the history of thought and architecture.

Therefore, we must consider, as grounds of every reasoning, the persistence and the immateriality of the effectiveness of geometrical studies in the process of developing a mentality that is suitable to conceive and appraise events in space. Besides, this effectiveness is not compromised by the abundant aids offered by infographics, now prevalent in the world of architecture and design through the complex forms of graphic communication.

The representation of three-dimensional space on the surface of a sheet of paper for obtaining a sensation of depth has always been, to man, one of the main problems to solve. The search for geometrical or mathematical methods of representation, to make spatiality more suited to the reality of vision, is a theme on which we must work, as well as a subject of intense reflection. As an example, the studies of Matteo Flavio Mancini, who suggested a methodology that can measure the impression of apparent depth achieved by painters in their works, an experience that confirms the power of analysis, comprehension and discovery of the instruments of synthetic representation [11].

Architectural representation and architectural drawing are thus the most common intermediary in approaching a real building. Antonella di Luggo took this subject up again in dealing with the graphic production of architect Gino Avena, who worked in Naples from 1930 to 1960, because of his particular attention to the representation of architecture and to its way of appearing in the urban scene: "Architecture makes use of drawing during its construction process and in the ways in which it appears, as representation implicitly establishes an analogy with reality, by accompanying architecture in the different phases of its development, starting from its initial idea, through its 'designing,' up to the precise definition of its constructive aspects and far beyond its realization, because, once built, architecture still uses drawing to tell itself" [12].

With this attitude, Giuseppa Novello, during her speech at the congress, underlined the value of direct reference to graphic documents, observed in their original materiality, because sharing knowledge through drawing "is an art that requires intelligence and sensitivity; it also qualifies other processing modes, supporting, testing, challenging them, but it may be considered a powerful ally in the technical field."

Although the temporal and cultural distance between nineteenth-century engineering and the current one is great and the comparison with today's practices may appear risky, however, conceptually considering the opportunities offered by the most advanced digital methods for project management, the references suggested by Giuseppe Mosca's drawings are anything but nostalgic: "their lesson is up-to-date and, if properly understood, might propose unexpected outcomes" [13].

It is unquestionably necessary, therefore, to associate the idea of space with the subject of architectural drawing and to take into consideration the geometrical approach that permits comparison, evaluating the problem of the relationship between Euclidean geometry, 'the geometry of the mind,' and projective geometry, 'the geometry of the eye' [De Rosa 2003a; D'Acunto 2004].

I think of the studies on Platonic solids conducted by Lucio Saffaro [14], who has always been so fascinated by three-dimensional geometry that he investigated the studies carried out by the great mathematicians of the past; he realized various paintings with regular and semi-regular solids, setting out on a path of research that, through philosophy and metaphysics, examines the representation of inaccessible realities, which, using rigorous geometries also leading to a perceivable and real structure, never become tangible.

During the Middle Ages these principles of control were not found in drawing, but in mathematical geometric procedures: operations of juxtaposing areas, preconceived alignments and dimensioning, ruled construction according to a series of mechanical steps whose validation and control apparatus was totally delegated to the mathematical and geometrical Euclidean moment. That is the reason why the issues concerning the world of architectural conception have always been linked to the genesis of shape, showing particular interest in geometry and numbers considered as prototypes of ideals, as symbols of a highest order. Indeed, geometry has held a role as a powerful instrument for the comprehension, description

and modeling of architectural space, thanks to its nature of being a conceptual tool, founded on formalized theories and, as such, linked to a system of rules, proving to be a successful means for describing the origin of the forms and figures of architectural construction.

Graphic analysis is a very effective instrument through which it is possible to examine a drawing, searching for its geometrical matrices.

This is what Michele Russo proposed in his study of the façade of the Monza Cathedral, in which an integrated experience of architectural survey, photo-modeling, photogrammetric reconstruction and geometrical analysis is shown: "In particular, the methodology adopted, based on UAV photogrammetry and image-based modeling, allowed the creation of a metrical, high resolution orthoimage, which has been used as reference for creating façade drawings, supporting the following material and diagnostic analysis of the wall. […] This latter aspect pointed out some specific features that are not visible at first sight, confirming that drawing, in its different meanings, remains an irreplaceable instrument of study and analysis" [15].

In the survey of the helicoidal staircase in Caprarola, Leonardo Paris searched for the formal matrix and the geometry that had guided the realization of the project [16]. Similar considerations were presented by Fabrizio Agnello and Mirco Cannella, who underlined how the geometrical analysis of the whole group of volutes in the tree of life in the southern porch of the Cathedral of Palermo reveal a very sophisticated overview involving decoration and the architectural framework [17].

Aiming to define a typological classification of the Ionic volutes found in architectural treatises dating from the fifteenth to the seventeenth century, Veronica Fazzina investigated the geometrical rules for their construction [18]. Geometrical rules at the base of project design were also the aims of research by Laura Aiello in her studies on Le Castella, after a careful historical and archaeological analysis on the basis of which to carry out the survey that became the object of geometrical and constructive reasoning.

The next step the author proposed was the association of conventional drawing to tactile drawing, whose essentiality and need of clarity lead to careful considerations about the work: the realization of bronze or wood models with the demarcation of the macro phases of construction, originally intended for a limited number of users, such as the visually impaired, has made even more immediate the understanding of very specialized data, made accessible by the immediacy of the materiality of the models adopted. The author claims that "after having made an autoptic analysis of the masonry works and codified their temporal relationships according to the classical methods of archaeological studies" it is necessary to entrust color with "the function of rendering the relative chronology of the walls immediately understandable" [19].

In the past, as well, the control and management of spaces was often left to a model (made of wood, plaster, etc.), often in reduced scale, which for the master builder was an example to follow directly on the worksite, so that the model grew as the construction works progressed.

Today, spatial management, or rather, spatial dynamism management, is resolved by the use of digital models and by the introduction of augmented reality.

Like many others, Guido Guidano and Carlo Battini also dealt with this topic, emphasizing that "the dissemination of knowledge about cultural heritage is the first step towards its preservation and, at present, virtual reality proves to be an effective tool for achieving this goal. [...] The direct experience and knowledge of a piece of architecture enable us to recognize its value and, therefore, to establish a good strategy for its preservation. The more intense the experience is, the more powerful the perceived need to preserve architecture will be. In this sense, immersive virtual reality allows the creation of processes of knowledge even without a specific technical preparation" [20].

Indeed, Andrea Giordano and Chiara Nichele also affirmed that multimedia tools "allow an easier approach to a work of art according to various levels of fruition: depending on the user, on his age as well as his grade of relevant experience, one can choose a visual, terminological and communicative language of the maximum effectiveness. It should be pointed out that this differentiation is made only to provide a hierarchical structure to information, and not to 'alienate' the less experienced user" [21]. Drawing architecture, from a certain moment on, has always been a direct method of study; drawing was the training ground of Architecture. Drawings were an abacus of composition and formal solutions that were important for being able to draw an observed object coherently. Alberti claimed that: "I have examined every ancient building that could be important in any respect, I

have examined them in order to obtain useful elements from them. I've ceaselessly ransacked, inquired, measured, sketched every possible contribution that wits and human industriousness offered me" [Alberti 1782, Libro VI, p.117]. Emanuela Chiavoni, Francesca Porfiri, Gaia Lisa Tacchi joined this line of research with a paper aimed to gain knowledge, by means of drawing, in all its different meanings, of the Palazzo dei Tribunali court house in Via Giulia, designed by Bramante in the early sixteenth century and only partially completed, and whose only trace is an impression left on the ground: "a few fragments remain of the massive and imposing rustication that distinguished its base" [22].

Vincenzo Cirillo's paper was in line with the previous idea and, through the cognitive function of drawing and of geometrical-structural analysis, interpreted the configuration of the staircase inside Palazzo D'Afflitto in Naples as an intervention of eighteenth-century embellishment. The perceptive study of the stairway to dynamically narrate space is interesting [23].

Francesco Maggio's work aimed to investigate a project, that of the Hôtel particulièr by the De Stijl group "which, in the existing bibliography, remained in the fixity of its representations and was never explored with the instrument of drawing, that is an interpretative and critical act of architecture involving, translating and transcribing the idea" [24].

Drawing for the purposes of measurement belongs to the area of so-called scientific surveys, because of the search for an ever-less-mediated objectivity. This need revealed itself in the mid-eighteenth century, when, to conciliate obedience to tradition with the new rational spirit, experts tried to structure, with philological precision, the contents of tradition itself, defining its methods of imitation with great precision. A great number of contributions have arisen since then, particularly by those aiming for a scientific reconstruction of the classic heritage: some examples are the atlas of *Ruins of Palmira* by Robert Wood, or the following *Ruins of Baalbeck* by the same author and the study entitled *The Antiquities of Athens* by James Stuart and Nicholas Revett, where they proposed surveys of Athenian monuments done in 1750, as well as many others. The success of architectural survey continued throughout the whole nineteenth century, as the plates by Paul Letarouilly, among many others, prove. He spent his life surveying Roman architecture, arranging a documentation that, in spite of some inaccuracies, constitutes a landmark for a subject that is still today not marginal.

These are only few examples useful to clarify how measured drawing has been, and is still today, the primary objective for the dissemination and study of architectural models. This dissemination has not always had only a scientific or cognitive nature. Just think of the role of *Ricordi di Architettura* [Bini 1990], printed in Florence between 1878 and 1900, where the divulgation of collective typologies of architecture or the extensive documentation of bourgeois and *petit bourgeois* building is functional to an exact political and economic period. A propagandistic instrument of professional success, strengthened by the direct comparison made using surveys of appropriate monuments or ancient architectural elements.

This does not detract from the subjective validity of the published drawings, that remain, having lost their original significance, a valid means of gaining knowledge for modern scholars, thanks to their careful execution and reproduction.

The wealth of surveys published has greatly increased in the last decades, due to the development of architectural and historiographical publications and to the improvement of the quality of the measurements and graphic restitutions.

In fact, nowadays automatic drawing and instrumental survey can provide documents that are very dimensionally reliable and graphically normalized, which ensures ease of recording and comparison. Electronic data processing enables us to digitize and memorize a huge amount of elements, so as to permit cross-comparisons which in a very short time can give us information that otherwise would only be available with a great waste of time and energy.

Alfonso Ippolito and Martina Attenni, starting from studies on lost archaeological heritage and the relationship between text and image that results from three-dimensional modeling, supported the appropriateness of using digital archives that "can affect the divulgation of information, not always disseminated on a large scale because of space and costs. [...] The application of all innovative technologies ensures the possibility to exchange objective data that are open to further interpretation" [25].

Today the dimensional component of architectural survey drawing can be easily investigated by the means at our disposal. Both the knowledge of the evolution of the way to tackle the problem of representing built architecture and the modern techniques available to the

draftsman-surveyor are aspects considered in many papers presented at the congress. But there are also other components that interest an architect during his dealing with the object to be surveyed: the volumetric-morphological, environmental, material and chromatic features.

Many contributions addressed this subject, although the graphic results of a survey are not always originally analyzed and considered: "In particular, survey always results as being the most common topic of our applied research, together with modeling, to which it is often associated for reconstructions of buildings and urban contexts […] but also –and unfortunately, on a great scale– as technicians who carry out surveys and restitutions and little more, without significant differences and specificities compared to other scientific-disciplinary areas. This is a limit that must be surpassed" [26].

Drawing is not always used in every situation to read and then to represent the existing reality and to verify the design, employing drawing as a means of critical analysis. In some papers, survey drawing is at the base of a critical reading supported by historical-archival and iconographic sources. Following these procedures, Alessandro Bandinelli, Marco Giorgio Bevilacqua and Ewa Karwacka were able to obtain a good level of knowledge of the Charterhouse of Calci [27].

In realizing survey drawings, we schematize and make choices, but we cannot stop with the perception of an object, we must explore its peculiarities and characteristics extensively; in this way, we will be able to get closer to its global understanding, though aware that we will never reach it.

This aspect of surveying must be pursued if we want our works not to be the mere acquisition of graphical and instrumental techniques, but a cultural growth and thus an ability to evaluate not only the dimension of architecture, in the sense of measurements, but even its dimension as a continuous connection between man and his way of being in space.

Then making a survey drawing will mean investigating these aspects, and connecting them to each other, understanding how much contents are important for understanding their many characteristics.

It will thus be possible to retrace most of the steps the designer took, from the ideation to the realization of the work and to any following modifications. This is what José Antonio Franco Taboada wanted to show us through the study of Alvaro Siza's drawings; according to the

author, the architect's travel sketches can be seen as a graphic document of inestimable value when we intend to study and understand the creative process that gave birth to architecture, establishing an inner path of project design [28].

Piero Sanpaolesi, recognizing survey as the only valid instrument for a full and thorough awareness of the spatial values of architecture, a knowledge proven through many years of work in the field of restoration in Italy and abroad, rightly wrote many years ago: "from this point of view a good survey is identified with the history of the building, it reflects the chronological and formal stages and verifies the formal diversities, it emphasizes the temporal sequences and records their anomalies, it clarifies static reasons and encloses, in a small space, in plain sight, their shape" [Sanpaolesi 1973, p. 62].

In addition, the building's texture and history can be read with a careful survey which, besides measurements, takes into account the messages that the stone document holds. Cecilia Maria Roberta Luschi reminded us of this feature, noting that in survey projects, graphic symbols used on ancient walls, including stonemasons' marks, have often been neglected: "instead, taking into account all the symbolic corpus distributed on masonry structures, the graphic outcome of a survey project is enriched by data that can influence judgements and provide ideas about the building being studied and the organizational method of the execution phase" [29].

On the other hand, drawing, in this operation of synthesis and choices, as already mentioned, is not only 'representation of elements with visible marks on paper," as in ordinary usage, but "thought, intention, project, plan." We could continue with the words of Quaroni, who defines drawing with "the dual meaning of invention-design and of graphic operation for the construction-communication of the invention itself" [Quaroni 1977, p.32].

When applied to graphic processing of survey restitution, the term drawing, in my opinion, does not fundamentally change its meaning: indeed, reversing the two definitions we have 'design of the invention' and "communication of the construction" with the meaning, in the first case, of individual reasoning of the operator-architect in search of the thread of the story, the motivations, the mechanisms, and in the second case, the communication of information to others about the contents acquired by the operator-surveyor.

These considerations are not new: they have been made by architects and artists ever since the Renaissance,

when survey was considered an irreplaceable instrument of knowledge. This is widely testified to by Vasari in his Vite when he refers, for example, to the activity of Brunelleschi in Rome between 1402 and 1407: "And so, having set out to measure the cornices and to draw the plans of those buildings, he and Donato persisted, sparing neither time nor expense. There was no place in Rome or elsewhere in the countryside, that they left unvisited, measuring what they thought good for their purpose" [G. Vasari 1568, p. 299]. And even when he tells about Ghirlandaio "portraying the antiquities of Rome, arches, baths, columns, colosseums, obelisks, amphitheaters, aqueducts, he was so good at drawing, using only his eyes, without a ruler, or sextant or measures" with considerable accuracy, as later the masters confirmed through verifications "after his death" [G. Vasari 1568, p. 476].

Architectural drawing is still undoubtedly the first vehicle of communication of artifacts in their present state, in the possible formal interpretations and in the process that organizes the future construction; especially now that digital technology allows three-dimensional calculations of effective technical and visual impact.

Pierpaolo D'Agostino focused on these topics, identifying the margins of adequacy of digital tools for supporting graphic representation, and how these new forms of communication relate to technological and cultural innovations, and how not only a lexicon is missing, but there is not yet even a basic grammar [30].

This topic was resumed in the report of Renata Pinedo Valdiviezo, who pointed out that the current technological tools have dehumanized graphic information, because the hand, and thus the pen, is not the direct extension of the brain [31].

The technique of drawing, at least until a few years ago, is essentially directed to the formation of images in which the values of the point and, above all, the line, are dominant. This has come about thanks to the peculiar characteristics of the means of expression, for instance pointed tools for writing or drawing such as pencils or pens. Today, interest has gone beyond and shifted mainly to the study of surface and volume. Numerous authors were interested in the graphic results of three-dimensional survey, proposing descriptive digital models of architectural artifacts as a means of mediation between reality and its representation.

The ability to automatically create technical graphics evidently frees resources that can be devoted to the development of ideas and approaches to research.

Many explanations have been given in recent years on the role of information technology, particularly in the field of architecture: on the one hand, for its role in infographic drawing, a true technical innovation to which, within a few years, all architectural and engineering firms have had to adapt; and on the other hand, for its potential in the field of three-dimensional modeling that truly represented a revolution in the field of representation for having introduced, next to the two-dimensional graphical model, a typical product of descriptive geometrical elaborations, and to the physical model in wood, cardboard, metal, etc., a new model that allows users to operate and apply spatially, with great speed and high geometric precision, procedures capable of visualizing environments and even moving objects.

All this precisely for the fact that what previously could be developed only with manual operations and careful reasoning, now can be done better and in less time automatically, generating virtually investigable models from which to produce, with simple commands, the canonical projections of the object such as plans, elevations, sections, axonometric views, perspectives, but also shading and shadows as well as chiaroscuro effects and other particular effects.

The research team coordinated by Fabrizio Apollonio and Marco Gaiani addressed the issue of digital visualization as a representation of a past that no longer exists, presenting a study case as an expression of a methodology that aims to combine informational aspects with scientific precision. The proposed methodology intends to be a possible answer to the multidisciplinary approach which characterizes the survey of the architectural heritage of the past where the reconstructed models, if scientifically substantiated, become shareable and transmittable documents for study [32].

The studies of Carlo Bianchini also focused on the subject of virtual restitution of ancient architecture as a tool for the research and communication of cultural heritage; they achieved the goal of "showing to the scholarly community (even the most recalcitrant in using digital technologies) the potential offered by 3D modeling, not only and not so much in terms of 'drawing,' but above all as an environment in which to explore, evaluate and make concrete re-constructive hypotheses" [33].

This topic was again discussed by Mario Centofanti, Stefano Brusaporci and Pamela Maiezza, who in their report rightly argued: "The theme of surveying is interrelated to

that of 3D modeling, considered not only as a summary of the results of research, but as a visual tool for studying, data processing and discussing the features of architectural artifacts, of their history and of their constructional and design vicissitudes" [34].

In addition, the paper of Paola Puma, dealing with similar issues, described the work done to document, with low-cost, quickly-executed 3D modeling, archaeological finds of fine workmanship coming from a tomb of Narce, an ancient city near Viterbo. In addition to validating the expeditious process experimented and the metric quality of the results obtained, particular attention was paid to the reliability of the visual qualities: "for better appreciation of the artifacts, in all their material, chromatic and formal characteristics, the models have been enriched by photorealistic textures" [35].

Geometry has played a powerful role in understanding, describing and modulating the existing or prefigured architectural space, because of its character as a conceptual tool based on formalized theories linked to a system of rules, proving to be a particularly effective tool for describing the genesis of the forms and figures of architectural construction.

Infographics, as compared to the methods of representation, involves only a noticeable modification of the operative medium which, unlike traditional geometry, functions analytically and not synthetically, offering the advantages of rapidity in the formulation and implementation of endless views, facilitating the control of complex shapes whose two-dimensional views often do not completely satisfy the representation of their plastic qualities.

This was confirmed by the researches of Paolo Clini, Ludovico Ruggeri, Antonio Corso and Gianni Plescia, which allowed them to obtain, "using low-cost, semi-automatic and non-invasive techniques and methods, processed 2D graphics at high resolution of a fine engraving on marble slab" giving "the opportunity for the study and digital cataloguing of architectural drawings of the Greco-Roman world" [36].

The wealth of dedicated programs must not, however, make us forget that the formative values of a discipline cannot be replaced or otherwise left in the background compared to operational methodologies; often the excessive laboriousness of the instrumental phase of a logical process shifts the commitment to learning from conceptually fundamental contents, that govern the operation, to the mere knowledge of mechanized proce-

dures without understanding their meaning [De Rubertis 1976, p. 5].

Another aspect, that must not be underestimated, concerns the ability of a computer to store a huge amount of data that could lead the operator to define the shape to be represented by recurring to an excessive amount of graphic information, so that the drawing would lose its characteristics of synthesis and critical analysis, essential for an evaluation of the objects to be represented, strongly linked to the final representation scale of the artifact.

In spite of the fact that descriptive geometry, as Monge codified it, is addressed to the diffusion of a technical training able to use drawing as an instrument for the control of graphic design operations on three-dimensional objects and as a moment of study of their geometric properties, it appears legitimate to propose a reflection on the redefinition of the codes of representation, firmly anchored to geometrical bases, but seen in the light of a radically modified cultural context.

Digital images should be considered from this perspective, as their vision no longer has any reference to the position of an observer placed in a 'real' world, optically perceived with the rules encoded since the days of Brunelleschi and his prospective tablet; the visual effect is instead attributable to the mathematical and electronic data that compose and make them perceptible through millions of pixels that characterize them.

Reality becomes more and more immaterial "and increasingly, the visuality" states Agostino de Rosa, "is thus destined to be placed on a cybernetic and electromagnetic terrain in which linguistic and abstract-visual elements coincide, and they will be consumed, circulated and exchanged in global form" [De Rosa 2003b, p. 14].

But it is still necessary to know the fundamentals of the theory for the construction of an image, at least for staying in touch with the procedures and rules of traditional drawing. Eduardo María Baviera Llópez, José Luis Denia Ríos, Jorge Llopis Verdú, Jorge Francisco Martínez Piqueras, in presenting their work on the use of laser technology, claimed that this technology is the one that gives the most interesting results regarding purely architectural survey, but we must still ask whether such a large amount of data can be, in some way, improved and completed [37].

With drawing, as with virtual reality, we may run into counter-productive attitudes when the tool of representation is considered a means of reproduction or imitation

of reality, without recognizing its tremendous analytical potential, its fundamental role as an instrument of understanding able to re-shape reality, whose computer-assisted modeling combines the complete definition of the three-dimensional conformation of physical models with the abstraction of traditional geometric representations, making it possible to realize all those perceptual operations of measuring, of control of the position of a shape in the 'virtual space of the computer.'

To fulfill the operations that characterize the principal activities of an architect who must operate, build and reason in space, a dynamic virtual model with its images in continuous mutation inside and outside the studied or conjectured object is a useful aid for imagining or prefiguring architectural space. Also for this reason, Michela Cigola, with Saverio D'Auria, Arturo Gallozzi, Leonardo Paris and Rodolfo Maria Strollo rightly argued that "digital technology can be an important means for optimizing resources for the conservation and enhancement of the cultural heritage so widespread throughout our territory" [38].

In conclusion, we can say that the graphical language of drawing, through its stringent codes of representation, must remain one of the foundations of project design training, architectural documentation and analysis. Traditional drawing, however, has been joined by other powerful expressive and communicative means, such as computer graphics and digital modeling, that we are learning to manage and make the most of both in research and theoretical fields, but especially in professional training.

Ultimately, however, "the practice of drawing […] remained the only physical relationship that the architect carries out with the physicality of matter that has to be shaped: it is his last 'manuality' and he must defend it fiercely" [Gregotti 1985, p. 65].

However, regardless of the tool for drawing, when there is no clarity of intent, confusion can arise: Michel de Frémin, as well, warned about this problem in his *Memoires critiques d'architecture*, when, at the beginning of the eighteenth century, he affirmed: "I always disagree with those who make a well-finished drawing, but where there is no precise relationship of the idea with the result […] I cannot endure a man who dares to affirm that he is teaching drawing, nor young ingenuous people who believe that by frequenting this so-called 'Doctor in Drawing' to learn how to draw lines on a piece of paper, they will master drawing; this practice is repugnant to my reason; indeed, learning to draw means obtaining inventive skills and discernment in invention: in a word, having a wealth of intelligence and imagination, through which a man finds all the means necessary for performing all kinds of good projects" [De Frémin 1702, Letter VI, p. 19].

I would like at this point to make a further consideration, suggested to me by a comment that Umberto Eco makes in his book Come si fa una tesi di laurea: "Photocopies are indispensable instruments.

They allow you to keep with you a text that you have already read in the library, and to take home a text you have not read yet. But a set of photocopies can become an alibi.

A student makes hundreds of pages of photocopies and takes them home, and the manual labor he exercises in doing so gives him the impression that he possesses the work. Owning the photocopies exempts the student from actually reading them" [Eco 1977, p.139].

So, to paraphrase Eco, it is possible that the possession of the graphic elaboration of a survey, whether digital or not, with all its fascinating, but in some cases mysterious values, exempts us from actually having to reach a true awareness of the object represented.

Notes

[1] The 38th International Meeting of Teachers of Representation Disciplines, XIII Congress of the Italian Union for Drawing, entitled *Le Ragioni del Disegno/The Reasons of Drawing*, was held in Florence, Italy, on 15-16-17 September 2016. Proceedings: Bertocci, Bini 2016.

[2] Koenig explains that the graphic mark does not merely denote something, as is the case for the marks of spoken language, but it connotes something, that is, it represents it, in other words, according to Moria's theory, this means that an image is an iconic sign, i.e. it has some properties of the denotatum. In Koenig 1964, p. 41.

[3] Di Luggo, A. (2016). Figurative variations on modernityà. In Bertocci, Bini 2016, p. 279.

[4] "If the first considers perspective as the instrument for demonstrating the objective certainty of a fact, the second considers it as a demonstration strictly linked to the abstraction typical of a mathematical process. The first regards perspective as the proof that from the phenomenon, thought can be reached, the second, as the way to explain thought through the phenomenon": Casale, A. (2016). Experimenting with Perspective. Particular relationship between the image and mind. In Bertocci, Bini 2016, p. 171.

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[9] In his interesting paper, the author underlined that "the intrinsic syncretism of digital means gave a second possibility of interaction to sciences and art. And if on the syntactical level the connection is ensured by the homogeneity among algorithmic codes, on the operating level this relationship appears to be clearly supported by the image, as the connecting semantic interface in intricate modeling contexts". Cocchiarella, L. (2016). The reason of the reasons: image and knowledge. In Bertocci, Bini 2016, p. 229.

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A Journey in the Fourteenth Century.
A Digital Reconstruction of Piazza delle Erbe in Verona

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Abstract

Digital visualization as the representation of a past that no longer exists is a communicative necessity in which virtual reconstructions have become means and experience of an otherwise intangible time. The case study presented is the expression of a methodology seeking to combine informative and scientific aspects. This method aims to provide an answer to a multidisciplinary approach that characterizes the study of architectural heritage of the past where virtual reconstructions, if scientifically substantiated, can become clear and transmittable documents.

Keywords: virtual reconstruction, 3D modeling, *cultural heritage,* rendering.

Introduction

The case study is the result of a multidisciplinary work involving city historians and architects, and part of a larger research project, presented at Expo 2015 in Milan, aiming at the virtual reconstruction of market squares in some Italian cities of the Middle Ages. The paper presents in detail the case of Piazza delle Erbe in Verona between the thirteenth and the fourteenth centuries. The aim of this article is to describe in detail the methodological and procedural aspects adopted and, on the other hand, to articulate the potentialities and the criticalities of the work done within the specific field of research. The area covered by the virtual reconstruction of Piazza delle Erbe, for its extension, lies in an intermediate dimension between the reconstruction of individual buildings and that of an entire urban area, presenting the pros and cons of both scales of representation. This aspect has determined the need to model the individual buildings overlooking the square on an architectural scale, starting with the historical-documental information available, according to different levels of certainty and degrees of accuracy. In this framework, it should be specified that the work presented was entirely produced by researchers working in the field of Drawing, in close collaboration, and with effective input and comparison with the city's historians, whose contribution was indispensable for verifying and excluding the various reconstructive hypotheses and indicating reliable sources derived from historical information. The comparison was continuous and profitable and involved all phases of the project: from the study of the sources to the production of the video.
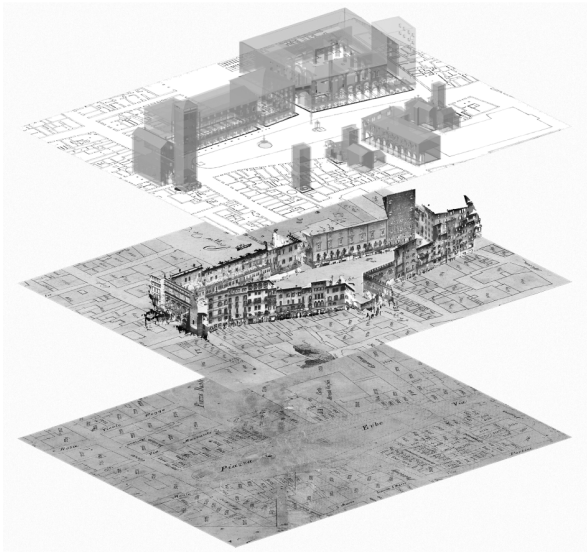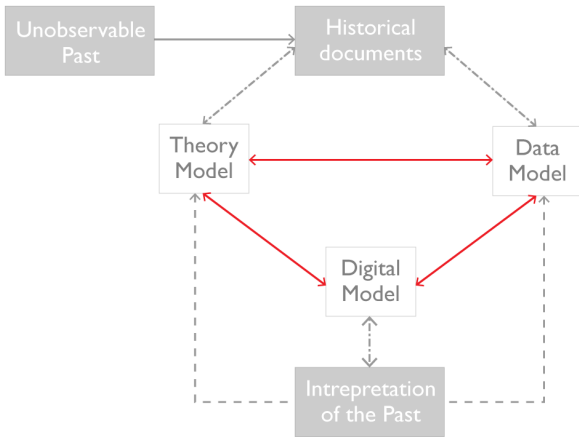
Fig. 1. Diagram of the virtual reconstruction process.

Fig. 2. Layering of procedure: historical data, survey-based data and hypothetical virtual reconstruction.

State of the Art

In the last twenty-five years the digital revolution has produced an important development of new tools and methods for 3D data acquisition, documentation and dissemination of information related to architectural-archaeological heritage. The availability of new and more effective digital technologies introduces the possibility of interchangeable media able to offer multiple nodes of access to a given term or object, and it enables a multidimensional approach to knowledge on several levels. The digital technologies propose new meanings of architectural representation, adding an extra dimension, the temporal one (diachronic and synchronic), which allows us to know an artifact not only in its evolution and transformation during its life cycle, but also through the analysis of its composition and geometric-formal matrix.

The advent of virtual reconstruction applied to archaeology introduced by Paul Reilly [1] opened the debate on the multidisciplinary approach to a huge amount of virtual reconstruction projects. There is a wide series of reconstruction works of design hypotheses and archaeological sites, as early as 1990 [2], as well as applied to architectural reconstruction of never-realized buildings [3] or urban spaces [4] that have used 3D digital modeling techniques. Koller [5] focused on the need to make visible the traceability of all additions, subtractions, and changes to 3D models, in order to make the hypothesis understandable and to display differences between 3D models and the object/artifact. One of the main aims is process transparency, that involves a virtual reconstruction and includes several problems about information management of the whole cognitive process [6]. Starting from data sources, up to the 3D model, the main issues are related to the traceability of subjective decisions and conjectures affecting the process of a certain grade of uncertainty [7] that opens the possibility to alternative options of reconstruction usually not declared [8]. The virtual reconstruction framework becomes even more complex in the case of large urban areas, where the difficulty of recomposing the overall documental framework is also accompanied by the definition and management of the different levels of certainty of the information collected and the related details of the data given back. The case study is part of the research project *Piazze, palazzi del potere e mercati del cibo nell'Italia di Dante. Progetto di ricostruzione 3D delle piazze e dei mercati alimentari di Milano, Bologna, Firenze, Verona* [9] aimed at proposing a virtual reconstruction of food market squares in some major cities of the Italian Middle

Ages, presented at Expo 2015 in Milan. The paper presents the case study of Piazza delle Erbe in the years straddling the thirteenth and fourteenth centuries. The first section provides a methodological framework concerning the virtual reconstruction of lost or never-realized architecture, with particular reference to cases of urban areas of limited extension. The following paragraphs describe the procedure adopted in the case study. The final section provides some general assessments of the experiment conducted.

The virtual reconstruction of buildings and urban areas no longer extant

Among the virtual reconstruction experiences of urban areas no longer extant, one of the largest virtual reconstructions of an entire ancient city is that of Rome in 320 AD [10]. It is a virtual reconstruction from incomplete archaeological data that utilized procedural and parametric modeling techniques to create visually compelling and detailed models [11]. In the same context, but equally remarkable for the approach, the methodology and the quality of the results achieved is the saga of *Assassin's Creed* [12] that is characterized by settings in ancient virtually rebuilt cities. The subject areas of the virtual reconstruction of Piazza delle Erbe are to be placed in an intermediate scale compared to the reconstruction

of individual buildings and to entire cities, preserving the pros and cons of both scales. The virtual reconstruction of a vast urban area, such as that which characterizes a square and its neighborhood, requires, in fact, on the one hand, the collection and compliance of a typical level of detail of the architectural scale (building) and, on the other hand, the typical problems of urban scale (large amount of buildings). We need to ensure, in the virtual reconstruction process, the fidelity/accuracy typical of the architectural scale at the individual building level (not always achievable) and the complexity (in terms of the variables to calculate and the consequent degree of accuracy to guarantee) typical of urban scale. This originates the need to define the individual modeled buildings that make up the scene of the piazza at an architectural scale, confronting a scene that is already at an urban scale. Each building compounding the scene of the Piazza delle Erbe, therefore, has been rebuilt in accordance with retrievable historical information of different types and accuracy.

The reconstruction of Piazza delle Erbe between the thirteenth and the fourteenth centuries: sources, methods and procedures

Beyond the impact of emerging 3D digitalization on museological and architectural documentation, on the

Fig. 3. Point cloud obtained using a Leica C10 laser scanner (rigth) and view of the plan with the scanning stations (left).
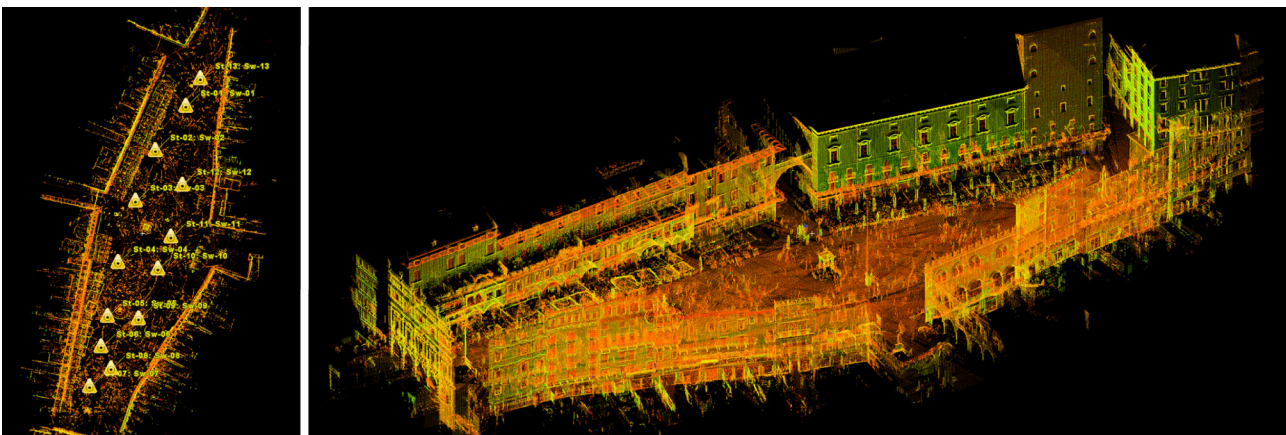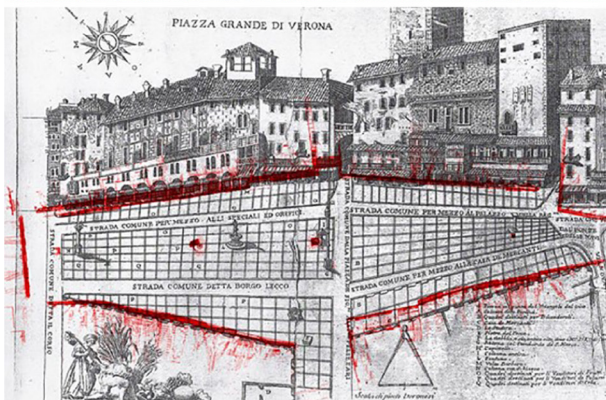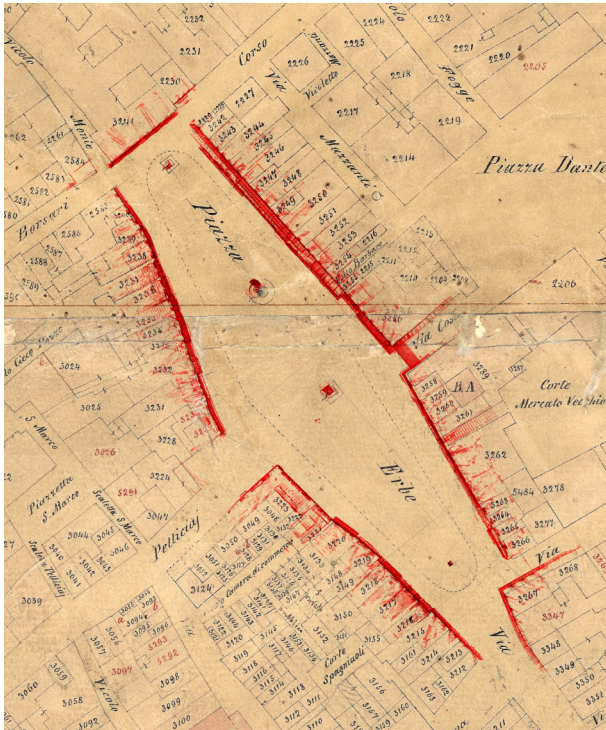
one hand, and the consideration of referred scientific requirements on the other; hypothetical digital 3D reconstruction faces different challenges and potentials.

The virtual reconstruction includes the composition—modifiable over time—of three mutually interrelated models: the theoretical, the data and the reconstructive hypotheses; which are defined by the process of interpreting the no-longer-observable past, starting from the historical records. The virtual reconstruction of Piazza delle Erbe has been developed in multiple steps. The first step is related to historical research, which used archival, iconographic, bibliographic, photographic sources, and so on, through which it was possible to gather important information on specific or general references related to medieval architecture in Verona, in the form of notarial documents, written texts, iconography, or (from more recent sources) etchings of views of the square, postcards and historic photographs, cadastral maps, etc. [13]. In this context, the contribution and the confrontation with the city's historians, Rosa Smurra and Francesca Bocchi, coordinators of the project, were fundamental. Through their research, it has been possible to obtain various documental sources through which we have been able to derive reliable information about the conformation of the buildings and the square of that period. In addition to graphic sources, such as the historical plans [14] and historical depictions of the square or the historical cadastre [15], there were also very important written testimonies [16] describing the square and the neighboring buildings. For example, a comparison with the Napoleonic cadastral plan permitted the verification of the actual conformation of the square; while most of the written descriptions have been used to reconstruct the models of non-existent or modified buildings (see steps 2 and 3).

The second step involved the survey of the entire piazza, which with regard to the floor plan did not undergo—on the basis of historical records available—any relevant transformation since the thirteenth century. The survey was carried out by integrating active (TOF laser scanner) and passive sensor technologies (digital photogrammetry). The persistence of the square's layout was supported by comparison between existing structures and the Austrian (1843-1852) and Napoleonic (1807-1813) land registry data, which represent the first geometric-based land parcel survey of the Veneto and Friuli area, and the drawing of the piazza—albeit of a lesser metric and formal accuracy—dating back to 1549 [17].

In particular, using the laser scanner, the shape of the existing square and the façades was recorded. Thirteen stations were needed to have the exact perimeter of the entire space. From the point cloud, the sections needed for indicative measurements of the individual buildings and the space plan to be rebuilt were obtained. Through digital photogrammetry, the textured polygonal models of those elements dating back to the time of the study were rebuilt: such as the fountain and the aedicula in the square. This allowed us to obtain a correct model of the scene geometry; furthermore, from the point of view of surface textures, thanks to the use of ColorChecker, it was possible to perform a color correction of the entire photographic set before processing the photos. The finished models with the textures, have been repositioned in their original locations. In addition, a photographic campaign of surrounding buildings was carried out to obtain information on the materials and details to be reconstructed (see step 4).

The third step was dedicated to isolating the buildings with more accurate and detailed historical information and to understanding which items had remained unchanged during the centuries and which elements had changed over time, making use of the sources collected during the first step. Again, in this case the constant confrontation with the historians was crucial to validating the various assumptions and excluding the less reliable ones. From the previous two phases, it was noticed that, despite the tolerances and inaccuracies of the original drawings, the plan of the square had remained largely unchanged from the Middle Ages to the present. The plan was redesigned from the Napoleonic cadastre where the parcel subdivision of the buildings was reported. This made it possible to hypothesize what was likely the façade set before the unification of the elevations that occurred later. In addition, by cross-checking the later dataset with the previous documents (engravings, notarial acts, iconographies), it was possible to identify buildings that were almost completely unchanged in their proportions and constructive systems, or buildings that had been extensively reshaped. For example, the Palazzo della Regione, the Mazzanti Houses and the Domus Bladorum, which had undergone important modifications both in relation to its façade with the displacement and refurbishment of almost all the openings, and also regarding its volume and number of floors.

The fourth step aimed to define a variety of architectural details and construction types referable to a sort of library of architectural elements of medieval Verona [18]. This collection of architectural elements was built from architectural evidence relating to the coeval historical period, immediately gathered in Verona, or in the absence of this evidence, by analogies collected throughout the territory of Verona and from literature. This was necessary because the purpose of the reconstruction was to obtain a comprehensive skyline of the square and its neighborhood, able to hypothesize and recreate the atmosphere of that time, contextualizing as correctly as possible the medieval marketplace of Piazza delle Erbe. Subsequently, in the fifth

Fig. 5. Sketch of the hypothetical reconstruction.
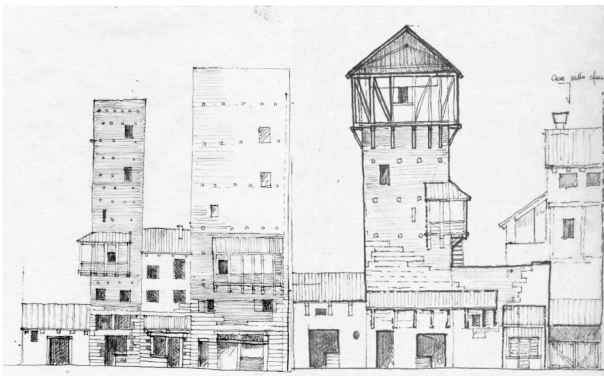
Fig. 6. Sketch of the hypothetical reconstruction.

step, we produced a set of material textures to be applied to the models. Even in this case we aimed to compose a set of photos related to buildings whose materials were comparable to those of the time interested by the reconstruction, allowing us to obtain a reality-based model able to reproduce the fidelity of color, texture, and properties of the perceived surface reflectance [19].

The sixth step dealt with 3D modeling, using as starting data those of the laser survey, integrated and implemented with historical data collected and processed in a critical manner, in order to obtain a historically correct and consistent set. It was decided to adopt both the methods of mathematical as well as numerical representation for the first phase of modeling: that is, to recreate the basic models of the final scene (Rhinoceros, Autocad and 3ds Max). The use of both presentation methods allowed greater flexibility in the formal control of the model's geometry. In this way, the model of the entire square with the neighboring buildings was obtained. An important choice at this stage was the scale of representation, or in other words, the level of detail to be adopted for the various models. Considering the expository intent and the final output of a video, we decided to use the 1:100 scale for basic geometric models. This choice allowed, through the next stage of rendering, to reach a scale of approximately 1:50. In general, we tried to simplify the models' complexity as much as possible in order to obtain a light scene in terms of number of polygons, so as to be able to populate it with goods, stalls and people.

The modeling phase was followed by texturing and illu-mination of the scene, trying to provide a high level of realism, applying, for example, effects simulating weathering and wear over time. The lighting setup was arranged trying to keep the "realism/rendering times" as high as possible. The setting we tried to give the most attention to was the positioning of the sun. Once the scene was correctly aligned with the cardinal directions, the sun's position was set based on the date and the specific geographic coordinates. This made it possible to have an illumination consistent with the years in which the scene was to be set. It should be noticed that the modeling phases were carried out only when it was already clear which textures would be applied and where; the geometries, to which different materials would have been applied, were divided into distinct layers. The photos taken on-site were modified to extract repeatable and correct chrome textures, to apply directly to digital models. The photos were developed with a photo-editing software to get seamless textures, and ICC profiles were generated and applied by a color profiling software to correct color aberrations at the time of shooting. As far as possible, we tried to use standard map projection systems, such as planar, cylindrical and triple planar, to speed up setting times. In some buildings, with very large surfaces with only one material, the texture repetition effect was too pronounced, and it was chosen to adopt the unwrap technique by applying high resolution textures on the entire façade as in the case of Palazzo della Mercanzia. To further enhance realism, worn and weathered effects were applied, such as leakages, moisture stains, patches of saline efflorescence.

Fig. 7. Texture layering.
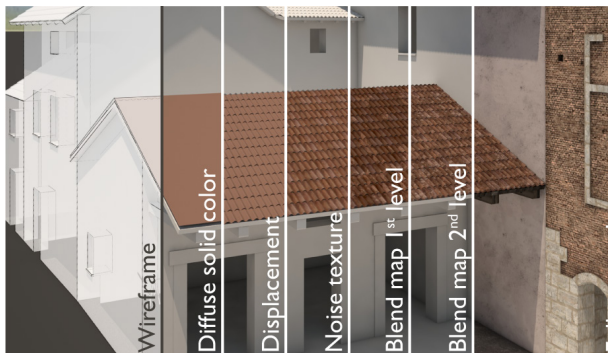
Fig. 8. Market props for populating the scene.
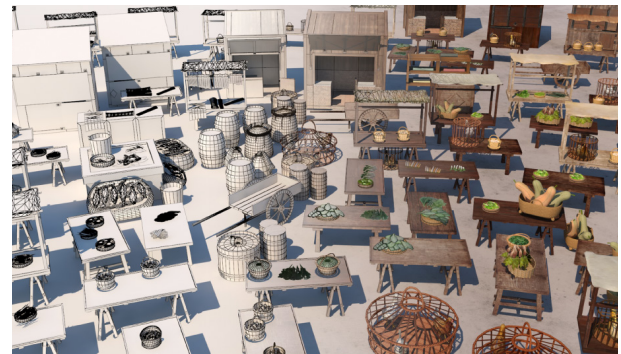
For the buildings on which we chose to use the textured unwrap system, it was possible to intervene specifically, by adding leakages on the sides of the window and door sills. Where instead we opted for box mapping or planar mapping, we chose to use multi-layered materials or blend materials, applying the original texture as the first layer, and as the second layer, the same lightened or darkened texture partially occluded with dirt maps in grayscale. To mask the repetition effect of the texture, the occlusion map was applied with a smaller tiling than the tiling of the texture.

A different type of dirt called VRay-dirt was used to darken the protrusions and the recesses, creating a dirt effect without unwrapping each building, decreasing the time consumption of the texturing phases. Finally, for the roof texturing, we chose to use a multi-layered material by adding a displacement map that simulated the geometry of the tiles, because modeling the single tiles would have exponentially increased the modeling time. For almost all textures, with the exception of the roofs, it was decided to integrate the roughness information, like shadows, in the diffuse channel, without the use of displacement and bump effects which would have slowed down the rendering times.

The final step was the production of the video. The camera paths were decided following a storyboard and the draft-recorded voice of the narrator. This made it possible to accurately define the rhythm of the video, and to determine the camera paths, synchronizing movements and times with the off-screen narrating voice. Even in this latter phase, the confrontation with the historians allowed us to define the scenes together with the final editing of the video. Once we decided and approved the camera paths, we populated the scene with goods, stands and people in medieval clothing [20].

The positioning of the objects, given their large quantity and great detail, was done by carefully taking into consideration the location of the cameras. At this stage, the scene was cleared of redundant geometries and buildings were added to give depth to the prospective views of the alleyways opening onto the square and that are captured by the cameras. Finally, all the frames were rendered separately using high resolution settings.

We used 50 machines, in network, for rendering, which required 35 hours of total computation. The various sequences were mounted in mp4 format and passed to professionals for the video and audio editing.

Fig. 9. Process of texturing: from the 3D model to the creation of the map using unwrapping.

2D

3D model

Unwrapping

Wireframe   Textured

Point Cloud

Wireframe

Hidden lines

Shaded

Direct light

Secondary bounces

Background

Flat textured

Texture aging

Populating with desks

Populating with goods

Populating with people
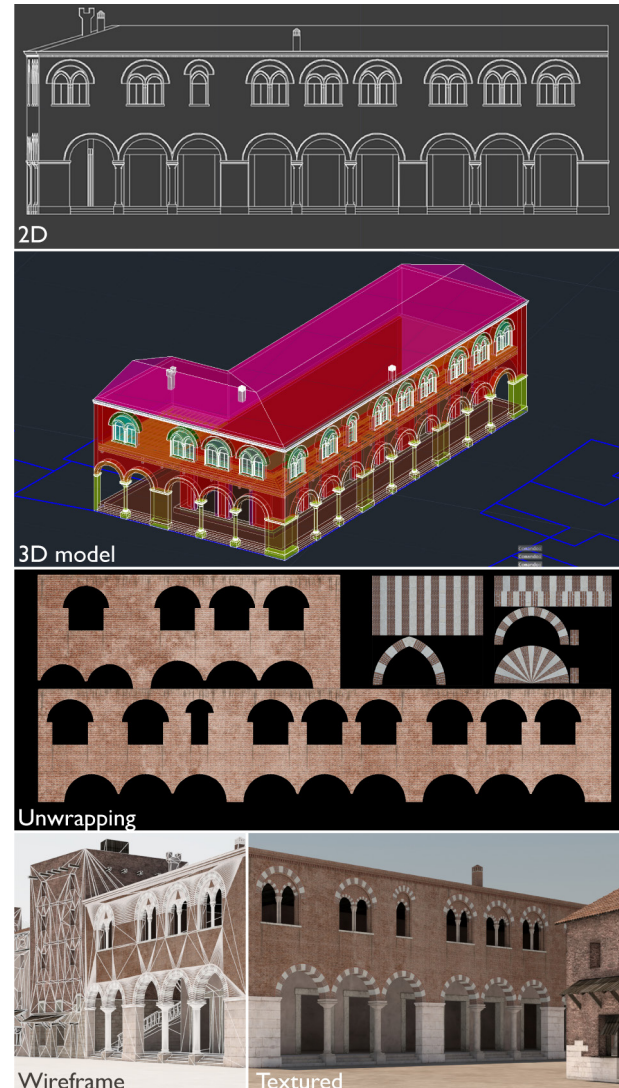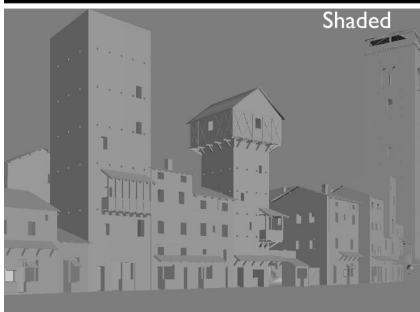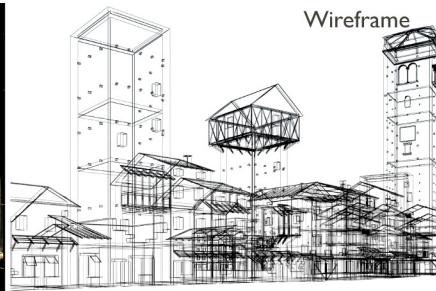
Conclusions

This case study is the result of a multidisciplinary work, where historians of the city and architects worked together with the goal of shaping a scene of daily life in the market square of Verona during the fourteenth century. The search for the historical and iconographic documentation relative to the early medieval age was flanked by a work of interpretation of that information, through which we tried to respond to the needs of scientific inquiry and the methods of modeling and three-dimensional visualization, aiming to combine informative aspects and scientific accuracy.

Digital visualization as representation of a past no longer extant today is a communicative necessity of which virtual reconstructions become means and experience of an otherwise intangible time.

The case study of Piazza delle Erbe has been presented as an expression of a methodology which had the objective of providing a possible answer to the multidisciplinary approach which characterizes the research on the Architectural Heritage of the past where reconstructions, if scientifically substantiated, become clear documents of transmittable contents. The achievement of this ultimate goal is still far away, especially where the transition from the individual building to the urban scale sector adds further degrees of uncertainty and complexity.

Therefore, from a disciplinary point of view, it is time to consider the field of virtual reconstructions as a discipline in itself. This will lead us necessarily to turn our attention

towards the development of a unified methodology and comprehensive documentation in virtual reconstructions, developing web-based information systems or virtual research environments able to ensure scholarly quality. Several research groups, such as the *Digital Arbeitsgruppe Rekonstruktione* [21] established in 2014, have been working on the topic of digital reconstruction of cultural heritage with the aim of creating a common research platform within the *Digital Humanities*. The purpose is to address the issues of disambiguation, the working methodology, documentation and the preservation of digital reconstruction projects. Efforts and experiences which lead to the achievement of significant progress forward.

Note

[1] Reilly 1990.

[2] ENSAM-IBM. 1992. *Virtual reconstruction of Cluny Abbey.*

[3] Burns, Beltramini, Gaiani 1997.

[4] Bocchi 1999; Bocchi 2004.

[5] Koeller, Frischer, Humphreys 2009.

[6] Kuroczyński, Hauck, Dworak 2014; Münster 2013.

[7] Apollonio, Gaiani, Zheng 2013a.

[8] Bentkowska-Kafel, Denard, Baker 2012.

[9] *A project from an idea of R. Smurra (planning and general coordination); scientific in charge* F. Bocchi, R. Smurra.

[10] <www.romereborn.virginia.edu> (consulted on June 13, 2017).

[11] Dylla 2010.

[12] *Assassin's Creed*, Ubisoft 2007; Hausar 2014.

[13] Among the other iconographic documents utilized, see: *Iconografia rateriana. Copy of Scipione Maffei*. Biblioteca capitolare, Cod. 106; *Piazza Grande di Verona. Engraving*, 1549; Ligozzi, P., *Verona città celeberima*. Engraving, 1630; *Prima Veduta della piazza detta Delle Erbe in Verona*. Engraving, 1747; Closs F., *Piazza D'Erbe*. Engraving, 1859; Barberis G., *Piazza Erbe*. Engraving, 1877; Austrian Cadastre 1843-1852; Napoleonic Cadastre 1807-1813, Historical Archive of the Municipality of Verona.

Fig. 10. Previous page. 3D modeling: from the point cloud to the scene populated with objects and people.

Fig. 11. Piazza delle Erbe: aerial view of the virtual reconstruction.

[14] *Prima Veduta della piazza detta Delle Erbe in Verona*. Engraving, 1747.

[15] Austrian Cadastre, 1843-1852; Napoleonic Cadastre 1807-1813, Historical Archive of the Municipality of Verona.

[16] Municipal Statutes of Verona, version dating 1276, 1327, 1393.

[17] *Piazza Grande di Verona*. Engraving, 1549.

[18] Arslan 1939.

[19] Apollonio, F.I., Gaiani M., Baldissini, S. 2011. A color processing for displaying reality-based three-dimensional digital models in RTR. In Rossi, M. (ed.). *Colour and Colorimetry. Multidiscipliary contribution. Optics and Photonics Series Notebooks*, no. 21, Vol. VIIb, pp. 260-267. Rimini: Maggioli.

[20] Human figures, shops, stalls, vegetable and animal products modeled by Michele Berretta.

[21] <http://www.digitale-rekonstruktion.info/uber-uns/> (consulted on June 13, 2017).

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Drawing the Reasons of Constructed Space.
Eighteenth-Century Neapolitan Open Staircases

Ornella Zerlenga

Abstract

Eighteenth-century Neapolitan open staircases are an urban and architectural event of unusual wonder. Created by the architect Ferdinando Sanfelice, they are masterful examples of a new formal and structural experiment. In this article, the origins of the San-felician staircases are discussed. They were chosen due to their particular urban, spatial and constructive value and have been the subject of an architectural and environmental survey campaign carried out through a direct method coordinated by the author. The origins of the Sanfelician staircases will be studied, highlighting the geometric-configurative arrays of their two main models, i.e. the 'falcon wings' and the 'cantilevered.' Due to its important architectural function, the staircase of a project is as old as the architecture itself. However, it is in the Baroque period that we experience forms that restore the staircase of a project as a space-time configu-ration representative of the architecture, along with not only the monumental but also the imaginative dimension. Eighteenth-century Neapolitan open staircases originated in the 1400s and are architectural organisms characterized by particular space-perception relationships. The diagrams compare (for the first time and to the same scale of representation) the staircases designed by Sanfelice in Naples. These issues have been dealt with in an architectural survey campaign of several staircases in Naples (2014-2017), whe-re the spatial layout refers to the Sanfelician models discussed here; the results of the comparative analyses, respectively between the staircases of the Sanfelice, Maciocco, Palmarice and Persico palaces are presented here.

Keywords: architectural survey, geometry of the models, Ferdinando Sanfelice.

Introduction

Eighteenth-century Neapolitan open staircases are an ur-ban and architectural event of unusual wonder. Created by the architect Ferdinando Sanfelice (1675-1748), they are masterful examples of a new formal and structural expe-riment. He was one of the most creative architects of the eighteenth century in Naples, best known for his monu-mental open staircases, including the one in the palace he built for himself and his family. In Sanfelice's architecture, the staircases are somewhat notable, rather than being in-cidental features set off to the side of a courtyard, he gave them central and prominent positions so that they became important architectural features in their own right. In this article, the origins of the Sanfelician staircases are discus-sed. They were chosen due to their particular urban, spatial

and constructive value and have been the subject of an architectural and environmental survey campaign carried out through a direct method coordinated by the author. The origins of the Sanfelician staircases will be studied, hi-ghlighting the geometric-configurative arrays of their two main models, i.e. the 'falcon wings' and the 'cantilevered.' The main source of information on Sanfelice's life is the bio-graphy written and published in 1745 by Bernardo De Do-minici, when the architect was still alive. Roberto Pane was the first scholar of Sanfelice, while the studies by Alfonso Gambardella give the most up-to-date biographical infor-mation. The architectural surveys of the Sanfelician stairs by Michele Capobianco are currently the most important. The geometric studies on eighteenth-century Neapolitan

open staircases began with the research group consisting of Anna Sgrosso, Rosa Penta and Mariella Dell'Aquila. These studies were interesting contributions to the typological and configurative reading of the Neapolitan open staircase, while the studies by Lidia Savarese and Adriana Baculo included the cataloguing of the different building types. More recently, studies on Neapolitan open staircases have been carried out by Antonella di Luggo and the author. In the drawing-up of redevelopment programs of built and natural environments, the architectural and environmental survey has assumed an increasingly prominent role of observation and critical reading of contexts and artifacts in order to restore knowledge oriented towards design.

The Neapolitan open staircase: representative models

Due to its important architectural function, the staircase of a project is as old as the architecture itself. However, it is in the Baroque period that we find forms that restore the staircase of a project as a space-time configuration representative of the architecture, along with not only the monumental but also the imaginative dimension.
Eighteenth-century Neapolitan open staircases originated in the 1400s and are architectural organisms characterized by particular space-perception relationships, to the point that it is possible to 'firmly state that the Neapolitan staircase represents the most original expression of local building and that it cannot be found in any other region' [Pane 2007, p. 86].
The mild climate, the narrow sections of the urban system (and the impossibility to see the design of the façade from the street), the narrowness of the courtyards (and the darkness due to the remarkable height of the buildings)

Fig. 1. The open staircase of Petrucci Palace: urban context; portal and staircase (photograph by the author).

have all favored the compositional idea of the 'open' staircase. In this sense, the model of a spatial system, consisting of a portal, entrance hall, courtyard and staircase, performed the function of access and representation for the residential building. Among the first examples of Neapolitan open staircases, there is one at Petrucci Palace on the corner between Via Benedetto Croce and Piazza San Domenico Maggiore. Antonello Petrucci (?-1487) bought the building from Bertrando del Balzo, who had built it at the end of the 14th century. The original building had its entrance on Via Benedetto Croce, but following the reorganization of the pre-existing square (now Piazza San Domenico Maggiore), Petrucci understood the future urban value and around 1470 opened a new entrance onto the square. The staircase, which was antecedent and lateral to the previous entrance, was now in line with the new one, and had a white marble architraved portal through which the open staircase was seen in the background, along with the loggia on the courtyard (fig. 1).
This complex spatial system (consisting of a portal, entrance, courtyard and staircase) which characterized both the noble residence as well as popular housing, over time changed into many different types. According to previous research on the cataloguing of the staircases in Neapolitan historical buildings, this sequence identifies differentiated paths in the composition of the space depending on: the number and shape of the courtyards (one, two, straight, curvilinear, regular, irregular); the position of the staircase (in line or decentralized with respect to the portal and entrance hall); where the staircase overlooked the entrance hall or courtyard; the presence of a garden. In addition, the open staircase can: have either an articulated façade or a continuous balcony; be a backdrop or a filter (in the case of a double courtyard); have one or more ramps (straight, mixed line, curvilinear); have a parallel (double) or symmetrical three-lane system; have a double symmetrical development (rectilinear, circular, mixed line). The type of open staircase also affects its structure, which can be: spine wall; on pillars; a free well on pillars; a free well that is cantilevered. Another type of open staircase is with the intrados facing the landings (with a horizontal impost) and ramps (with a variable inclined impost), which can have: barrel, ribbed or groin vaults (all-round, depressed or raised); lunette vaults (cylindrical or spheroidal); domes (spherical or ellipsoidal); spherical or elliptical triangles; cloister or domical vaults; Roman vaults. The different combinations of these conditions gave a

different visual-perceptual impact of the space, both from inside the staircase as well as from the courtyard (with or without a visual filter) and for the alternating of light and shadows. In the redevelopment program for Baroque Naples, this complex system of entrances to the buildings (that in the sculpture of the portals presents the first ring of this spatial dynamism offering a great perspective effect) became the true protagonist of the urban and architectural scene. Along the axis of the 'decumano minore' (the so-called 'Spaccanapoli'), within a few hundred meters, between the end of the 17th and the beginning of the 18th century, there were some of the most majestic and imaginative portals, due to their shape and size, ever conceived, such as those of the noble residences: Carafa di Maddaloni (by Cosimo Fanzago); Pignatelli di Monteleone and Filomarino (by Ferdinando Sanfelice); Carafa della Spina (attributed to Martino Buonocore; according to others by Ferdinando Sanfelice). The greatest creative expression of the early-eighteenth-century Neapolitan open staircase can be attributed to the architect Ferdinando Sanfelice. This complex architectural reality manifests itself through a dynamic flights of stairs covered with vaults and a changing perception of views, with light and shadow created by perforated walls. These are an added value to the design, capable of triggering a space-perceptual continuity between the courtyard (interior space), where there is a staircase, and the street (external space) from which the staircase can be perceived through the archway of the entrance. While

in pursuit of its main architectural function (the vertical connection between the different floors of a building), the Neapolitan open staircase is a reservoir of space, representative of several factors which are produced and manifested in it. This condition finds its main reason in the narrowness of the streets with the consequent inability to see the unique design of every façade from the street. Therefore, in the program for the building's expressive requalification, the portal and staircase assume the function of attracting attention, as a stage scenery where the portal is the proscenium and the staircase the backdrop.

A survey of the spatial qualities: formal and structural models compared

During the first half of the 18th century and with the arrival of the Bourbon court, Sanfelice was the undisputed protagonist of the modernization plan of Naples. For Sanfelice, the staircase stood out as a representative space of the residence and was an opportunity to propose examples of unprecedented experimentation, formal and structural, according to the unusual 'falcon wings' or 'cantilevered' models. Formal experimentation on the design of the staircase can be found in the Italian treatises starting from the 16th century (fig. 2). Sebastiano Serlio, even if in *Libro VII* he uses several staircases for his architectural projects (rectilinear, circular, oval), does not describe the different types.

Fig. 2. *Drawings of staircases in the treatises on architecture by Serlio, Palladio, Scamozzi.*
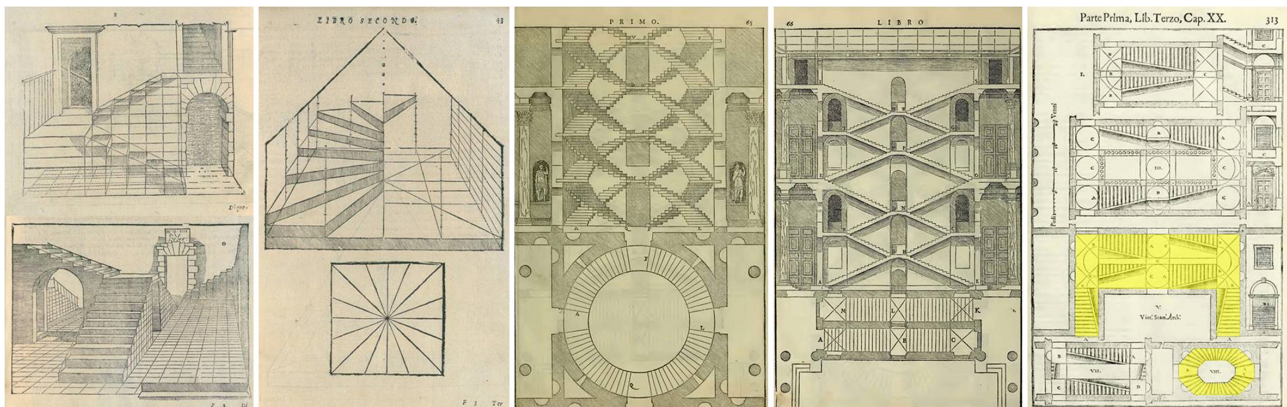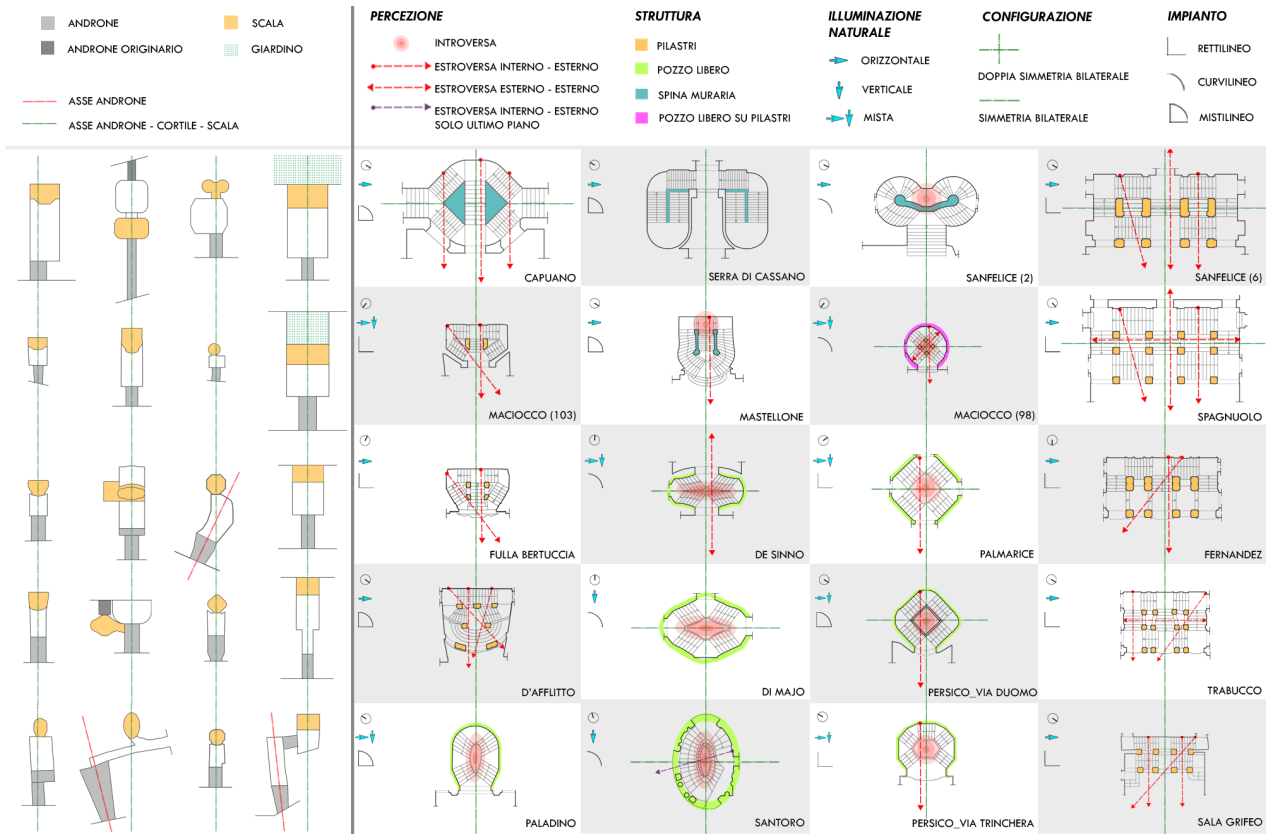
Fig. 3. Drawing of the Sanfelician staircases: comparison of the models (scientific coordination by the author; graphic elaboration by Vincenzo Cirillo).

In *Libro II*, dedicated to perspective, Serlio introduces the staircase as a complex example to design and proposes more simplified and straightforward profiles such as the 'square spiral' staircase rather than the 'round' one [Serlio 1600, pp. 41-43].

A first cataloguing of the different typologies was carried out by Andrea Palladio. In Cap. XXVIII of the *Libro Primo*, entitled *Delle scale, e varie maniere di quelle, e del numero, e grandezze de' gradi* (staircases, and various manifestations of them, and the number and size of the steps), Palladio introduces the "spiral," "oval" and "straight" staircases and states that structurally may present "a column in the middle"

or "an inside wall" (with pillars or spine wall), as well as being "empty in the middle" or "without a wall" (cantilever). In particular, he described some models of staircases that had already been realized, drawing in plan and section, the double spiral cantilevered staircase of Chambord Castle, which he defined as a "beautiful and new invention" as well as a straight double staircase [Palladio 1570, pp. 60-66]. Particularly interesting for the analysis of the 'falcon wings' and 'cantilevered' Sanfelician models is the theoretical contribution of Vincenzo Scamozzi (1548-1616) in Capo XX of his treatise, entitled *De' siti, e forme convenevoli a varie maniere di Scale private ad uso de' tempi nostri, & alcune*
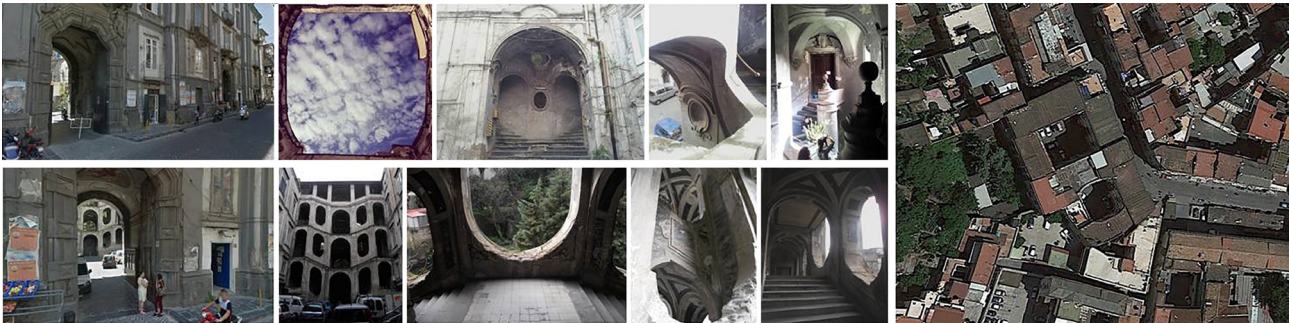
Fig. 4. The staircases of Sanfelice Palace in Via Arena alla Sanità, No. 2 and No. 6 (photograph by Vincenzo Cirillo; aerial photograph by Google Earth).

introdotte dall'Autore (Places, and suitable forms for various types of private staircases to use in our times, and some introduced by the Author). Scamozzi used ten models as examples that, although related to the usual circular, oval and straight-line systems, anticipated significant elements of creativity in the Sanfelician models. The fifth 'type' refers to the 'falcon wings' model being configured with lateral ramps, allowing access to the upper floor and leaving a free space below the central ramps as a passage. The eighth 'manner,' instead, introduces a straight cantilevered type with rounded corners [Scamozzi 1615, pp. 312-317]. From the structural point of view, it is in manuals of the late 19th/early 20th century that the design of staircases is differentiated according to the type and the load-bearing system of ramps and landings. In the Architect's Manual by the architect-engineer Daniele Donghi (1861-1938), published in ten volumes from 1906 to 1925, staircases are divided into two main groups, called ''a collo'' and ''a volo.'' The first, ''are the ones that have the stairs supported throughout their length, or by a filling underneath or by vaults, or the stairs resting on the ends of walls, arches, or on stone sides supported by pillars or columns''.

The second are stairs ''in which the inner side or even the outside one are only supported at the bottom and the top of the staircase, or staircases whose steps are only supported at one end, that is, they are cantilevered.'' On the ''a volo'' staircases, Donghi states that they ''have a much lighter look than the ''a collo'' ones, and the cantilevered staircases, especially when the stairwell is very large, multiply the number of stairs and these are very wide, having a very light aspect, which sometimes even raises the que-

stion of the solidity of the staircase'' [Donghi 1925, pp. 637, 638, 657]. The graphical and configurational analysis of the similarities and differences of eighteenth-century Neapolitan open staircases has been the subject of study by a research team led by the author. The diagrams compare –for the first time and to the same scale of representation– the staircases designed by Sanfelice in Naples. These issues have been dealt with in an architectural survey campaign of several staircases in Naples (2014-2017), where the spatial layout refers to the Sanfelician models discussed here, and where the research work and contextualization has been supported by the recent archive studies carried out by Alfonso Gambardella. In the synoptic table, the planimetric systems of the studied staircases are compared as well as the access systems to the buildings (entrance hall, courtyard, staircase) according to the following key elements (fig. 3): shape (straight, curvilinear, mixed line); plan (bilateral symmetry, double bilateral symmetry, coaxial: entrance hall, courtyard, staircase); structure (spine wall, pillars, cantilever); vault system (simple, compound); illumination (from above, front); perception (extroverted, introverted). The models of the staircases realized by Sanfelice in the Sanfelice (No. 2 and No. 6), Serra di Cassano, Capuano, Palmarice, Di Majo and Maciocco (No. 98 and No. 103) palaces were compared to those of the Spagnuolo, Fernandez, Trabucco, Sala Grifeo and Mastellone palaces (attributed by historical criticism to students of Sanfelice or workers close to him) and also to those of the De Sinno, Furla Bertuccia, Persico, D'Afflitto, Santoro and Paladino palaces, which according to the recent archive studies, Alfonso Gambardella attributes to Sanfelice. The staircases

Fig. 5. *Elevation and plan of the entrance system of Maciocco Palace, No. 98 and No. 103. Geometric-configurative and visual-perceptual analysis of the staircase of Maciocco Palace, No. 103 (scientific coordination by the author; architectural survey and modeling by Valeria Marzocchella).*
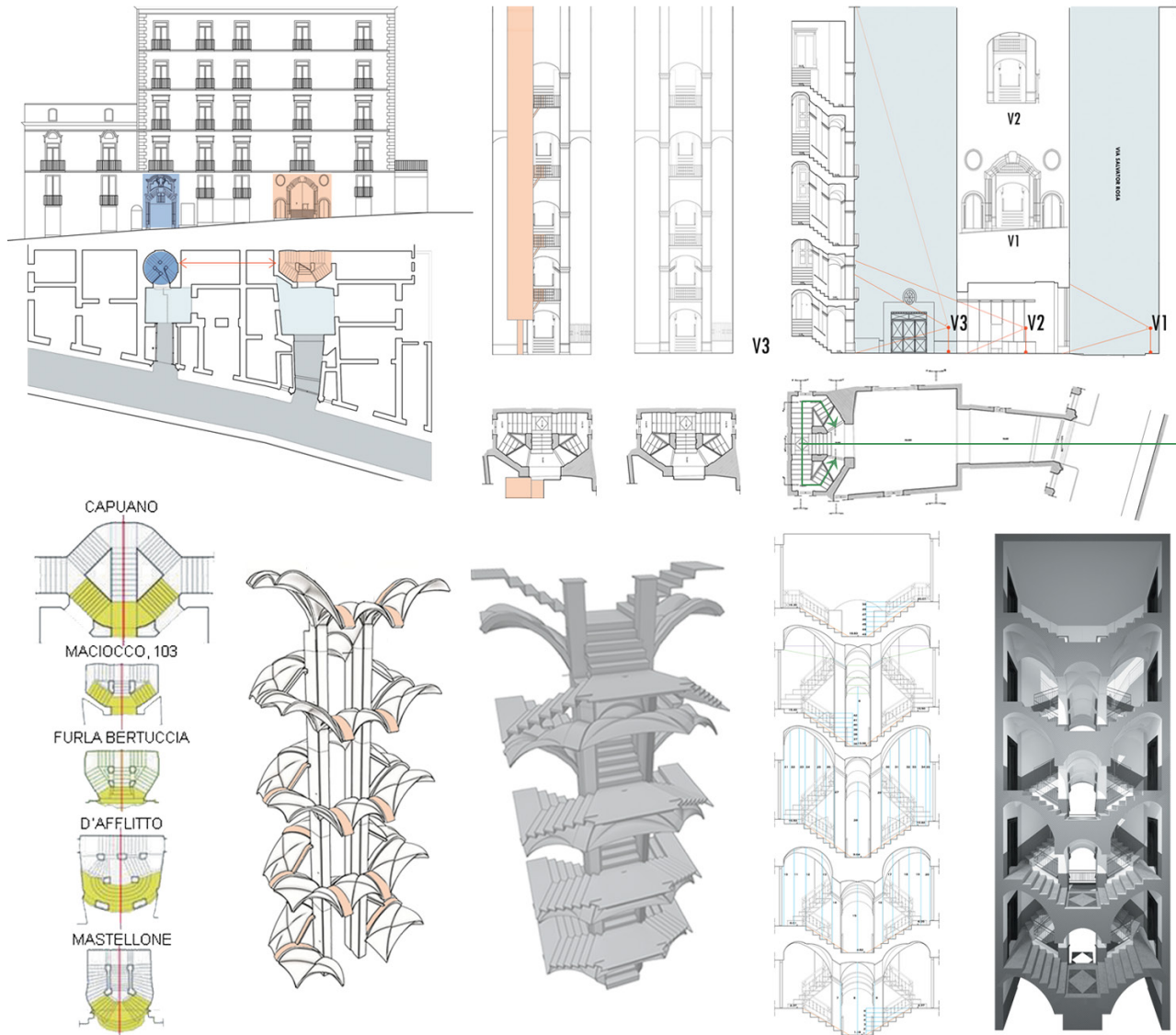
of these buildings (along with that of Sala Grifeo) were the subject of architectural survey, upon the basis of which a critical reading was made on: the geometric matrix of plano-altimetric systems; spatial configuration of the vault and ramp systems; visual-perceptive fruition during the use of these spaces. The results of the comparative analyses, respectively, between the staircases of the Sanfelice, Maciocco, Palmarice and Persico palaces are presented here.

The survey of the staircases of the double-entrance Sanfelice and Maciocco palaces

In the 1720s, Sanfelice designed his family home, built in Via Arena alla Sanità, consisting of two buildings facing the street with a joint façade characterized by two identical portals. The staircases, with different spatial layouts, each face a differently-shaped courtyard (fig. 4). One of the two staircases (No. 6), taking up and reinterpreting the tradition of the monumental double staircase, introduces in the panorama of the building, an unusual theatrical model called 'falcon wings.' The spatial configuration of the 'falcon wings' comes from a particular plan design of the staircase. This refers to the double monumental staircase with four flights of stairs that wrap around an empty space sharing a central flight. In this diagram, the direction of the stairs is set along the transverse direction, freeing the central bay on the ground floor, so that it is not filled by any flight. This solution allows the connection of the front courtyard with the free space behind to be used as a garden. By virtue of the presence of a completely perforated body of the staircase, this solution allows the passerby to see through the entrance hall, beyond the staircase and into the garden at the rear. The 'falcon wings' staircase in Sanfelice Palace occupies the entire width of the transversal façade of the courtyard opposite the entrance and it is made up by a body that has the same height of the building. The structural system includes sixteen pillars whose plan rhythm is regulated by a double bilateral symmetry and in which there are different flights of stairs, landings and wells, and upon which the whole system of vaults and arches rests, whether horizontal or rampant. Both sides of this staircase, of considerable size, are perforated; the one facing the courtyard shows the oblique course of the ramps in an upward direction thus giving an image of the wings of a hawk during flight. The open Sanfelician 'falcon wings' staircase generates an 'extroverted' staircase. It innovates

with imagination and boldness the design of the residential staircase, making itself the central place of the representative space of architecture. The objectives of Sanfelice such as scenic and structural wonder give a new type of staircase that makes the multiple perceptions as well as contrasts of light the main elements of an original design. The reinterpretation of the double monumental staircase and its spatial reconfiguration in multiple vertical levels (made possible thanks to a daring experimentation of walls, pillars, arches and vaults) formulates a new circulation space. The perceptual experience is dynamic and full of multiple views, it is presented both by the continuous visual crossings, that along with the openings of the arches and wells allow the gaze to go in all directions, by the change of the tonal value of the light. In this architecture of visuality and multiple experiences, the prevailing feeling is that of being in an 'explosive,' 'centrifugal' space, where nothing must or can remain immobile. As soon as it was realized, the biographer De Dominici commented, astonished by this staircase, saying that 'it is the most beautiful, vague and magnificent, never seen before in the world and continually it is copied by Professors of Architecture in many buildings that will be built in this city of Naples' [De Dominici 1742, p. 651]. This model was widely replicated in a Naples that had fallen in love with spectacular Baroque scenery, with the staircases of the Spagnuolo, Fernandez and Trabucco noble palaces as outstanding examples, while the staircase in the Sala Grifeo Palace represents a derogation to this model, showing descending, not ascending ramps. Like Sanfelice Palace, Maciocco Palace is also constituted by two buildings facing the street with a joint façade characterized by two identical portals with the concave-convex profile of the architrave typical of Sanfelice (fig. 5). The staircases, with different spatial layouts, each face a courtyard of a different shape and size. Number 103 refers to the spectacular 'falcon wings' model, while Number 98, with central pillars, refers to the 'spiral' (circular) one. As De Dominici wrote, for the building of 'Councilor D. Antonio Maggiocco,' Sanfelice had conceived, according to a 'new invention of two different staircases, and which both serve the same building'; however, the project was not realized and 'two separate Sanfelician staircases were made in different locations.' The building was 'redesigned, enlarged, and reduced to the modern [...] such as the entrance doorway, as well as the first-floor staircase, such a magnificent and beautiful invention' [De Dominici 1742, p. 650]. However, at present both stairs are very compromised. In the early

Fig. 6. *Geometric-configurative and visual-perceptual analysis of the staircase of Maciocco Palace, No. 103 (scientific coordination by the author; modeling by Valeria Marzocchella).*
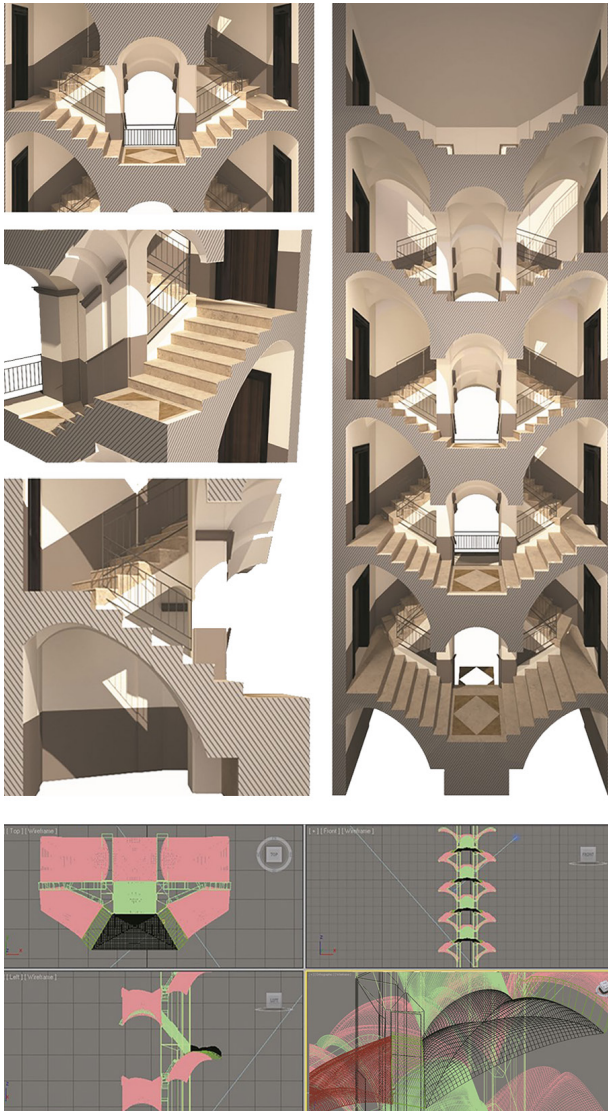
1960s, the staircases in Maciocco Palace were surveyed by Michele Capobianco [Capobianco 1962b, pp. 554-557]. The surveys and photographs attached contribute to the data, making it possible to carry out a comparison with the significant changes that subsequently occurred. Comparing the surveys of 2014 with those of 1962, today the visual perception of the two staircases has been greatly modified due to the insertion into the façade, at Number 103, of an elevator that annuls the scenic cantilevered effect of the staircase on the courtyard and, at Number 98, due to a remarkable transformation of the entrance hall and courtyard for commercial and residential uses that has significantly reduced the view of the staircase from the street.

The architectural survey of the staircase of Maciocco Palace, located in Via Salvator Rosa, No. 103, carried out by Valeria Marzocchella, documents the renovation work realized by Sanfelice to decorate the building (figs. 5, 6). The pre-existence of the courtyard and the entrance hall led the architect to conceive a coaxial system of entrance hall, courtyard and staircase despite the oblique course of the street. The stairwell gives an irregular but symmetrical hexagonal shape with respect to the longitudinal axis. This gives a five-ramps system, with the central one being singular, and the other four are symmetrical, two-by-two, with respect to the axis. This system gives two symmetric wells of triangular shape between the ramps, two landings leading to the apartments (in the transverse direction) and two resting landings (in the longitudinal direction), of which the isosceles trapezium has the largest base on the courtyard, creating a wide opening that illuminates the staircase. The ramps are supported along the transverse directions by flying buttresses, supported by central pillars and perimeter masonry. The rampant arches discharge a system of vaults consisting of several spheroidal triangles, while the central ramp is covered with barrel vaults. The presence of wells and flying buttresses allows us to enjoy a multitude of views onto the ramps and courtyards. While these geometric-configurational analogies make the spatial plan of the staircase of Maciocco Palace, No. 103, appear like the 'falcon wings' model, the cantilevering of the hexagonal plan on the courtyard recalls the staircase of Capuano Palace. In the latter, the regular octagonal profile of the plan is touched on three sides by the courtyard, creating a vibrant and clear movement of light, recalling Borromini's concave-convex views. This solution will be replicated with less intensity in the plans of the staircase of: Furla Bertuccia Palace (surveyed by the author for the first

time with Raffaella Monaco), which has a plano-altimetric pattern similar to that of Maciocco Palace; D'Afflitto Palace [Cirillo 2016, pp. 209-216]; Mastellone Palace, where the cantilevering onto the courtyard relates only to the ground floor.

The architectural survey of Maciocco Palace in Via Salvator Rosa, No. 98, by Salvatore Volpicelli, documents the analogous restoration work to modernize the building, but in this case the mastery is even more exemplary (figs. 7, 8).

The physical space in which Sanfelice operates is small, with this staircase having the smallest planimetric layout among those compared in the synoptic table. Even in this case, the courtyard and entrance hall are already present but not coaxial. In order to make the staircase visible from the street, Sanfelice conceived a stairwell with a circular profile and central square well on pillars, which the architect rotated 45° with respect to the front of the courtyard. Along the sides of the well, Sanfelice places four ramps to determine the interlock and, at the same time, he designs a façade open onto the courtyard. The landings are a quarter of circle, of which only one leads to a room, while the other three are for resting. Among them, on the one that overlooks the courtyard, there is a large opening, which shows three floors of the staircase to the outside. This simple solution, exclusively geometric, generates a dynamism of remarkable visual-perceptual attraction. In fact, from the street, though not perfectly in line, the view is attracted by the eccentricity of the pillars rotated at 45°, whose sloping sides invite our gaze to follow the ramps going up. Structurally, the staircase is "*a collo*" and, towards the well, the steps rest one end on rampant arches supported by the pillars of the well. The ramps, on the other hand, are supported by ribbed vaults, while the landings by cloister vaults. The slope of the ramps towards the stairwell refers to the theoretical model of the cylindrical helix, the curved line of a right circular cylinder generated by a point flowing uniformly along the generatrix of the cylinder itself while it rotates evenly around the axis, following the law of the directrix. This geometric pattern invokes the "snail-shaped" staircase realized by Sanfelice in his own residence in Via Arena alla Sanità, No. 2. The spatial configuration of a spiral staircase arises from a planimetric circular or oval shape where the steps dwindling in size towards the center, or the inside, rest on a central pivot ('core' or 'column'). The solution designed by Sanfelice is 'double' in the sense that there are two separate spiral staircases that run parallel but in opposite directions and they are accessed by a single straight flight located in the middle.

Fig. 7. Geometrical-configurative and visual-perceptual analysis of the staircase of Maciocco Palace, No. 98 (scientific coordination by the author; survey and modeling by Salvatore Volpicelli).
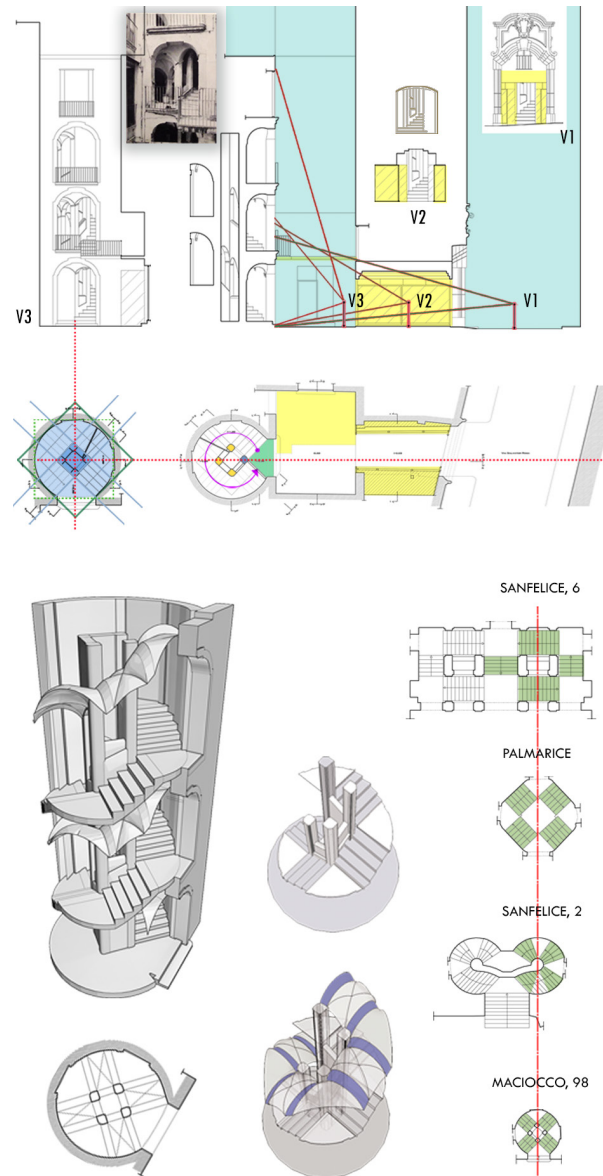
This staircase is full of an intense 'introverted' spatiality, internal and confined. While going up the steps, the staircase gradually reveals itself, surprising the observer, and stopping its ascent at the window overlooking the courtyard and then leading to the first and only floor. The presence of only two light sources contribute to the gradual unfolding of the reservoir of space particularly thanks to the significant tonal variation of the natural light that can be appreciated during the ascent. In conclusion, the staircase of Maciocco Palace, No. 98, recalls both staircases of Sanfelice Palace: to No. 2, due to the circular plan; to No. 6, due the well on pillars. At the same time, it also refers to the cantilevered staircase of Palmarice Palace (illustrated below) due to the grafting of the ramps on the sides of a square rotated 45° with respect to the front of the courtyard. These multiple aspects make this staircase a highly suggestive architectural event where the narrative of the visual-perceptive, 'extroverted' and 'introverted' qualities of the space are combined.

The survey of the cantilevered staircases of Palmarice and Persico palaces

Sanfelice designed two staircases in Naples which, just like the double circular one of Sanfelice Palace, are characterized by the analogous design of an attractive and intense internal space that is not manifested by anything outside: these are in the noble residences of Palmarice (Piazza Teodoro Monticelli, 1) and Di Majo (Discesa della Sanità, 68). The projects of these staircases revisit the ring staircase where the steps are cantilevered and joined to the side walls, leaving a central space known as a well. This staircase is full of an intense 'introverted' spatiality, internal and confined. While going up the steps, the staircase gradually reveals itself, with surprise, stopping its ascent at small windows overlooking the courtyard. The architectural survey of the staircase of Persico Palace in Via Duomo, No. 220, by Giuseppe Celiento, revealed numerous similarities with those of Palmarice Palace (figs. 9, 10). The staircase of Persico Palace can be accessed through an arch that is almost in line with the courtyard and entrance hall. The plan of the staircase is a square rotated 45° with: the vertices blunted according to a quarter of a circle; the flights along the directions of the sides; the triangular landings and a central square well also rotated 45°. This condition is not insignificant, since it is on the courtyard, the staircase creates an unusual perceivable dynamism of the ramps perceived from both the entrance on the ground floor as well as the openings at the different levels. The intrados of the flights is solved with Roman vaults and the landings are covered

Fig. 8. The staircase of Maciocco Palace, No. 98 (photographic survey by Gino Spera).

with very depressed spheroidal vaults, different from those in the Palmarice and Di Majo staircases. The staircase of Persico Palace has a basic geometric layout but the result is spectacular, not only due to the dynamism of the 45° rotation (as with the circular staircase of Maciocco Palace), but also for the natural light that penetrates through the arches opening onto the courtyard, including, at the top floor, a circular window). There are seven steps as in the Palmarice, Di Majo and De Sinno staircases. The elevation overlooking the courtyard is different. In Palmarice Palace, it is straight and not in line with the courtyard and entrance hall. In Persico Palace, the elevation follows the convexity of the landing, assuming a cylindrical and non-flat spatial

configuration as in the already mentioned D'Afflitto Palace. The curvilinear layout joins the sides of the courtyard and refers to the spatial solution introduced by Sanfelice for Capuano Palace. As a result, the arches that open onto the courtyard of Persico Palace are oblique just like the arches of the cloister vault, which are set on the curvilinear walls of the corners of the stairwell.

Conclusions

The architectural surveys carried out on these eighteenth-century Neapolitan open staircases has highlighted

Fig. 9. *Geometric-configurative and visual-perceptual analysis of the Persico Palace staircase (scientific coordination by the author; architectural survey and modeling by Giuseppe Celiento).*
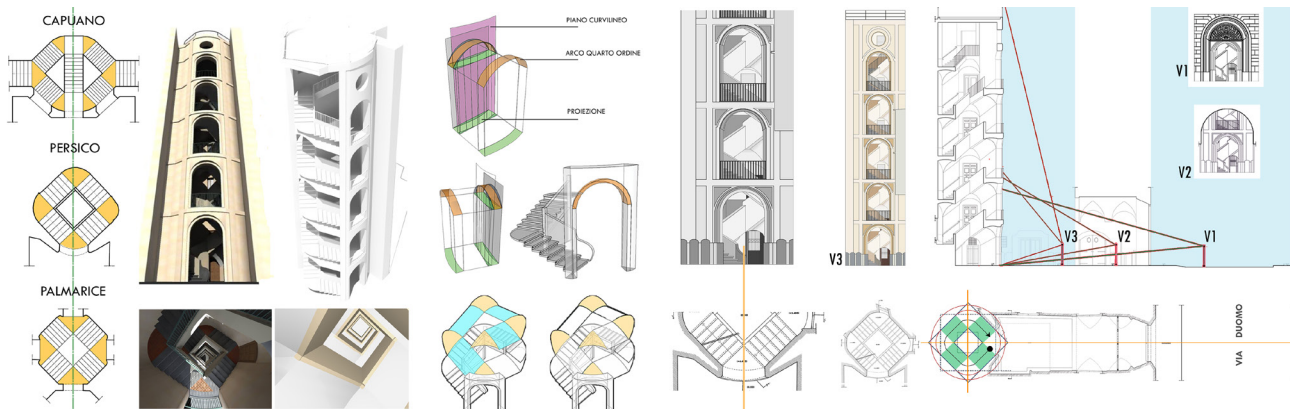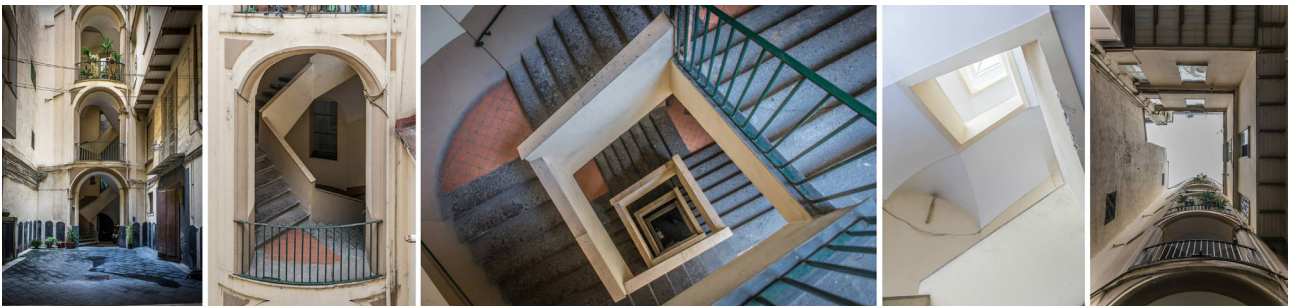

Fig. 10. *The staircase of Persico Palace (photographic survey by Gino Spera).*

the formal similarities and differences through a critical geometric-configurational reading, but not only. The results of the surveys show Ferdinando Sanfelice's inclination to create marvelous, bold and new spatial images of architecture, such as his staircases, generated by the skillful manipulation of elementary geometric patterns carefully contextualized in the places, for both new and restoration projects. In this sense, for Sanfelice, the geometric awareness of the configuration of space allows integrating the shape to the structure in a mutual reference that makes nothing superfluous.

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The reasons of drawing
as an expression of creativity and trace of design thinking

The expressiveness of drawing, in terms of perfect controllability to make an idea come true, provides a freedom of expression that could not otherwise be achieved. So, Drawing is understood as the ''place of possibility'', where the idea that underlies design develops, changes, and comes true.

Elementary Observations on Drawing *

Franco Purini

The relationship between drawing and architecture is one of the historical issues of the *art of building*. Considered by some historians, critics and architects as a simple tool, it is, however, regarded by other scholars and designers as a much more complex area, to the point that it would not be possible to write a history of architecture while eliminating the results of this graphic exercise. Many works which have remained on the drawing board are, in fact, milestones necessary for describing the significance of a period in the history of architecture which, if it were illustrated only by the buildings that were actually constructed, would not be able to reveal the fabric of the ideas being confronted at the time. To better understand this statement, I would like to immediately clarify that, although it is true that architectural

drawing has construction as its primary outcome, it is equally true that this objective involves the execution of a large number of different kinds of drawings each of which, besides their value in relation to architecture, can also have, as will be discussed later, a series of cognitive and aesthetic contents that present the graphic work as a complex work, not rarely a work of art. This expressive dimension should be evident while it is, in fact, as was said at the beginning, the object of a historical controversy in which those who do not attribute an intrinsic meaning, unrelated to a constructive result, to architectural drawing, oppose those who do recognize it. In the following notes, this matter will be entered into, in order to more fully understand the nature and contents of the graphic exercise for architecture, in addition to the par-

ticular issues of this endless dispute. Even though I am here anticipating something that I will focus on later, it should be said that, as a whole, drawing is a *text made of texts*, each of which is specific to the design process. This plural structure of drawing gives it, as Manfredo Tafuri stated in a well-known conference in Parma in 1980 organized by Arturo Carlo Quintavalle, an *ambiguous* character produced by the stratification and interference of the various contents proposed by all of the graphic texts. From the points outlined in this premise I will try to demonstrate, in all their amplitude, the problems related to the relationship between architecture and drawing, with the intention of outlining a sort of map of the central issues that have marked and that still govern this founding relationship today. Lastly, I would like to point out that every architect has several ways of making projectural choices, all legitimate. One can start from an empirical method, making one attempt after another, working on examples to be reworked. It is possible to strictly follow a theoretical path, as well as hybridizing architecture with other forms of knowledge, such as sociology, among others. Some architects prefer to experiment through a series of models, while others prefer to work on neo-functionalist themes or to adopt parametric methods. As far as I'm concerned, I chose drawing at the very beginning of my studies since, in my opinion, it is the most complex cognitive and creative space in which all the just-mentioned directions of research can be comprised.

A contradiction

While it is true that Italian architecture presents, throughout its history, an intense and constant relationship between the compositional and constructive exercise and drawing–a relationship documented by a vast tradition of treatises–it is also true that for many reasons, there does not seem to exist, especially in regard to modern and contemporary architecture, an equally continuous interest for this fundamental relationship by those who actively follow the evolution of this disciplinary debate. Obviously, one continues to speak of drawing but the discourse tends almost always to remain outside of theoretical issues and in-depth critical analyzes. Remaining, for what regards time, in the last few decades, it is important to remember the important yet isolated interventions by theorists, historians and critics such as Francesco Moschini and Gianni Contessi. To the work of these *historical* observers of the relationship between mod-

ern and contemporary architecture and drawing should be added the contributions, also significant, of professors such as Fulvio Irace, Antonella Greco, Giorgio Muratore, Franco Cervellini, Ghisi Grütter, Carlo Mezzetti and Livio Sacchi. It is also worth mentioning the role of exploration and communication exercised by several exhibition establishments in recent decades, such as, in Milan, the Galleria Solferino, active in the 1970s, and the Galleria Jannone, while in Rome it was the AAM Gallery (*Architettura Arte Moderna*) of the above-mentioned Moschini, to be the main driving force of the so-called Architettura Disegnata (Drawn Architecture), which I will return to further on. Lastly, various magazines must be mentioned: Luciano Patetta's *Il Disegno di Architettura*; *Controspazio*, especially in the period in which it was directed by Paolo Portoghesi; *XY. Dimensioni del Disegno*, by Roberto de Rubertis and *Disegnare. Idee, immagini*, by Mario Docci. Alongside the activity of the galleries and magazines listed, some of the more rare and less-thematic initiatives proposed by structures such as the Venice Biennale, the Triennale of Milan, the *Istituto Nazionale per la Grafica* (National Institute for Graphic Design), professional associations, *Inarch* (*Istituto Nazionale di Architettura*–National Architectural Institute), the UID (*Unione Italiana per il Disegno*), founded and animated, until his death, by Gaspare De Fiore. This list, at least, would seem to deny what I previously said at the beginning of the paragraph, but if one thinks about the extent of the role of drawing in architecture, it is undoubt-

Fig. 1. Franco Purini and Laura Thermes, Study for the compact city, 1966.

Fig. 2. Franco Purini and Laura Thermes, Compact city, 1966, perspective view.
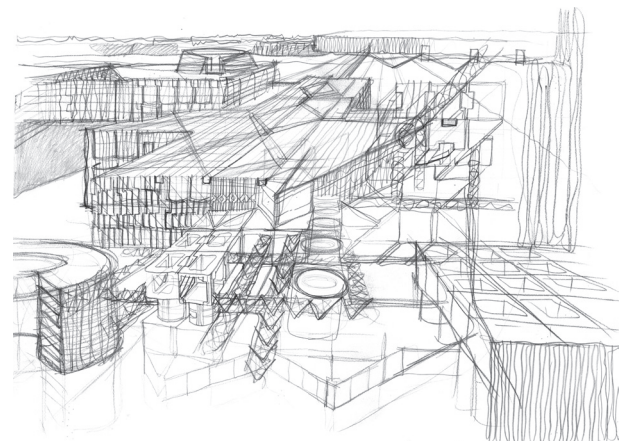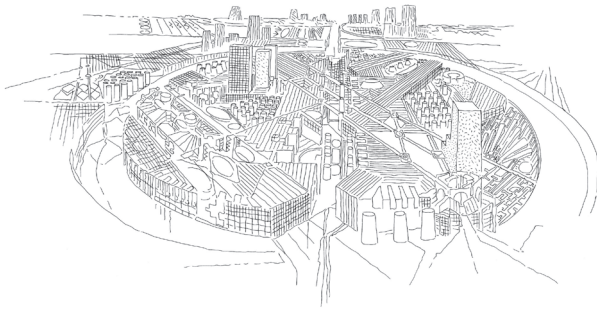
Fig. 3. Franco Purini and Laura Thermes, Compact city, 1966, perspective view.

edly small quantitatively, even if the persons mentioned are certainly among the best nationally and internationally to deal with this topic. Even several architects who draw have given significant contributions to a wider understanding of the contents of the graphic exercise.

A misunderstanding

The marginal presence of the relationship between architecture and drawing in the Italian historical, theoretical and critical reflection has, among several minor motives which it is not possible to discuss here for reasons of space, a major reason. This consists in the fact that the majority of historians, theorists and critics dealing with architecture–think of Bruno Zevi–consider drawing a simple tool which, once the work prefigured by it has become a physical reality, completely exhausts its function. Within this more than reductive concept, which appears to be a true *ontological misunderstanding*, drawing is considered, at best, only a *document* related to a particular design stage. Thus, for this reason, it would not possess its own aesthetic autonomy, not being able to present itself, even when its formal quality is high, as a work of art. This idea does not seem to take into account either the cognitive and creative complexity of graphic research, or, above all, the fact that, while a drawing refers to something other than itself, that it *represents*, it expresses its own reality as an artifact. A reality that must be evaluated independently of the meaning and content that architectural work can assume. From this point of view, an architectural drawing, when it is conceived and
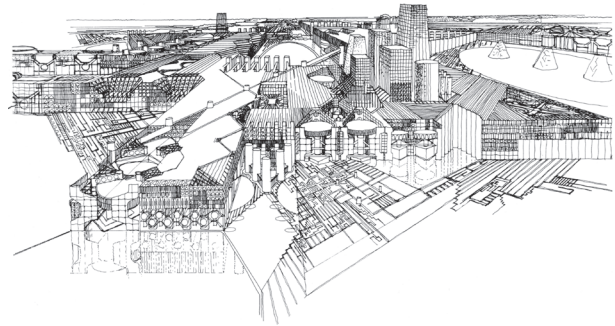
executed to the maximum of its potential, as I have already said, is a complex text which, beginning with the signs with which it is drawn, is articulated in a series of expressive planes in which different thematic areas cross, all polarized by a specific formal intention. The general disinterest towards drawing does not diminish even when it becomes an object of appreciation by historians or critics who normally deal with arts other than architecture. Indeed, even in this case, architectural drawing is not evaluated positively for its intrinsic qualities, but only because it is, for example, the result of various *trespassings* into other specifics, in a process of appropriation of aesthetic dimensions which, in itself, it would not possess. In other words, it is the *self-subversion* of its role which would in this case constitute a motive of interest, and no longer its internal functionality within a range of values that legitimize it in its own theoretical and practical identity.

Architectural drawing can be thought of as *a measuring device*. Surveying the world, designing a building and then building it involves actually putting into what you are seeing, imagining and realizing the metric paradigm, a tool that allows you to confer to existing things, or to things whose construction is planned, a coherent logic extended to the individual parts of the work and to their entirety. In the Vitruvian treatise the term *symmetria* means precisely the metric dimension as a *quantitative correspondence*, ie as reciprocal comparison, starting from the repetition of elements, of a modular unit. From the quantitative evaluation, which is certainly a bit mechanistic, it is then possible to pass, through a *poetic transmutation*, to *eurithmia*, that is to say, the harmony arising from the recurrence of elements
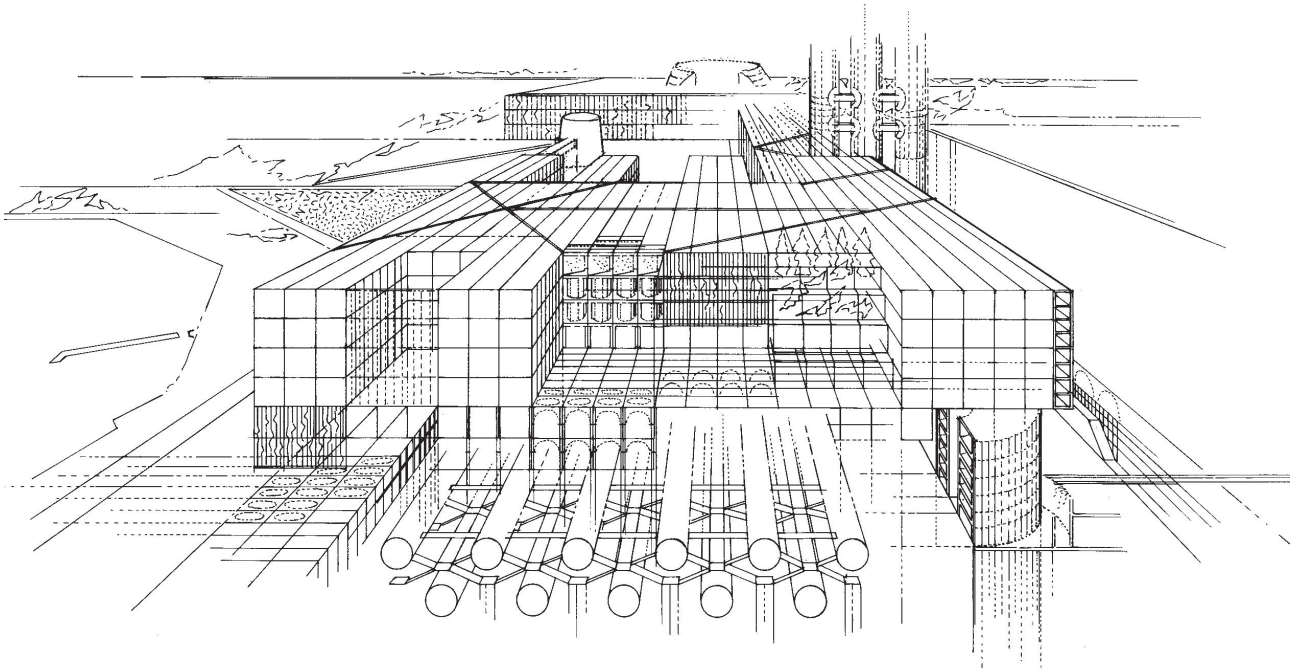
Fig. 4. Franco Purini and Laura Thermes, Compact city, 1966, perspective view.

and their composing themselves in the superior unity of form. When an architectural work reaches this dimension—when it 'sings,' as Paul Valéry has written—the measure loses any *normalizing*, *rigorous*, *restrictive*, *material* content. It may reverse itself into the allusiveness of the infinite, into the imprecision that becomes scalar oscillation, dimensional vibration, constituent ambiguity. In this way, an architectural work inverts its intrinsic rationality in a multiform and variegated complexity. A complexity which, remembering that in the meaning of the idea of reason there is also that of division, produces separation and distinction to then arrive at that unpredictable fusion of its components in an *unpronounceable unity* that transcends every possible measurement.

The sign, which is the very essence of the signature, could be defined as the primary outcome of an energy that the mind and the hand emit at the same instant. The sign establishes the graphic field, creates the *light of the drawing*, fuses space and time. The sign is somehow opposed by the *gesture*. If the sign, in fact, establishes writing as an action within a total projectuality, which thus presupposes a legitimizing temporality, the gesture, instead, seeks expressionis ignition, figurative excess, a destabilizing drift with respect to the intrinsic rationality of the sign. This rationality, which derives from the sacred action of *ploughing*, and that for this origin (which, incidentally, gives life to *bustrophedon writing*) presents the sign itself as *constructive*, is opposed by the destructive nature of the gesture, its unpredictability, its genetic possibility of expressing irrationality. A manifestation, as is the sign, of a primal energy, the relationship between gesture and sign is like that between disorder and order, or between chance and necessity.

The sign and the gesture are joined by the *tracé régulateur*, present throughout the history of architecture, loved by many architects, including Le Corbusier, Mies van der Rohe, Figini and Pollini, Maurizio Sacripanti, Oswald Mathias Un-

gers, Vittorio Gregotti. The *tracé régulateur*, which has the task of *differentiating the indistinct*, presents itself as an isotropic grid within which the elements subordinate their autonomy to the place they occupy, triggering an intense dialectic between locational equivalence and positional hierarchy. The *tracé régulateur* is similar to a tensional field, in which the conflict between uniformity and polarization is staged.

Architectural drawing takes on different forms, each of which illuminates a particular problem of a project. There is survey drawing, without which it is not possible to know a building or any other man-made object, such as a table or a chair, just as, if they were not drawn, no one would ever know how the elements of the world really are, such as, for example a flower, a tree, a rock, a stream, a cloud, a landscape. Then there is the sketch, the most important kind of drawing because within it there is the idea of what one intends to design. This is a drawing whose character lies in the speed with which it is done. A speed that is the result of a sudden synthesis of themes and motifs accumulated at the beginning of the design process as clues. A sketch is like the DNA of a building, a system of a few essential features that describe the appearance of the future work. Drawings fundamental for the development of an architectural idea are the plans, in which the ponderal, proportional, quantitative and qualitative relationships are established that ensure the *magic* of the building's formal correspondences; the sections, which are also subject to the invention of dimensional equilibriums, the elevations on which the *tectonic machine* that governs the object comes to the surface. Axonometries, perspective views, perspective sections, aerial perspectives, show a construction in different ways, thus highlighting the singular aspects of buildings, their relationship with the context and the territory. Sometimes drawings are produced that do not have an explicitly projectual content but are confronted as completely formal works that pose freely compositional themes. Themes that could in time be used in an architectural work. Taken together, these graphic forms are not really separate, as it would seem from the words used to describe them. They cross and hybridize. So a sketch can regard a plan, an elevation, or a perspective view as well as a detail. It is up to the architect to decide on the best graphic strategy for solving problems and for making the right decisions at the most appropriate moments of the design process.

When, between the 1980s and 1990s, digital drawing made its sudden appearance in architecture, it was enthusiastically greeted by those critics more alert and more open to the innovations of the discipline. Bruno Zevi held that it would have finally freed architects from the burdensome and, in his opinion, conformistic commitment to composition, since this new kind of graphic expression was almost automatically able to transcribe, in transmissible forms, the designer's intentions, favoring his innovative potential. Even the dreaded homologation induced by the computer with the consequent, yet misleading, end of authorship, was deemed an essentially positive fact, because it would have favored a widespread and shared theoretical and operative renewal of architectural culture. At the same time, several scholars, including Antonino Saggio, Luigi Prestinenza Puglisi, Livio Sacchi, Maurizio Unali, drew attention to the fact that digital drawing favored not only an improvement of an instrumental nature, but opened the way to a *new imagery* of a neo-naturalistic matrix. Phytomorphic, zoomorphic and mineralogical elements; star clusters and clouds; continuously changing, densely structured surfaces that evolve in

Fig. 5. Franco Purini and Laura Thermes, Study for the façade of the compact city, 1966.
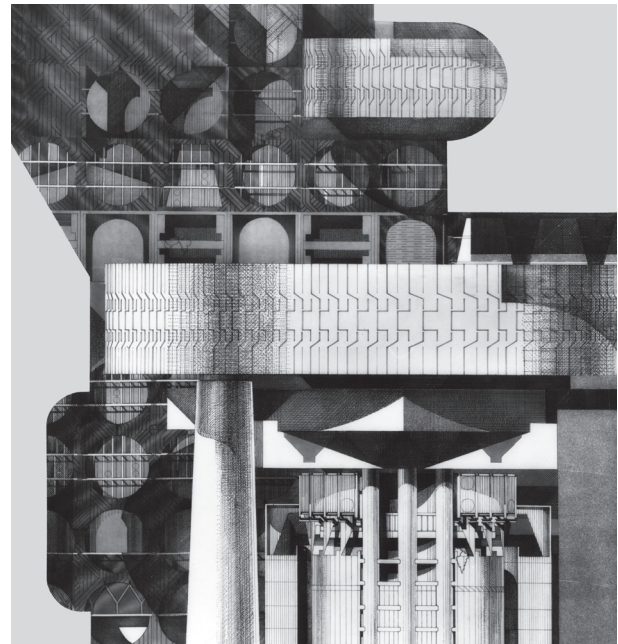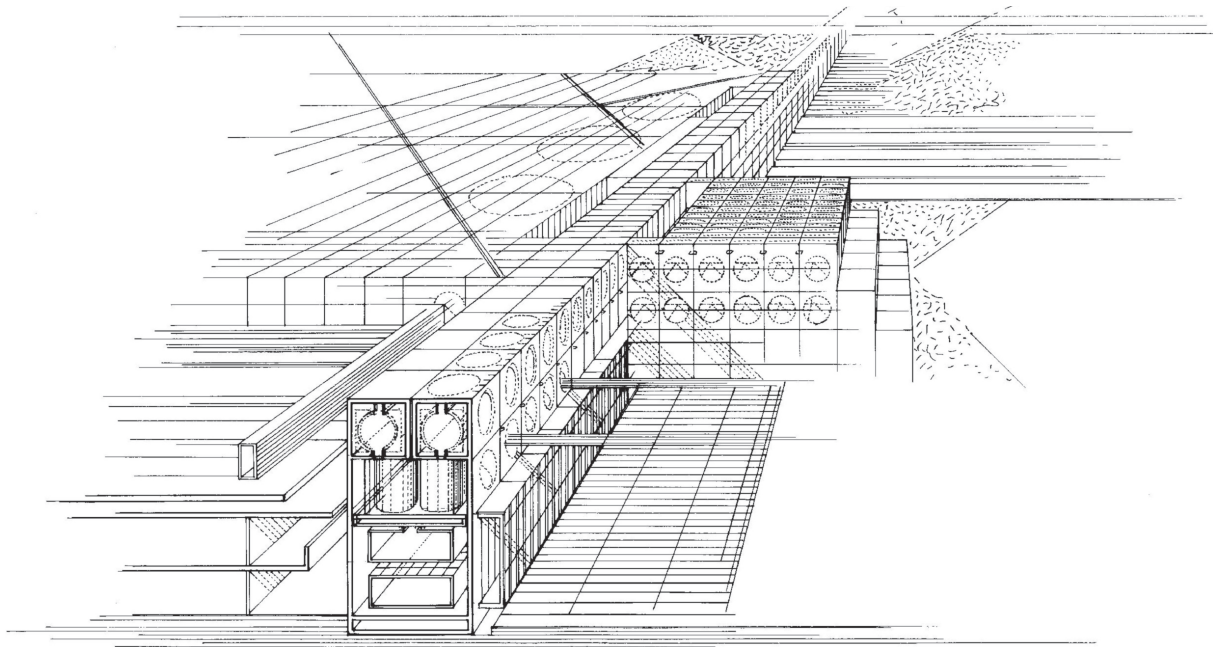
Fig. 6. Franco Purini and Laura Thermes, Preliminary studies for the section of the street built between Rome and Latina, 1967.

every direction of space are some of the materials that defined a figurative horizon that architects could refer to. In this regard, I think that, deprived of a space and a temporality, since its basic cell, the *pixel*, does not have the possibility of representing luminous and chromatic variations, digital drawing, despite many contrary opinions, does not exclude the autographic dimension. In fact, if understood in an integrally linguistic key, it can give rise to autonomous and original stylistic solutions, taking on the artistic value which manual drawing can reach, and often does reach, and, certainly, its own formal content. Naturally, the sign and the gesture will be lacking, but the intentionality of the expressive writing will, in any case, be recognizable. Obviously, I believe that the absence of sign and gesture is irremediable. Drawing not only represents what has existed, what exists and what will exist. It is also able to make visible what has never existed in the past, but which could have or could not have existed. At the same time, I think drawing is capable of representing a landscape, a city, a building for the

present or for the future that could exist or not exist because technically not constructible or because they would overlay pre-existences which could not be demolished. This undoubtedly elemental observation implies that the dimension in which architectural drawing exists is not 'real' reality but a *reality proper to drawing itself*. An autonomous reality that blends concrete existence with what can only live in the imagination. At the same time, in this *reality of drawing*, the past, the present, and the future meld into each other in an allusive continuity of a unique, somewhat immobile temporality, unless this would be a logical paradox. A paradox that in the space of art is, instead, possible. Drawing is therefore much vaster than reality, comprising the impossible, that is, the unreal, the fantastic, the astonishing, the prodigious. Joseph Michael Gandy's drawings of the Bank of England in which the artifact still to be constructed is represented in ruins expresses, in exemplary fashion, this mysterious and evocative interlacing of thematic resonances.
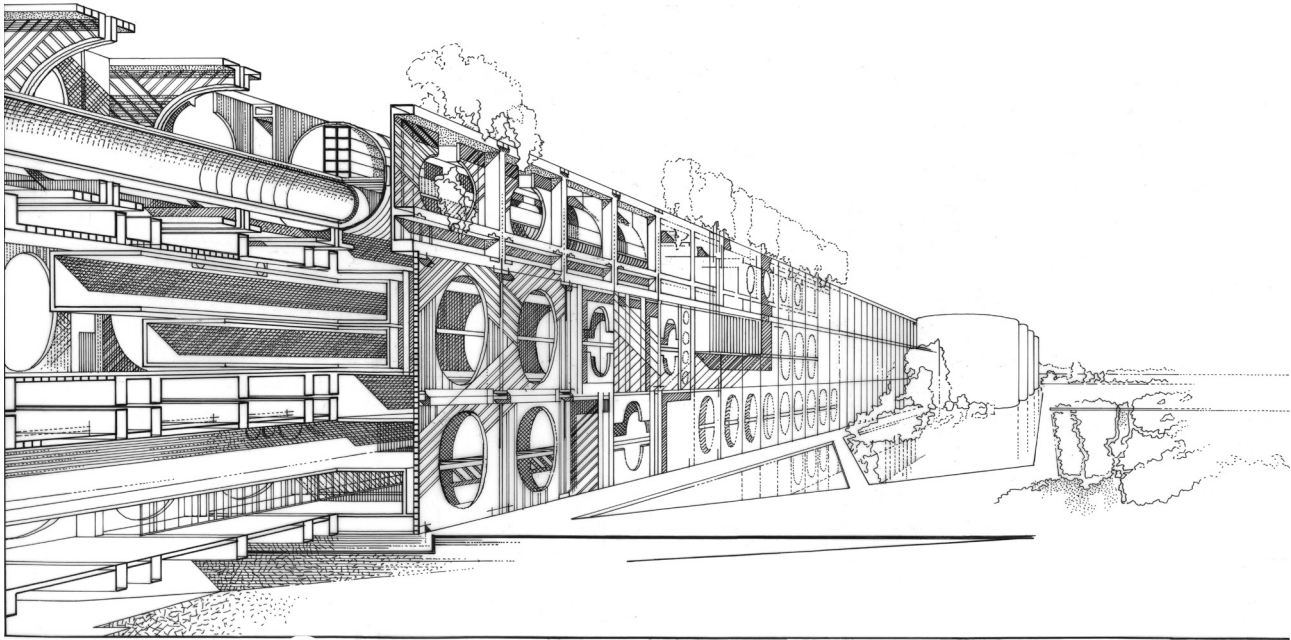
Fig. 7. Franco Purini and Laura Thermes, *Project for a street built between Rome and Latina, 1967.*

The main contents of drawing

An architectural drawing proposes three main contents. The first consists in its being *the formulation of an idea*. It is precisely this cognitive and propositive essence that makes it impossible to consider it as a simple tool. Drawing is, in fact, both the physical and ideal place in which an image, which only the architect can see with the eyes of the mind, the 'internal drawing' according to Federico Zuccari, reveals itself in a system of signs, making itself *external* and *objective*. This is, always according to Zuccari, 'external drawing.' The second content concerns the *communication of this same idea*. Drawing allows the architect to share what he has thought of with his interlocutors, allowing a certain number of operators, whom he might not even know, to realize, at the end of the project, the works he envisaged. For this reason, each drawing *speaks in the absence* of its author. The third content is recognized in the *memory* that the drawing incorporates. During a project there are many choices made, choices that involve the exclusion of a large number of solutions. Reconsiderations, accentuations, compositive emphasis or subdued weavings of elements leave their own traces in the body of the drawings and of the work, making it possible to trace back through the genetic process that had been followed, reconstructing the most significant moments, the secondary stages, the indecisions, the stops and the restartings. The fact that architectural drawing is idea, communication, and memory does not exhaust all the potentials it is capable of expressing. Narrative elements, iconic suggestions, diversions, symbolic and allegorical arrays mingle, transforming the drawing into a sort of *infinite palimpsest*, in some cases explicit and coherent, in others implicit, mysterious and contradictory. Always pervaded by an artistic intent, architectural drawing can undoubtedly be a work of art, as is made evident by the observation of the drawings of Leonardo, Michel-
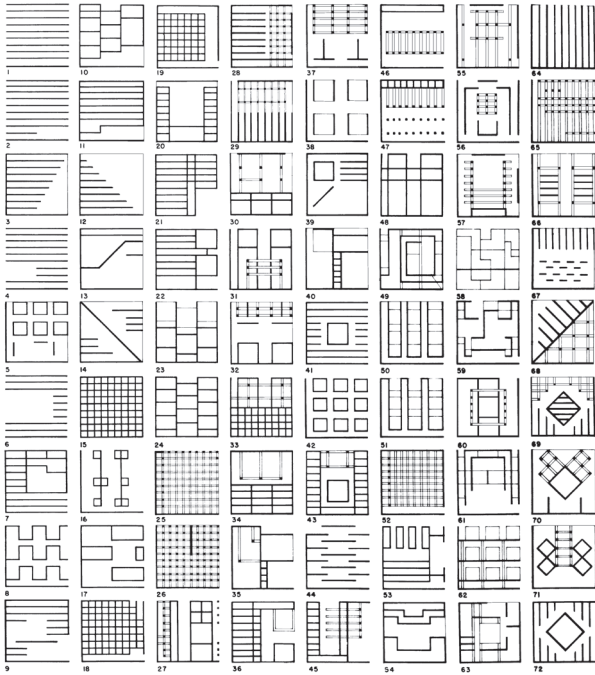
Fig. 8. Franco Purini, Classification through sections of spatial situations, 1968.

angelo, Antonio Sant'Elia and so many other architects who, even greatly reducing their number, would be too many to mention.

Types of drawing

I would now like to go back to some of the previously outlined points and briefly explore them. Architectural drawing is not univocal. It addresses a multitude of interests. There is a kind of drawing meant for understanding the structure of the physical environment, from the territory to the city, and from this to buildings and their furnishings. This is *survey drawing*, a rather complex practice through which the architect *looks* at the world, going from simply *observing* it to *seeing* it for how it is in the truth of its external and internal reality. Palladio's surveys of the Roman baths, the extraordinary drawings by Eugé-

ne Viollet Le Duc related to Mont Blanc; John Ruskin's inspired *reportages*; the Mediterranean impressions of Carl Friedrich Schinkel, Alvar Aalto, Le Corbusier; Giuseppe Samonà's sketches and drawings of the Cathedral of Cefalù describe a universe of graphic restitutions aimed at understanding and communicating the complexity of materials and interweavings in the physical world. There is then an architectural drawing that has as its objective the best possible communication of the decisions made by an architect. This is *professional* drawing, which, by being accurately and consciously based on the conventions related to *graphic writing*, builds a fabric of comprehensive information, profoundly studied in all its parts, strictly defined in the individual themes into which it is articulated. This type of drawing, related to realism, contrasts with a type of drawing that could be called *theoretical*. This is drawing conceived as the site of an advanced experimentalism on form, a place somewhat foreign, at least apparently, to reality, as it aims to reveal *space theorems*, to propose unusual and astonishing images. Revelations and proposals, as in John Hejduk's diagrams or in Peter Eisenman's analytic schemes, which in their enigmatic nature pose the problem of being recognized as something having to do with architecture. Forms different from theoretical drawing, which can also be considered as a *landscaping of interiority*, that is to say, as the result of a radical awareness of the primacy of imagination, are *visionary drawing*, that makes utopia transmissible and operative, even when it only lives on sheets of paper; *diagrammatic drawing*, in which an architectural program proposes itself as that which is common to graphic expressions such as the morpheme, the *logo*, the diagram, the ideogram, visual elements in which the graphic weights, the distance of elements and their reciprocal placement assume the role of a conceptual device capable of governing a compositional process; and *notational drawing*, which identifies the components of a particular architectural language rather than those of a building.

The meanings of a drawing

A drawing always has at least three planes of meaning. The first one could be called *directly referential*. These words are meant to indicate the *subject* illustrated by a certain graphic work. For example, a drawing can represent a landscape, a city, a building. In this case, the directly refer-
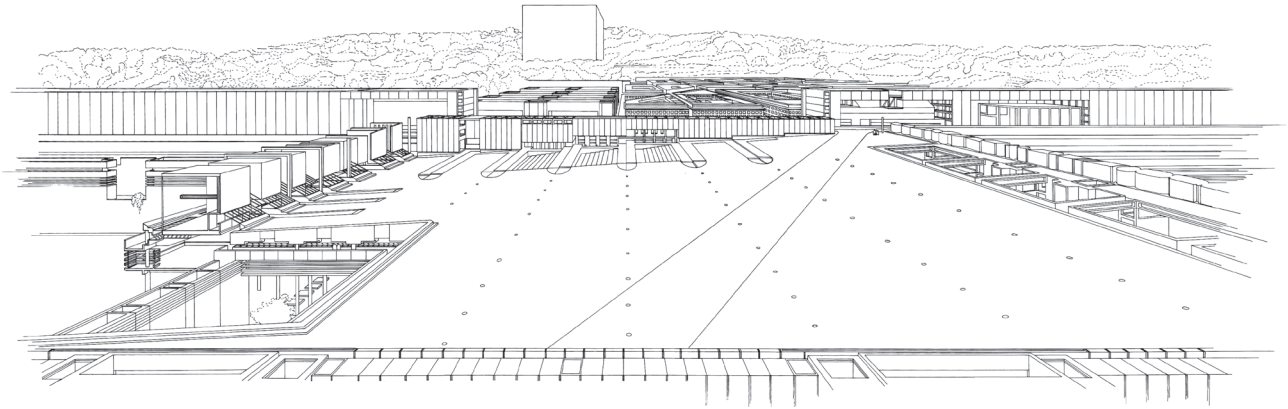
Fig. 9. Franco Purini and Laura Thermes, Bridge at San Giovanni dei Fiorentini in Rome, 1968, perspective view.

ential value would be recognized very simply in what the drawing itself would show. More complex is the second level of meaning, which can be defined as *metaphorical*. This includes all those thematic values which, by extension, are assumed by the parts of the object represented as well as the result of their coming together to form a whole. The word metaphorical points to the fact that the architectural object becomes an emblem of a certain relation to reality and its interpretations. A *closed* building would then allude, through an exclusive and space-separating conformation, to the idea of a community that defends itself from the rest of society with insurmountable doors and fences. On the contrary, an open artifact would speak of the various and complex relationships that would arise if this same community opened up to other social groups. The third level of meaning is referred to as autonomous. At this level of meaning, both the object in its typological and functional determination, as well as its metaphorical potentiality, disappear. Only the values of *form* remain, reduced to the purest abstraction. As though they were no longer architectural, the dimensional relationships, the scalar declinations of the parts, their modeling are presented from this point of view as a gravitational system that sees a number of elements approaching or distancing themselves, giving rise to some sort of *artificial cosmic order*. It is at this third level that a drawing can demonstrate, through its autonomy, its own artistic value.

Reading a drawing

The reading of any drawing, including an architectural drawing, is never a simple operation. Indeed, it is necessary to identify oneself with the image that is being observed and at the same time defend oneself from it, nurturing in its regards a kind of *prejudicial hostility*. Only after a series of interpretive rituals can this hostility, or if you prefer, this *distance*, be overcome. This resistance is opposed by another, this time expressed autonomously, of the graphic work, which for this reason would be protected by a true *guardian*. The task of this entity is to prevent those who want to interpret the image to enter those three planes of meaning, introduced in the preceding paragraph, which it itself proposes. The reading of a drawing also includes accelerations and slowdowns, stops, deviations and mistakes. As in a labyrinth, the eye must explore the image from far away, from up close, in its graphic layers, in its relationships with its own borders, often changing the itinerary between these ways of reading, starting from the same direction as the gaze, which is often subject to sudden reversals. Some parts of the image are not, for example, essential, but serve as *fillers* of the narrative pauses from which any text, including the graphic text, is always characterized. Fillers are not occasional, but necessary for distancing the main *places* of the representation. There is therefore an internal hierarchy to be understood, as there are compositional

traces, including some, explicit, and others, implicit. In addition, a drawing lies on a *plane* because it is usually done on a two-dimensional surface. In fact, besides the three-dimensional space it can represent, a drawing is the bearer of a virtual depth given by the nature of the sign with which it was created and by the interweaving which the sign itself gave rise to. By weaving together all these aspects, a multidimensional, thematically multifaceted, intrinsically *open*, *parallel text* is produced, a text which translates into a *visual narrative* that is non-coherent and linear, yet simultaneously continuous and discontinuous, positively contradictory, diversified and metamorphic.

The cultural areas of Italian architectural drawing

In Italian architecture there are four major cultural areas, which find a near-exact correspondence in four concepts of architectural representation. This polycentric structure causes the architectural identity of the Italian peninsula to have a *composite* character, due to the co-existence of traditions and trends regarding different procedural methods. The multipolar nature of Italian architecture does not weaken its identity but instead strengthens it, articulating it into specific issues. The first and historically most important of these areas is the Florentine area. Here, the found-

Fig. 10. Franco Purini and Laura Thermes, Urban Center and Management Center of Latina, 1972, floor plan.
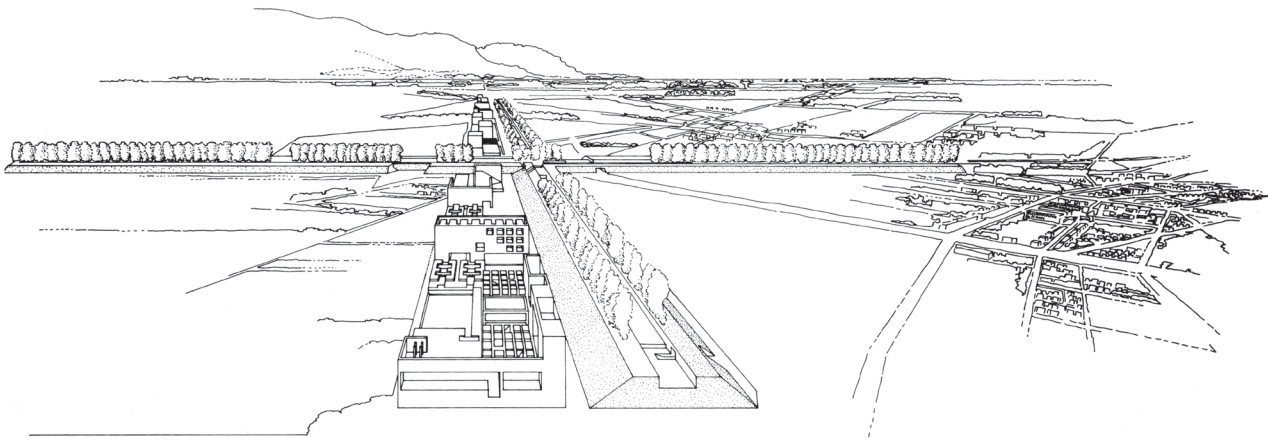
Fig. 11. *Franco Purini and Laura Thermes, Urban Center and Management Center of Latina, 1972, perspective view.*

ing element is *drawing*, that is, the result of the way in which landscapes, objects, bodies are rendered through the *line*, which is taken as an ontological principle. Theorized mainly by Giorgio Vasari, who built the *Accademia delle Arti del Disegno* (Academy of the Arts of Drawing) on it, this discipline appears as something eminently *conceptual*. Drawing is, in fact, the mental essence of physical things as well as fantastic simulacra. In addition to its intellectual aspect, the graphic exercise, as was the case in Michelangiolesque art, traces the path of a spiritual research on the world, destiny, life, death, and on what might exist after death. Inside the Florentine area, drawing, inspired by Neoplatonic themes, appears as the primary emblem of reason, reflecting the *divine design*. Florentine culture, and by extension, Tuscan culture, strongly influenced the Roman area, though this is dominated rather by the *idea* of mass, materialized in dense, compact, closed volumes. In fact, Rome inherited from Florence that character of strength assumed by its buildings, a stern and almost reclusive tone that was to astonish Stendhal. This idea of *severity* encounters in the Roman area another conceptual suggestion, that of the *ruin*. Hence *section imagery* as a Roman theme *par excellence*. The mass, the stratification, the ruination, which *opens* buildings to external space, have represented and represent the essence of Roman architecture, which in the eighteenth century found in Giovanni Battista Piranesi its most illustrious interpreter. Ludovico Quaroni's 1987 project for

transforming the Vittoriano into a ruin is one of the latest and most convincing examples of this cultural character. The components of Roman architectural identity, in which an attitude of rational thinking winds like filigree, as in Giuseppe Valadier and in Adalberto Libera, contrasted silently by the formal vertigo of the Baroque, confirmed in the twentieth century by an expressionistic vein, are resolved in a type of drawing with strong imaginative energy, approaching visionariness, as in the proposals of Maurizio Sacripanti. The Roman theme finds a complete and radical overturning in the Milanese area. Pervaded by still-operative Gothic mementoes, such as the scintillating Torre Velasca built by the BBPR architectural partnership, the architectural culture of Milan has been deeply marked by the Enlightenment and Neoclassicism. The *civil architecture* of that season, situated between the end of the eighteenth and the beginning of the nineteenth century, constitutes the programmatic outcome, is the emblem of a collective choice of order, balance, formal composure, the representative capacity of society, of constructive correctness. The place of the elaboration and transmission of these architectural features has been and still is the *Politecnico*, a school in which reason is presented as a theoretical paradigm and as an expressive horizon. Consequently, the architectural drawing of Milan is essential, precise, analytic and altogether synthetic, with no illustrative intent nor allusions to anything else not of a compositional and techno-

Fig. 12. Franco Purini and Laura Thermes, Urban Center and Management Center of Latina, 1972, detail of a building.

logical nature. In thinking of twentieth-century Milanese architecture, certain examples come to mind: the thematic solidity of Giovanni Muzio's graphic works, into which a pale metaphysical tonality penetrates; the mathematical rarefaction that animates with essential lines the visual world of Giulio Cattaneo; the restrained disruptiveness of Giuseppe Terragni's severe, limpid views; the didactic clarity of Franco Albini's drawing; the analytical dryness of drawings by Ignazio Gardella; the wide scope of Vittorio Gregotti urban visions, in which a strongly Cartesian sense of space is confronted in a vital contradiction by the preoccupied closure of Behrensian architectural works; the conceptual seduction and descriptive severity of the architectural representations of Giorgio Grassi and Antonio Monestiroli. An exception is Aldo Rossi, whose sketches and pictorial compositions are like poetic autobiographical surveys to which daily life offers its objects and its atmospheres, now serene, now painful, all in a scenographic stillness that is not limited to, as in Muzio, evoking un underlying metaphysics, but that places at its own center an explicit re-reading of the De Chirico-esque world. The fourth major cultural area of Italian architecture is the Venetian area, dominated by color, or rather by the tangentiality of drawing in favor of the decisive role of tonalism as the dissolution of the environment in a chromatic irides-cence in which everything is blurred, modified, with moving and transparent shapes, becoming pure feeling. Exemplarily represented by the drawing of Carlo Scarpa, suspended between textual stratifications and material evocations, this architectural identity has been captured with remarkable results by Le Corbusier in the project, unfortunately unrealized, for the Hospital in the San Giobbe neighborhood of Venice. The four areas, Florentine, Roman, Milanese and Venetian, have obviously not remained intact in their genetic profile. Over time, they have been in dialogue, exchanging themes and compositional methods. Milan and Venice have established a sort of alliance that has sought to dominate the Italian debate, starting with the *Politecnico* and the IUAV (*Istituto Universitario di Architettura di Venezia*–Higher Institute of Architecture of Venice), as recalled by the history of the *La Tendenza* movement. Milan then found support in the Naples school, while Rome tried to enter the lagoon city's thematic-formal area, opposing the south-north axis to the east-west Venice-Milan axis. The Romans Bruno Zevi, Saverio Muratori, Luigi Piccinato, Giuseppe Samonà–a Sicilian who had moved to the capital city in the 1930s–Carlo Aymonino and Manfredo Tafuri taught for many years in Venice, introducing motifs into that cultural context which were different in respect to the *environmental colorism* that governed architectural research there. The Roman presence balanced, in a certain sense, that of Milan, since most IUAV teachers, including Ignazio Gardella and Giancarlo De Carlo, came from Lombardy's capital city. In Venice there were three primary architectural areas, with the result of making IUAV a determinant pole in the international disciplinary debate. The other contexts gave rise to cross-alliances and the most diverse filiations. The school of Rome *reproduced* itself, so to speak, together with that of Milan in Pescara, while by itself it profoundly structured the Faculties of Reggio Calabria, Bari and Ascoli Piceno. Turin has always remained in its strange dimension of *extraterritoriality*, while Florence has maintained its autonomy by defending itself firmly from external influences. In this purpose, it has been aided by its world-wide fame, which, especially since the nineteenth century, has made it a city that hosted colonies of foreigners, especially English and Americans, a tradition that still persists today. In brief, the condition described, referring to four major cultural matrices, has created a complex system of interferences and superimpositions. However, it can be stated that, apart from the many contaminations and modifications of orientations that have

intervened over time, these matrices are still quite recognizable and operative. They govern, even in the digital age, the situation of drawing throughout the peninsula, giving it that *composite* character that reflects the polycentric nature of our culture.

Drawn Architecture

In the 1970s and 1980s, Italian architecture was the protagonist of a world-wide phenomenon, the so-called Drawn Architecture. This was a phase of research that was not homogeneous, but instead, strongly differentiated internally, in which a large number of architects, observing the effective depletion of the original themes of the Modern Movement, gave life to a season of advanced experiments, using architectural representation. Drawn Architecture had a dual content. It was, in fact, theory and image together, holding within itself both the new conceptual frameworks proposed in the debate of the time, and the unusual linguistic forms that those same frameworks demanded. In Florence, Andrea Branzi and Adolfo Natalini, in continuity with historical stararchitects such as Giovanni Michelucci, Leonardo Ricci and Leonardo Savioli, gave life to a radical season by producing iconic apparatuses inspired by the then current revival of interest for Utopian thinking, of fundamental importance for a general rethinking of territory, city and architecture. Alongside them, other Florentine architects should be mentioned, such as Roberto Maestro, Remo Buti, Francesco Gurrieri, who played an important role in the renewal of drawing. In Rome, Drawn Architecture was also enlisted in a thematic continuity with the role that architectural representation had always played. In this context, Piranesi's work has never ceased to exert a decisive attraction, as it recalls, to simply remain in the twentieth century, the architecture of Armando Brasini, but also that of designers such as Alessandro Limongelli, Pietro Aschieri, Innocenzo Sabbatini, the authors of works with dramatic plasticity in which echoes are perceived of the *colossal*, as well as expressive, atmospheres alluding to the evocative power of ruins. Due above all to Maurizio Sacripanti, a visionary architect to whose drawings is assigned the testimony of a research remaining almost entirely on paper, is the welding of the years spanning the 1930s, the 1940s and the 1950s with the new scenarios of the 1960s and 1970s. Mainly to his example, but also to the minor contribution of Mario Ridolfi, Ludovico Quaroni and Carlo
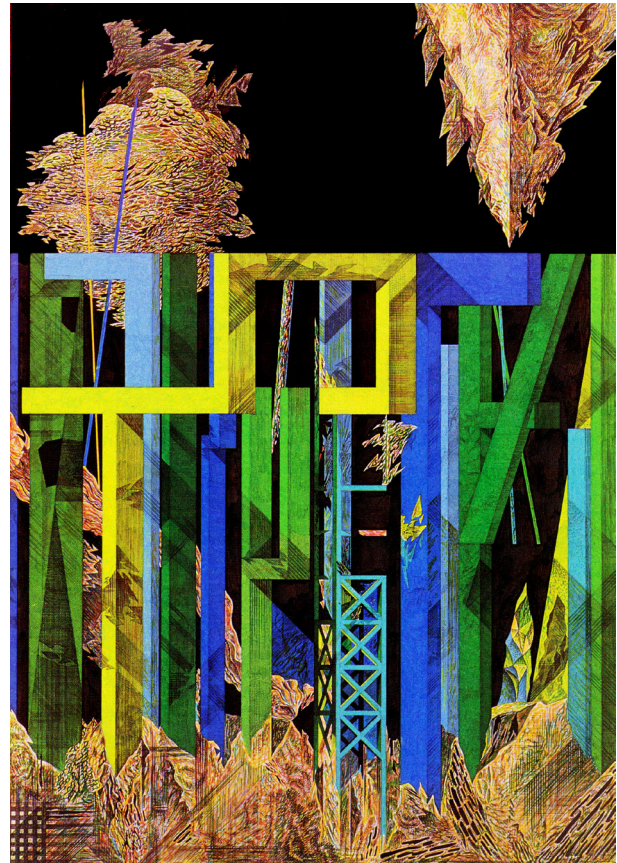
Fig. 13. Franco Purini, The architectural orders 1990.

Aymonino, a series of fundamental experiences must be referred. Among these are Paolo Portoghesi's inspired work on the memory of architecture; the *ante litteram* radical experiments of the GRAU group, which Alessandro Anselmi and Franco Pierluisi took part in; the graphic conceptualisms of Vittorio De Feo; the geometric meditations suspended between *simplicity, linearity, complexity* of Costantino Dardi; my own urban proposals, of a futuristic tone, suspended between form and construction; the *metropolitan fragmentism*, veined with neo-avantgardism, of the Studio Labirinto; creative surveys into *the past as*

future by Dario Passi; the poetic abstractions of Lauretta Vinciarelli; the *adventurous spatiality* of Franco Luccichenti, the *contaminations* between painting and architecture of Silvio Pasquarelli. Also participating, with remarkable success, in the Roman experience were Claudio D'Amato, Francesco Cellini, Giancarlo Micheli, Giangiacomo D'Ardia, Mario Seccia, Franz Prati and Aldo Aymonino, architects to whom we owe creative experiences whose effects on contemporary debate are still noticeable today. In Milan, Aldo Rossi, Giorgio Grassi, Antonio Monestiroli, Arduino Cantàfora and Massimo Scolari, founders of *La Tendenza*, have made a worldwide contribution to Drawn Architecture. From Rossi's biographical subjectivism to the *mineral objectivity* of Grassi; from the *hyper-stylized neo-classicism* of Monestiroli to the *thoughtful and interiorized realism* of Cantàfora and to the *enchanted utopianism* of Scolari, we have witnessed an extraordinary flowering of works that have refounded architecture under the sign of its autonomy. Although they belonged to the radical era, even Ettore Sottsass, Alessandro Mendini and Franco Raggi should be counted among the Milanese architects who made a significant contribution to the story of Drawn Architecture. A story that in Turin saw Pietro Derossi involved with his *situationalist* drawings and in Venice, the second center after Milan of *La Tendenza*, Gianugo Polesello with his *taxonomic drawings* and Luciano Semerani with suggestive compositions divided between appropriation and allegory. Guido Canella, more concerned with the contamination between the avant-gardes and the twentieth century, than with the re-proposing of the themes of reason in Illuminism and Rationalism, has been present, in a less frontal way than the exponents of *La Tendenza*, with striking assemblies of architectural fragments in the rediscovery of the theoretical and militant value of drawing. In Naples it is necessary to remember Uberto Siola's *typo-morphological* alphabets and the geographical and architectural views of Salvatore Bisogni. Diffused throughout the world by the Triennale

of Milan, the Venice Biennale and many other exhibition sites, among which I mentioned, at the beginning of this text, Moschini's AAM and the Galleria Jannone in Milan, Drawn Architecture formed the link between the *criticism* of the Modern Movement, which had marked the beginning of the 1960s, and Postmodernism, born at the end of the 1970s, a movement that it influenced significantly. The same digital revolution, with the primacy of the image that distinguished it, has found in the iconic heritage brought together by Drawn Architecture an important, and now historic, precedent.

The last observation I would like to propose concerns the relationship between manual and computer-aided drawing. Bruno Zevi's illusions on the end of traditional representation as an elective site of research have been attenuated in recent years. Today, digital drawing has become contemporary architectural drawing, required for purely technical reasons by the totality of commissions, but this does not mean that the practical benefits that it presents have been joined by truly new imaginative resources. Simply stated, creative processes seem to always evolve in the same way, starting from a *thematic-poetic nucleus* that finds, in the dialectic between 'internal drawing' and 'external drawing,' mentioned earlier, the secret laboratory in which the embryo of an architectural work finds its primary form, the founding idea that will govern the whole design process. In conclusion, manual and digital drawing have established a sort of alliance that sees them co-exist, the first as an ideal genetic space, the second as an advancement of the instrumental aspects of the graphic exercise in architecture, a principally communicative exercise that can find its inspired iconic dimension only if carried out with the wisdom and sensibility without which an architectural drawing able to remain in our memory would not be possible. The revelation of something that, despite being thought of at length, when translated into a drawing, always reveals something unexpected and surprising to us.

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Animation of Represented Bodies,
Between Science and Design Practises

Massimiliano Ciammaichella

Abstract

Most of today's design practices focus on complex form, displaying free-form animated surfaces inspired by the complex geometries and structures of the human body. Nonetheless architectural, product and fashion design tend to employ the same representational tools and methods in order to build artifacts which recall the shape of the human body in motion, as subjected to continuous trans-formation and hybridization processes, in 3D deformable models. The final purpose of the artifact can often be traced back to a single frame of the whole animated sequence, representing the entire design process consisting of continuously morphing of models or, as in the case of Generative design, it is even possible to rebuild the evolutive processes of he form. The paper investigates theories and methods for an eidomatic description of the body by means of a trans-disciplinary analysis of the state of art, testifying the latest trends in 3D animation, also through the documentation of some specific case studies selected by the submitter. The theories and the latest techniques of digital video representation will be compared and analyzed in order to discuss differences and similarities in design practices that have as a main subject not only the body, but also its communication. Representing the body today implies relating to the scientific innovation that often endows it with coexisting integrated technologies and, meanwhile, researches the performance effects of its image, through transformation processes that present innovative and possible communicative scenarios.

Keywords: animation, human body, free-form surfaces, morphing, design practices.

The digital drawing approach to design is for its very nature animated and manifests itself in continuous movements that orbit the point of view around the shape to be modelled, so that architects and designers, by now accustomed to the information technology tools, work in a dimension that Derrick de Kerckhove defines as an 'extended present', because ''The collective technological memory furnishes the means for infinite explorations in different levels of time'' [1]. Conversely, the analog drawing tools have reproduced in the fixity of the conclusive image the results of a gestural experience which hides a non reproducible nor reversible time. Yet the image in motion permits to reproduce the experience and to document the results of a process in progress. In both cases, between digital and analog devices, the available *medium* can guide the actions of the subject who employs it, and according to Lev Manovic [2] the animation, which played a fundamental role in the birth and development of cinema, plays now a central role in computer graphic, by alternating a ?real' collective imaginary to a 'synthetic' one.

Today the study and the observation of dynamism processes are concerned with the human body and design artefacts in general, in such a way as to assume a core role both in the results of practices and in the methods of project representation, which describe them. Rather than focusing on completeness of the *static* form to be achieved, the designer constructs real animated sequences that intertwine and blend the image of the body with the

Figs. 1, 2. Illustrations by Jan Stephan van Calcar, in Vesalio 1543.
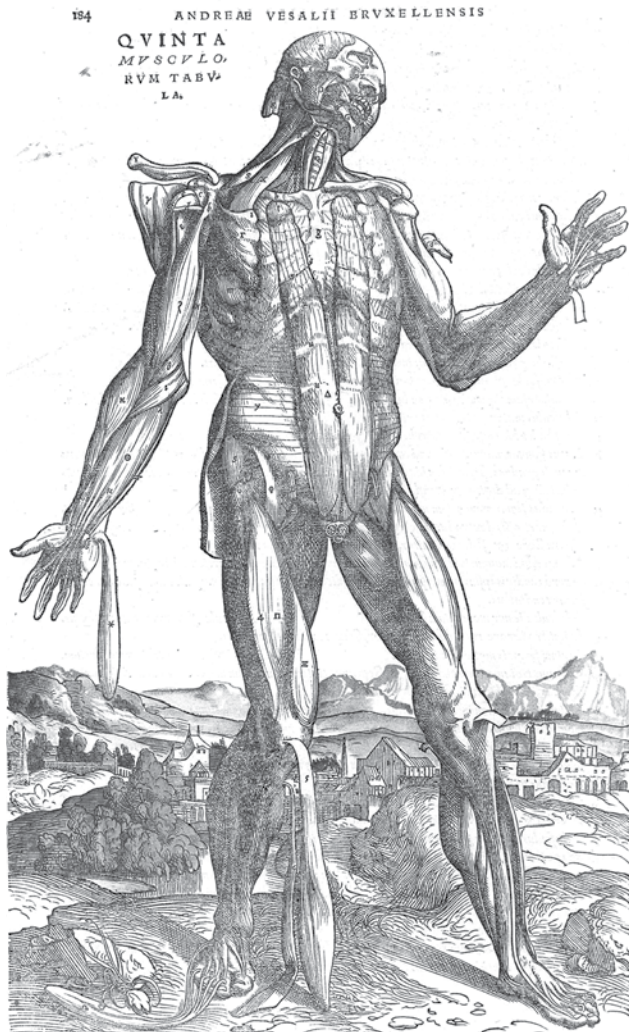
images of architecture and product design, in figures that are the result of becoming processes.

In fact, the relationship between body and architecture has always been very present and has, on the other hand, a very long history that ranges from research of proportion and symmetry in a perspective of Vitruvian centrality, to organicism, to anthropomorphism, until reaching the present hybridization and technologization of a body that does not refuse the metamorphosis of prosthetics, either for medical or aesthetic reasons but, as Anthony Vidler [3] suggests, dissects itself and redraws its skin thus continuously testing and experimenting. Then the focus moves from the external completeness of the complex machine of the human body covered by the epidermal lining towards introspection and deconstruction.

Hence, the body undergoes dismemberment and subsequently the bowels are cut.

This paper, therefore, pays attention to the image of the contemporary body, subjected to contamination of any kind, which alters its form and content, questioning the concept of identity itself.

In a sort of non-nostalgic return to classical studies of anatomy, new forms and physical possibilities helped by technical artificialization are experimented, and yet the body image is not static and reveals a pulsating nature, unlike the anatomical representations of Andreas Vesalius [4], that registered scientific discoveries through dissection, as documented by the masterful illustrations by Jan Stephan van Calcar [5] (figs. 1, 2).

Here the static nature typical of this type of representation, which has stratified pieces of information for centuries through a sequence of plane images, must face the three-dimensional representation of the digital clone and with its animated introspection, in line with the endogenous analysis which medicine performs on an alive body through videos, displaying what is usually unseen.

In this sense, the methods of project representation have considerably developed, passing from the traditional languages of drawing that returned the description of the artefacts in a limited two-dimensional projection–dear to Gaspard Monge–to the full control of objects distinguishable in their real three-dimensional features and movements in the cases in which they are present.

For a long time architecture was basically seen as a discipline devoted to the construction of static solid volumes, but since the 1990s, the massive introduction of personal computers available to everyone and the low cost CAD softwares into the market have transformed the work of the designer, who has become a 'sculptor' capable of modelling complex three-dimensional shapes in space, so that the term 'drawing' ends up by coinciding more and more with the term 'modelling.'

The physical reality of objects can thus be simulated, and so can the dynamism that will hence be somehow prevailing in the project's actions and in its communication.

Rem Koolhaas's approach in the *Jussieu Libraries* [6] design was significant. In it the curve imposed on the floor surfaces defines a continuous path that meanders freely within a transparent box, but the visitors' movements determine the project's representation strategies. These strategies are not reduced to the simple orthogonal projection, which is still in use in the plates of international architecture competitions, but draw a diagrammatic continuous section remindful of Marey's studies [7] and of the deconstruction of human motion, summarized in a synoptic image capable of synthesizing the frames of a kinematic sequence through the invention of *chronophotography* (fig. 3).

Concepts such as structure, skin, force, deformation, motion and animation become the key words of an architecture that uses digital technology to represent the complex form through NURBS [8] algorithms–which translate into mathematical models the totality of natural forms through directrix curves along which generatrix curves run for the realization of sinuous surfaces–and not only.

The idea of movement is already rooted in the type of approach offered by solid modelling techniques and the figures employed can be continuously changed, because of their subjection to the action of force gradients; these are vectors that progressively alter the 'figures' geometry while the designer can decide what the final result of a structure that evolves over time will be [9].

A structure uses the properties offered by the inverse kinematic chains in order to self animate. So the techniques of 'rigging', generally used for the animation of 3D human characters in cartoons and video games of the last generation, are applicable to the body of architecture. It is necessary to construct a skeleton and define hierarchies of movement for it, because every single movement of a bone will affect the movements of the bones attached. In particular, we can apply a movement to the last object of the chain, thus defining the intermediate positions of bones connected within the same hierarchy, in order to construct an inverse kinematics chain able to shape the skin of the architectural shell which will take different poses (fig. 4).

However, although Kinematics studies body motions without considering the causes that generated them, further changes to the geometry of three-dimensional models can be implemented by subjecting them to the dynamic action of attractive or repulsive force gradients, to physics laws and gravity.

Very often Kinematics and Dynamics are integrated in the design practices of many architects, but they also interact with other design disciplines, such as Fashion, that necessarily creates moving architectures animated by bodies.

Fashion designers such as Hussein Chalayan redefine the *silhouette* by using digital technology to shape the geometric surfaces of garments directly on the bodies.

These are subjected to the dynamic action of morphing or experiencing microchipped innovative materials [10], on clothes shape-shifters that independently move and open the doors to the *Animatronic Fashion Era* [11].

But the entire design process, from concept to finished product, can be equipped with digital clones, i.e. avatars that reproduce the sizes of real human bodies on which the apparel is modelled, simulating the traditional technique of *moulage* with which designers can drape textiles directly on the dummies.

They are organic models which *mesh* [12] defines as surfaces, generally polyhedra with quadrilateral faces.

These surfaces can be transformed into curves converting the linear profiles into tangents and NURBS directrix and generatrix.

By doing so, the plane surfaces of patterns collide with the bodies, reconstructing the curve shapes and the animated
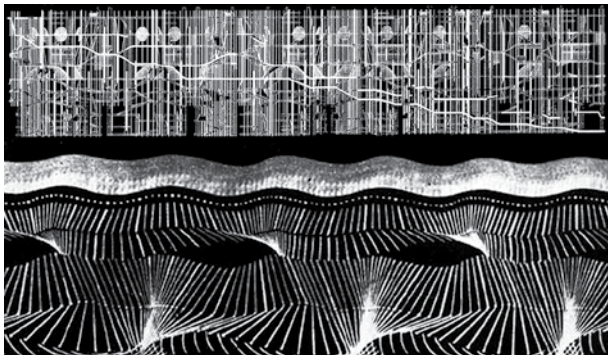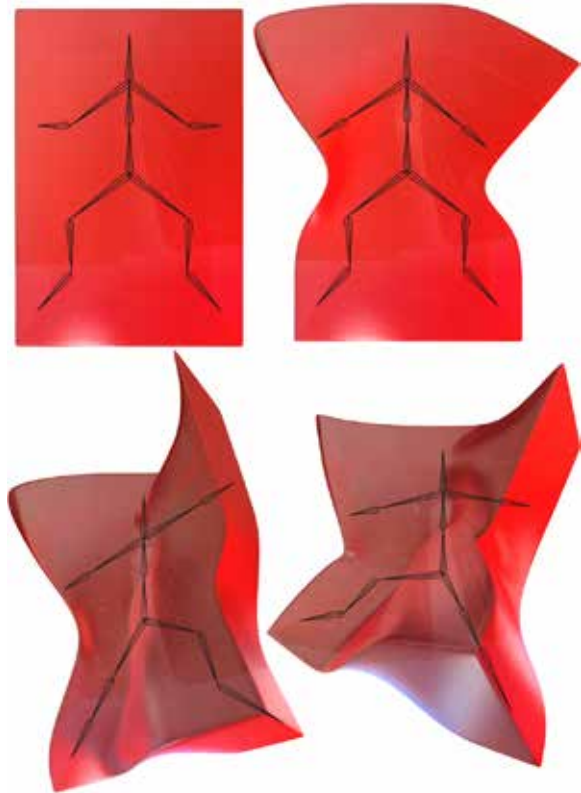
Fig. 3. Graphic scheme developement of the National Library in France, designed by OMA in 1992-93 and cronophotography of Soldier Walking, É.J. Marey 1883.

Fig. 4. M. Ciammaichella, Rigging the Box, 2016. Invers kinematic chains applied on a subdivision surface.

draping of clothes through the 'clothing simulation'; indeed many softwares allow operators to associate the physical properties of materials to surfaces that make up clothing. The real body and its digital clone are overlapped to adapt to the demands of the project and at the same time the new technologies reflect present and future aesthetic images, actually, even before designing clothes, fashion has always designed the bodies, as stated by Lucy McRae [13], an Australian artist who defines herself a 'body architect.'' Her work explores the boundaries of a body that does not reject prosthesis, evolving and reshaping its anatomy.

In fact, the parallelism with today's architecture, its complex forms and representation methods which determine its geometry, does not show substantial differences.

The movements and the poses of the 'structural skeleton' determine in both cases the variations of a volume covered with an infinitely elastic skin; for Bart Hess [14], a friend and collaborator of Lucy McRae, the animation of the body draws instead the soft surfaces which cover and modify it, in order to understand its evolution and to exploit its potential, between genetic manipulation and redefinition of the beauty concept.

In *Echo* [15] (fig. 5), the body movements of an actor suggest the dynamics of digital surfaces which dress and filter through translucent membranes that vibrate as thin shells. They are fluid skins of an alternative body that perfectly mimics the gestures of a real body and perfectly superimposes on it, thanks to the use of dedicated software to 'camera tracking' [16].

It is easy to understand that digital modelling and 3D animation offer multiple possibilities of expression and they often seem to influence the project.

Architectural product and fashion design get to use the same tools and representation methods to build artefacts that recall the shape of the human body in motion, subject to continuous processes of transformation and alteration. But when the body is the exclusive subject on which the current projects of visual communication and multimedia focus, there are two opposing trends: on the one hand the aim is abstracting it to highlight the traces of its movement that will subsequently allow to recognize it, to the other hand perfect virtual clones are reconstructed in such a realistic and expressive way as to wonder about their real nature. In the first case the capture of a person's movements through repeated scans could be represented on a numerical model which gives back only a cloud of recorded points in place of the body.

Fig. 5. B. Hess, Echo, 2011. Video frames
<http://vimeo.com/40286131>.

Fig. 6. D. Franke e C. Kiefer, Unnamed soundsculpture, 2012.
Video frames <http://vimeo.com/38840688>.

Fig. 7. Universal Everything, Made by humans, 2012. Video frames
<http://vimeo.com/52025659>.
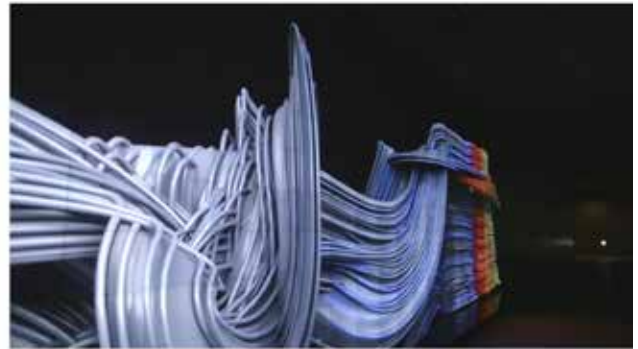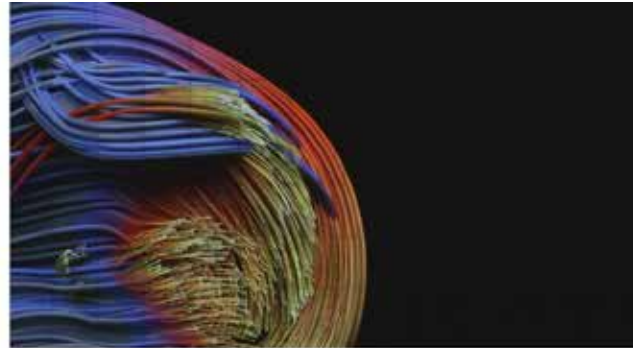
Consequently, physicality dematerializes and the points follow the sinuous curves drawn by the choreography of a dancer as a swarm, as in *Unnamed soundsculpture* [17], which represents the balance between contextualized form of motion in the virtual space and abstraction of the real subject that determines it (fig. 6). The same thing can be said of *Made by humans*, an installation realized by *Universal Everything* [18], a renowned graphic design studio, whose title announces the endless drawing that the body is able to track when it is not still. In this case, its shape melts and is carried away by sinuous curved surfaces that delimit the space of action of the body and are formalizations of its passage, recorded by sophisticated motion capture instruments (fig. 7).

When, on the contrary, the subject has to become recognizable, the digital representation exhibits hyper-realistic 3D avatars that embody the desired aesthetics.

Their impact is, however, less invasive than a bistoury, although even the image of the most beautiful bodies is changed by the editing software for images, as seen in fashion magazines and advertising posters.

Moreover, the accurate digital clone of the body can be reproduced by means of body scanners, or by using low cost techniques typical of photo modelling, where the subject is photographed simultaneously from different points of view in order to produce a three-dimensional model with ultra high resolution textures; this is made possible by Multi-stereo Matching Softwares [19] more generally used for surveying small size artefacts and in the acquisition of painted surfaces. This methodology has been tested upon a living body–which is difficult to survey because it is never motionless–in the video clip *Memex* [20] by the British band Duologue, where photogrammetry becomes an expedient to investigate the aging processes of the body and the concept of mortality itself (fig. 8).

Today representing the body means relating to scientific innovation, that often endows it with coexisting integrated technologies and, at the same time, questions the performance effects of its image through transformation processes that could offer new possible communicative scenarios.

Re-reading and interpreting the traces of its passage means building the basis for designing its action space, but framing its image means relating with a globalized body that aims at surgery artifice in order to move Eastern canons towards the West and vice versa. Architecture too seems to have adapted to these tendencies, relying on parametric

Fig. 8. Marshmallow Laser Feast e Analog, 2014. Video frames of Memex's videoclip, Duologue Band <https://vimeo.com/104385260>.
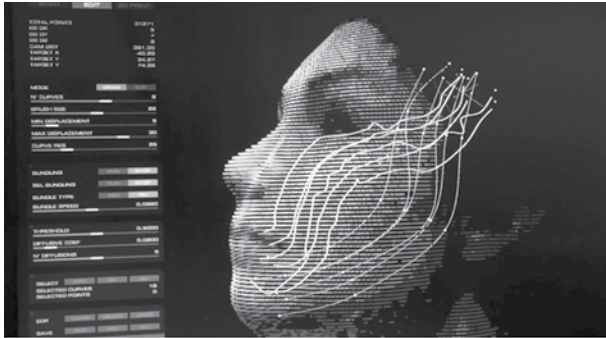
modelling with generative algorithms as a process of reunification of a form of living that often repeats itself and tends to make recognizable the software that created it and not the designer's hand.

It is a particular type of 3D modelling, also called 'associative', which does not stimulate the designer to aspire to a sense of formal completeness, because the final shape will be the result of a variable and continuous process, but can also activate a series of interdependent parameters arranged in a schematic configuration.

It is a sort of family tree within which, if one or more parameters are modified, the infinite formal configurations of the project consequently change.

However, the algorithmic logic which uses sliders to modify surfaces and solids in animated sequences is different from the usual practices of digital representation.

In many cases it seems as if the drawing is erased by the aseptic distribution on a plane of components and scripts which require skills more similar to information technology programming than to drawing programming. In this sense, many plug-ins and softwares [21] could be developed by improving the easiness of use, given the innumerable morphological configurations they are able to activate and the great interest in this type of parametric modelling, which not only affects architecture, but design in general.

However, for now the results produced by generative design tend to homologate the definition of intertwined structures that seem to mimic the complexity of bones viewed under a microscope or in the redrawing of the skin on them, which can be cut or covered by repeating patterns.

The final results will be articulated anthropomorphic figures for which the human body can act as a support for new compositions, less invasive than the tattoo, yet reflecting on the strict relationship between physical nature of the body and digital artifice, as can be seen e.g. in *Collagene*, a project by MHOX [22] (fig. 9). In *Collagene* faces are scanned by *Kinect* sensors that represent their numerical model on which one can freely trace the curves along which curved profiles of a complex structure easily prototyping with 3D printers extrude. The group of designers investigates the properties of biological systems in order to develop generative artefacts [23], but here the reasons of growth are arbitrarily related to the free form of a virtual organism crossing the geographies of the face that it engages by redrawing its mask. From all the above considerations the *animation* of represented bodies taking place at the cross-

roads of science, design practices and communication, is the dominant feature of a system of planning approaches that invest in digital representation methods which focus

on the evolutionary character of a complex shape made up by the free surfaces of a body in constant transformation and the subject of a multidisciplinary open dialogue.

Notes

[1] De Kerckhove 1996, p. 163.

[2] Manovich 2001.

[3] Anthony Vidler says: "It is a body which seems to be fragmented, if not contorted, deliberately torn apart and mutilated almost beyond recognition. Paradoxically, it is advanced precisely as a sign of a radical departure from classical humanism, a fundamental break with theories of architecture that pretend to accommodation and domestic harmony. […] Its limits, interior or exterior, seem infinitely ambiguous and extensive; its forms, literal or metaphorical, are no longer confined to the recognizably human, but embrace all of human existence, from the embryonic to the monstrous; its power lies no longer in the model of unity, but in the intimation of the fragmentary, the morsellated, the broken": Vidler 1990, p. 3.

[4] Vesalio 1543.

[5] Jan Stephan van Calcar (Giovanni da Calcar, Cleve1499-Napoli 1546), Painter and illustrator, the artist moved to Venice in 1537 approx, where he worked in Titian's study.

[6] OMA, Rem Koolhaas, design project for the unrealized National Library in France, Jussieu Campus, Paris 1992-1993.

[7] Étienne-Jules Marey (1830-1904), was a physiologist who worked on the study of movement in its different variants. He developed the contemporary work of Eadweard Muybridge, but unlike the editor and photographer, Marey worked with a single photographic camera for the shooting of multiple images, using actors in catsuits and markers for the motion capture.

[8] NURBS: acronym for *Non Uniform Rational B-Spline*, it described mathematical algorithms which represent curves, solids and surfaces of every genre. See: Piegl, Tiller 1997.

[9] Ben van Berkel says: "Move is about redefining organisational structures on all levels [[…]. Structures are free to assume different identities" van Berkel, Bos 1999, p. 15. Body skeletons are included, their kinematics could affect the animated morphology of architecture. In this sense, Greg Lynn clarifies the fundamental role of the animation in design processes: "Animation is a term that differs from, but is often confused with, motion. While motion implies movement and action, animation implies the evolution of a form and its shaping forces; it suggests animalism, animism, growth, actuation" Lynn 1999, p. 9.

[10] See e.g.: *Windblown dress* presented at the *Inertia* spring/summer 2009 collection and 2007 spring/summer collection.

[11] Hussein Chalayan: Turkish/Cypriot fashion designer who was among

the first to integrate new technologies into his creations. In particular the spring/summer 2009 woman collection, developed in collaboration with Swarovski, has been defined by critics as *Animatronic Fashion*.

[12] Unlike the NURBS, which are mathematical models since they are described by equations, the mesh surfaces are numerical models because are described by the coordinates of vertices.

[13] Lucy McRae is an artist who explores the limits of human body ant its form: <www.lucymcrae.net> (consulted on May 14, 2017).

[14] Bart Hess is a Dutch artist who has collaborated with Lucy McRae in different projects whose protagonist is the body and its form <http://lucyandbart.blogspot.it/> (consulted on May 14, 2017). He works primarily with video and has produced the *Slime Art* effects of the video clip 'Born This Way' for the icon of pop-music Lady Gaga, director Nick Knight, 2011. In order to appreciate the work of Bart Hess, refer to its website <http://barthess.nl> (consulted on May 14, 2017).

[15] *Echo*: video directed by Bart Hess for the National Glassmuseum in Netherlands, Leerdam, 2011. <vimeo.com/40286131> (consulted on May 14, 2017).

[16] Camera tracking is a procedure able to digitally translate the spatial coordinates and the properties of single perspectives, registered by a real camera. Generally, the video shoots are processed by softwares able to recognize common points on contiguous frames. They will become spatial points of a cloud on which one can define the geometries of simple solids, such as cubes and parallelepipeds, but also flat surfaces recognizable in various frames. The effects of the real video camera will be converted, like contributions of a digital camera, to import into a common 3D animation softwares.

[17] *Unnamed soundsculpture*: video by Daniel Franke and Cedric Kiefer, in wich the moves of a dancer were registered by three Kinect depth camera (Microsoft), and subsequently reworked into a 3D modelling software such as 3D Studio Max (Autodesk).

[18] Universal Everything is a famous graphic design studio founded by Matt Pyke. <http://universaleverything.com> (consulted on May 14, 2017).

[19] See e.g.: Agisoft PhotoScan <www.agisoft.com>, PhotoModeler Scanner <www.photomodeler.com>, 123D Catch <photomodeler.com> (consulted on May 14, 2017).

[20] The project is a collaboration with the Marshmallow Laser Feast <vimeo.com/marshmallowlaserfeast> and Analog <analogstudio.co.uk> (consulted on May 14, 2017).

[21] See e.g.: Grasshopper <www.grasshopper3d.com>, ParaCloud GEM, <www.paracloud.com>, GenerativeComponents <www.bentley.com> (consulted on May 14, 2017).

[22] MHOX is a generative design lab founded by Filippo Nassetti and Alessandro Zomparelli on 2012 <www.mhoxdesign.com> (consulted on May 14, 2017).

[23] Do the Mutation, *Collagene*, May 29, 2013, p. l. In: <dothemutation.wordpress.com/2013/05/29/collagene-4/> (consulted on May 14, 2017).

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Louis Kahn, the Beginning of Architecture.
Notes on Silence and Light

Noelia Galván Desvaux, Antonio Álvaro Tordesillas

Abstract

Louis Kahn spent his entire career trying to answer the need for architecture to be a reflection of man's life. He elaborated on this idea using his thoughts on institutions as a response to human activity, and where the architect starts their design process.
The search for these beginnings led him to look at the origin of architecture, trying to establish a theory that would give a response to the division between the creation's desire to be and the architect's desire to express, articulating all of these thresholds that architectural theory passes thorough as a creator of appearances. All of these abstract concepts that Kahn talks about materialise through drawing. They are lines that find themselves drawn half way between text and the drawing being analysed, and they refer to universal ideas on architectural concepts.
We will be exploring the idea of the origin of architecture, from silence and light, through an entire series of notes from the architect's personal journeys, which were evolving along with his thoughts on architecture from the fifties until his death in 1974.

Keywords: Louis Kahn, drawing, idea, silence, light.

Introduction

From a restless spirit to his calling to be a painter, Kahn had many graphic design influences throughout his life that led him to develop his own system. The perfection of the lines he drew made him try to strengthen the creative intentions of his drawings (fig. 1) through diverse techniques [Montes 2016, p. 93], in which the search for abstraction and expression became one of his key interests. He was a multi-faceted architect, with a complex conceptual rhetoric based on aphorisms. A lot of the time he expressed this with short, unrelated phrases, almost creating visual poetry, and liked students who were eager to listen to his talks, those who, as he said, learned more than what he taught. In his classes and conferences, he used ideas related to one recurrent, central thread, which through linguistic philosophy, explored the meaning of the words and used them to find solutions.

The Louis Kahn drawings that we will look at here are the graphic design expression of intellectual unrest, but they are also the representation of an oral rhetoric which defines itself as the project development of his architecture. Because of this we can consider Kahn one of the first architects who, after the Modern Movement placed special emphasis on architectural representation [Otxotorena 1994, p. 205].

As we have previously said, this interest would not be focussed on disciplinary drawing, but on a specific vision of representation where self-expression was a priority. For Kahn these drawings would be maps to guide the architect

through creative thinking; a field in which they can find the essence of their projects. Kahn drew in order to find [1], to pick up intuitions and ideas and bring them from silence into light. There is a willingness to be in them, an existence of which the architect is an instrument; of which ideas seem to take on a life of their own through drawing.

We refer specifically to those drawings that serve to help us understand and explain his process and search. In these drawings, Kahn found a method to work, an architectural way of thinking that evolved with time.

The terms that Kahn referred to with his ideas were changing, as were his lines, but the architect returned time and again to his origins, to the stepping stone where he discovered all the available possibilities.

I love the origins

At the start of this project, an important factor was the study of man's habits that would define the uses and needs of the architectural project. For Kahn, the project needed to adapt to the needs of the institution that it was going to accommodate.

"I can assure you that the most satisfying thing was the certainty that solutions did not come from a dead programme" [Kahn 2002, p. 24].

Changing a project involves liberating forces, being able to understand the nature of a group of spaces and give them shape. And it is in his thinking regarding institutions, based on human activity, where we can easily find the origin of the creative and compositional process of Kahn [Sabini 1994, p. 34].

This way of the architect projecting, comes from his years as a student at the Beaux Arts Institute in Philadelphia [Browlee 1998, p. 15].

For Kahn, shape did not refer to architectural contours or profile, but the essence that an architect must discover in an architectural programme before it becomes contaminated by practical considerations. But "programme was too boring a word" [Kahn 2002, p. 24], it did not include the width of meanings that Kahn wished to find, faced with a new project. It was about finding the nature of space and the essence of the institution.

This stance, of not complying with closed programmes, was one of the key motives for the multitude of non-constructed projects that Kahn treasured in his study. His most beloved client, Jonas Salk [2], gave him total freedom to design his laboratories in La Jolla. He added a thought to the project: "I'd like to invite Picasso to the laboratory". Kahn noted in this, one of his best projects, that the programme is not just function, but a series of rules, considerations and hopes to do with the nature of the building.

Fig. 1. L. Kahn, *sequence about his hands drawing using charcoal in his studio. Frames from My Architect, a son's journey, Nathaniel Kahn.*
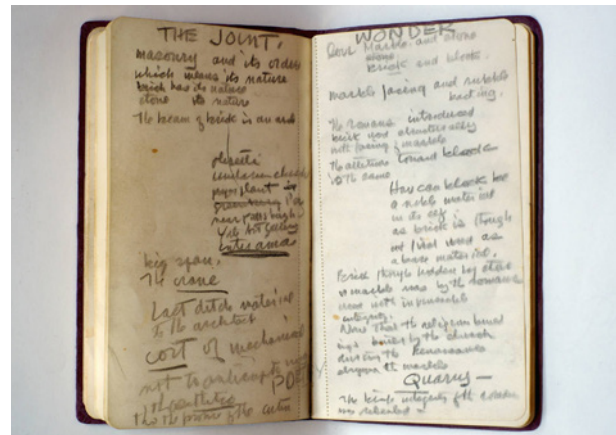

Fig. 2. L. Kahn, *notebook The Joint meets Wonder, ca. 1966-1974. Photo Jon Rohrer. Louis I. Kahn Collection.*

Asking an architect to ignore this and design a building as an intelligent response to a list of surfaces "is like writing to Picasso and saying to him: I want a portrait…with two eyes…a nose…and just a mouth, please" [Kahn 2002, p. 45]. These for Kahn were the architect's rights.

We return now, as Kahn did, to the origins. There, at the start, work should not start with surfaces or pre-established (fig. 2) ideas regarding a place or an intution.

Awareness è [3], understanding of a problem and of the nature of things must come to the fore: "what the things want to be."

The institution, which in recent years Kahn would call 'availability' [4], is found within this origin. In what he would call preform, an architype that refers to an archaic shape where all possibilities are condensed [Kahn, Latour 2003, p. 101]. The architect is the one who has to acknowledge the institution's need to exist.

The inspiration of living was the origin of the architect's institution. But Louis Kahn's North America was not the same as that of Thomas Jefferson, of Frank Lloyd Wright, or of Mies Van Der Rohe.

Nor was it, when Kahn articulated these ideas, the optimistic North America of the New Deal. The essence of the institution had been weakening in society in pursuit of the technical feats and social changes.

Kahn was aware that inspiration and awareness were already being vaguely perceived in the institutions of his time [Roca 2009, p. 24]. "Today the shadows are black. But in reality, there is nothing like that of white light, black shadow. I believed in when the light was yellow and the shadows were blue. White light is a figurative way of saying that even the sun is standing trial are certainly all of our institutions are" [Kahn 2002, p. 16].

Willingness to exist

Nevertheless, Kahn believed that a revolution was possible, that through wonderment [5] new institutions of man would be born. Since man's capacity to acknowledge that which is found in the origins, the immeasurable, generates the institution; and this is found within man with regard to the need for expression and existence.

This particular definition of the term institution is the expression that designates common faith, 'the human agreement' as Kahn called it, which aims to discover the nature of things in the world.

It is more an idea than a reality [Giurgola 1996, p. 93]; and is established through an order based on the common characteristics of mankind. In this way, Kahn's standpoint refers us to the many ideas linked to living [6] as an inherent desire of man that allows him to fulfil his potential. The nature of space and the institution has what Kahn called 'existence will'.

In his text *Order is*, Kahn clearly shows that the nature of each thing has a specific will to be: "that is why a horse painted with stripes is not the same as a zebra" [Kahn 1955, p. 59].

Architecture is not conceived or born when we ask how to construct it but when we explore what it is that it looks to express; it is more to do with discovering what according to Kahn has been forgotten, the primordial order that already 'is', that is immaterial, pure creative force and inclusive will.

Kahn would write: "A dome is not conceived when we ask how to construct it. Nervi made arches grow.

Fig. 3. L. Kahn, drawing for City/2 exposition: The Street is a Room, 1971. Louis I. Kahn Collection.

The Street is a Room by agreement A community Room the walls of which belong to the donors. It's ceiling is the sky
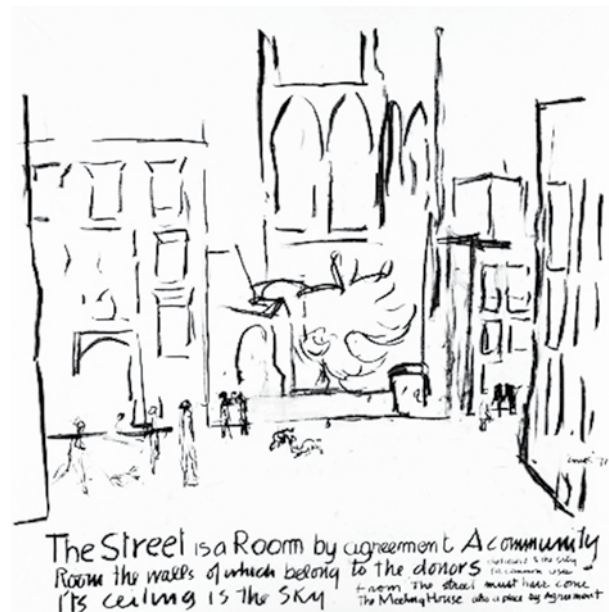
Fuller made domes grow" [Kahn 1955, p. 59]. However, both respond to the institution they serve.

For Kahn, there are three key wills that respond to constant institutions throughout the history of architecture and refer, in their origins, to the home: the will to learn, the desire of encounter and the desire of wellbeing; which translates in the institutions of the school; the street and the city (fig. 3).

"Schools started with a man under a tree, who didn't know he was a teacher, discussing what he was aware of, his knowledge, with a handful of people who didn't know they were students" [Kahn 1962, p. 115]; "the street is a room of consensus […] where people live, learn, shop and work" [Kahn 1971, p. 33]; "the city is measured by the character of its institutions […] these places that must conserve a way of life" [Kahn 1971, p. 34]; "these days these institutions are being called into question. I think this is down to them losing the inspirations of their origins" [Kahn 1971, p. 34].

Faced with changing circumstances, Kahn required the renovation of interpretations: to look for "new expressions for old institutions" [Norberg-Schulz 1990, p. 12].

Sabini stated [Sabini 1994, p. 15] that amongst all the books in his library Kahn proffered a History of England of which he, despite having eight volumes, only ever read the first, looking for that origin that had never been written: "I am particularly interested in English history, I find it fascinating. Even when it is a vicious history, it had the quality of a search. However, every time I start to read the first volume, I stop at the first chapter, and I read it and reread it, always trying something different. Naturally, my idea is, probably, to read Volume Zero" [Wurman 1986, p. 245].

Drawing to discover

On the 12th February 1969, Louis Kahn held an exhibition of his work at the ETH in Zurich, giving a talk entitled *Silence and Light*. As he stated during that talk, he had only made a few basic notes which were drawn from one central thread, and began drawing on a board because "this time drawings themselves were the talk" [Kahn 2003, p. 244].

Kahn wrote two words on that board–silence and light– explaining he was going to talk about some ideas he was developing at that time (fig. 4).

It was one of his most abstract and complex theories that he had developed on architecture so far.

Silence and light were words he had chosen at this point, nearly at the end of his career, for collecting all his poetic ideas concerning the process of architectural creation.

Fig. 4. L. Kahn during the 1969 conference at the EHT, Zurich. Photo by Peter Wenger © Archives de la construction moderne - Acm, EPF Lausanne.
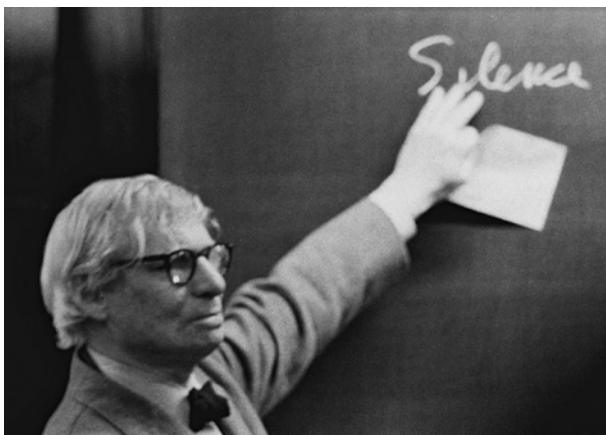
Fig. 5. L. Kahn´s notebook Architecture the making of room, Silence and Light, ca. 1970. Louis I. Kahn Collection.
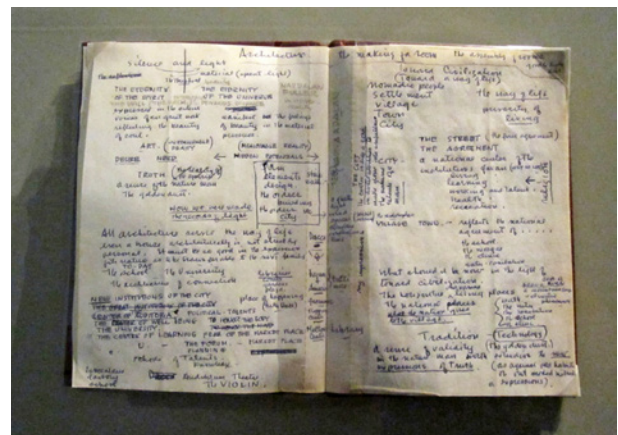
Within this context, light for Kahn represented a means of expression by which nature became present in the architecture, while silence was a wish of expression present in the collective unconscious [Tyng 1984, p. 129].

Kahn, who was fascinated by the idea of discovery, told everyone in attendance that the process of architectural creation meant to take away the silence from a project, a building, an idea, and to bring it into the light, in order to make it real, to materialise it. Kahn continued his talk, which as always was disorganised and full of gaps, he used metaphors and references from within his own universe which he tried to explain (fig. 5).

Things became clearer however, thanks to the drawings Kahn was making on the board. They were about diagrams and charts, where pyramids, lines, and rays of light mixed with words in this graphic parallel speech to which we will refer in this text. These drawings are especially relevant when addressing the study of Kahn's work and understanding his way of thinking.

His ideas on silence and light, and the drawings that accompany them, are the means of expression through which the nature of architecture was presented, and the methodological base of our study on the relation between drawings and Kahn's thought process.

Form, drawing and order

The beginning of the graphic talk on the architectural process developed by Kahn starts in the fifties with the concepts of Institution and Wonderment, and their subsequent translation into Form, Order, and Design. Kahn´s diagrams show us how human thought and feelings (the will to be and to express) are related to the concept of Form. In his drawings from 1953 and 1954, Kahn did not show any special interest in the term Form, but focussed on three creative phases: the nature of the space, the order and the design [7] (fig. 6).

From 1960 onwards, Kahn includes Form as the result of two opposite desires: the will to be, linked to human thought, philosophy, and, especially, to history [8]. This is a look back to the beginnings and the deep searching through memories which are defined by archetypes. In addition to this, there was the will to express, related to feelings, and the need for translating all mental images of inspiration into reality. This dichotomy would turn Form into an expression of the Institution [9].

Fig. 6. L. Kahn, *nature of space, order and design, 1953-1954* [Tyng 1984, p. 22].

Fig. 7. L. Kahn, *on the creation of Form, 1960* [Tyng 1984, p. 30].
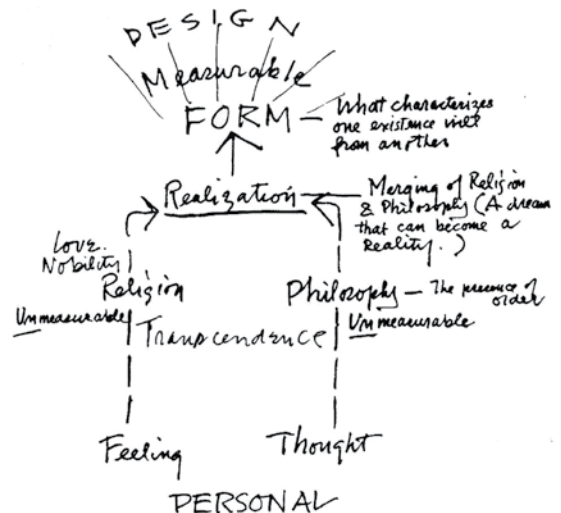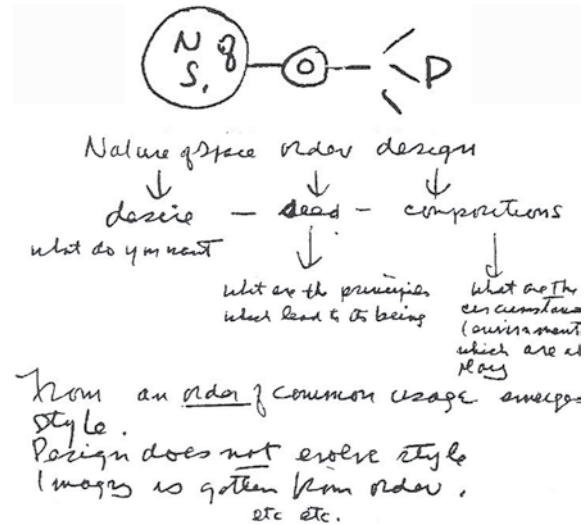
Fig. 8. L. Kahn, Silence and light, 1968 [Tyng 1984, p. 135].

Fig. 9. L. Kahn, Silence and light, 1972 [Tyng 1984, p. 135].
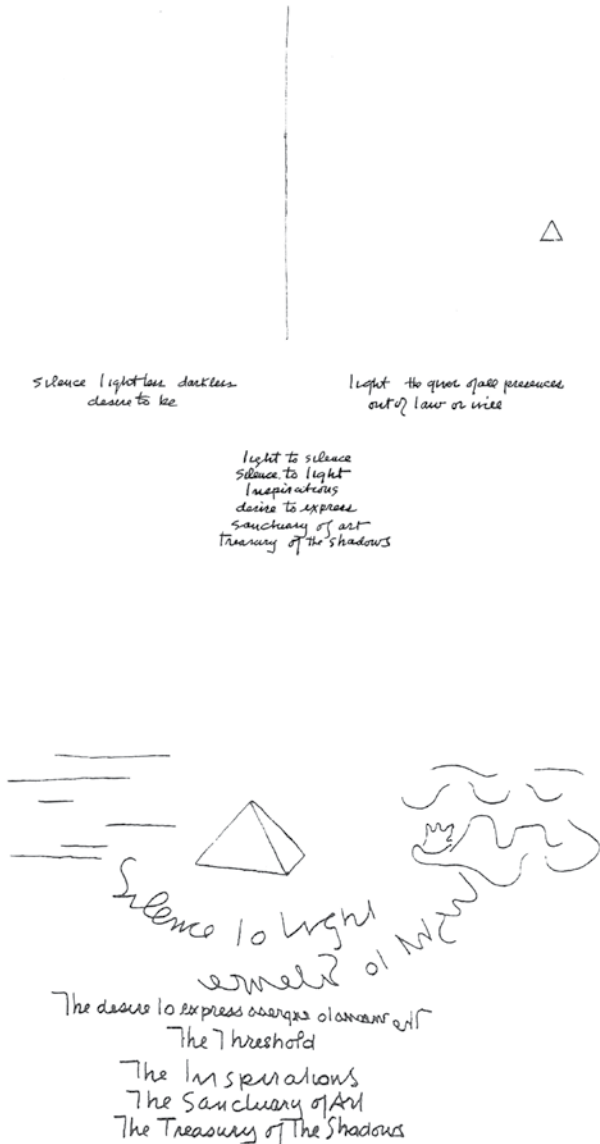
In order to understand this term included by Kahn in 1960 we should distinguish its English meaning as 'form' or 'shape'. In this sense, Charles Moore suggests that "form determines a field in which realities may be taken or given shape. […] There are millions of possible shapes, shapes, for a spoon, whereas there is only one form, form" [Sabini 1994, p. 37].

Therefore, for Kahn, shape has neither an outline nor a predefined size. Shape is an abstract concept, while design is in reality a reflection of its translation, a drawing of the shape that expresses nature.

"Form is *what*, Design is *how*. Form is impersonal, design belongs to its producer. Design is a circumstantial event (the available budget, the plot, the client, the knowledge needed); Form has nothing to do with all these circumstantial conditions. In architectural terms, Form describes a harmony of spaces suitable for a specific human activity" [Kahn 1962, p. 115].

Therefore, Design refers to shape, as it is circumstantial and the result of a project process. However, to attain it, a conceptual Order should be developed first.

This is related to all tangible conditions, such as place, structure, material, and budget to complete the Design cycle (fig. 7).

So, for Kahn, Order would be his best working tool, an archetype, a mental layout which allows him to interpret the desires of Form.

Many of the ideas that structure his domestic or institutional projects come from this idea of Order; geometry, in Formal Order terms; spaces that serve and are served, such as the functional order, or the field which refers to tectonic order [Brownlee 1998, p. 107].

Since 1968, Kahn started to symbolise Order using a pyramid, and referred to architecture as the balance between silence and light. The pyramid represents geometry, and the project moving from silence to light materializes through this geometry as a threshold, as a catalyst [Juárez 2006, p. 25].

From silence to light

During this same time period, Kahn´s approach became more and more metaphysical. It is said to be influenced by Hindu spirituality [Goldhagen 2001, p. 2], due to his projects developed in Dhaka and Ahmedabad. Be that as it may, Kahn gradually scaled down his sentences, using a

Figs. 10, 11. L. Kahn, Silence and light: eternity, 1972 [Tyng 1984, p. 136].

limited number of words in his speech, the meaning of which were notably profound.

He even avoided the use of punctuation, and his text structures changed into unconnected sentences, arranged in lines.

Meanwhile, his drawings became less representative (fig. 8). We are therefore able to establish it in the famous drawing of 1968 about silence and light (fig. 9).

The pyramid represents creation as a consumed light; whereas silence corresponds to the whiteness of paper, both separated by a dividing line, the threshold.

In later drawings, several horizontal lines picture all possibilities found in silence, whilst in light they have been curved into a particular shape.

The representation of the threshold between silence and light, where order sits, is drawn from a perfectly delineated line in 1968's drawing of an open area where the pyramid from the 1972 diagram is located.

Geometry is situated in the transitory space between what would be the ideal and tangible. In a sense, Kahn appears to be concerned about the myth of creation [Tyng 1984, p. 137], in terms of the constant exchange of silence and light, within their cyclical and never ending nature.

One of his last drawings of 1972 describes eternity as two siblings, each with features that Kahn assigns to silence and light.

Then, he draws them, combining scientific and religious ideas about the origin of life (figs. 10, 11).

Juan Navarro Baldeweg states that Kahn "saw himself seeing visions" [Juárez 2006, p. 9], that is, he was aware of the fact that his architecture came from an inner world in which everything was abstract, from a fantasy universe where his projects were visions.

His architecture, the step through shadows in the search for light. His drawings were the images of his architectural thought, and the graphic analysis of his ideas.

His way of thinking was a way of life. "If I were asked who I would like to be at the present time I would say the writer of fairy tales. It is from the meaning of the incredible that all human desire of creating and implementing comes from" [Kahn 1968, p. 23].
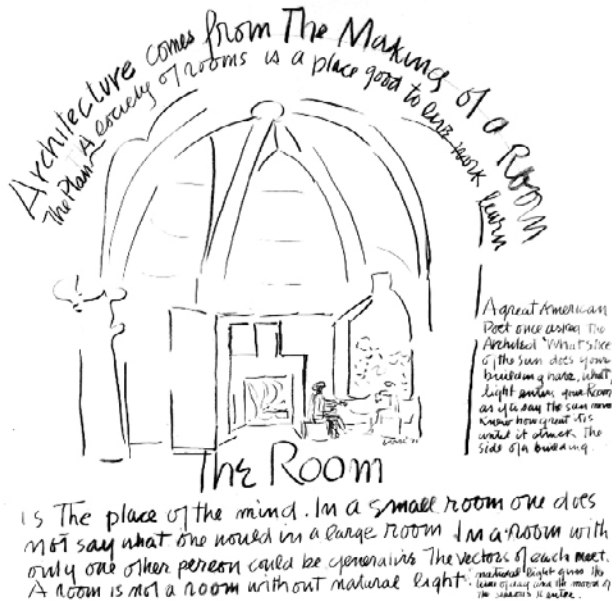
Fig. 12. L. Kahn, drawing for City/2 exposition: The Room, 1971.
Louis I. Kahn Collection.

Conclusions

In this system, Kahn found a working method which was evolving over time.

The terms his ideas referred to responded directly to his need to learn, at the same time changing what his projects did.

But the architect returned time and again to the origins of architecture, to the starting point where he found all possibilities. Louis Kahn developed his theory on the process of architectural creation through texts and written work that were always accompanied by images.

These looked to clarify the complex nature of his words.

It was then, nearly at the end of his career, where he found the theory of silence and light, understood as a poetic collection of all of his ideas regarding the process of architectural creation. Kahn placed special emphasis on these beginnings, because within this there were no pre-establi-

shed ideas, just comprehension and understanding of the nature of things, and therefore the institutions of man.

But in this search for the origins, or Volume Zero of architecture, there was a constant that was linked to the unchangeable [Kahn 1972b, p. 19].

As confirmed by the metaphysical, the eternal is the unlimited in time and in space. For Kahn, the return to origins was found in that which has been, which is and will be, so in the end, his search will be for eternity.

In 1971, shortly before his death, Louis Kahn would draw his famous drawing *The Room* (fig.12), for the *City/2 (City over Two)* exhibition at the Philadelphia Museum of Art [10]. Perhaps this is one of his most famous drawings, not just because of great expressivity, but because of its content and significance.

The idea that architecture stems from the construction of a room, and that any building is in reality a collection of linked rooms [Kohane 2009, p. 174] helping to kick start a concept that is as novel as it is old in the history of architecture; it is so simple in essence, and at the same time so complex, in the architectural search that Louis Kahn carried out throughout his career.

When Kahn confirmed that the Room is "the start of architecture" or "a place of the mind" [Kahn 1972a, p. 124] it refers directly to his theory of Silence and Light.

His architectural design of the space responds to an inner force, this 'existence will' which makes the essence of the Institution emerge.

Ultimately, we can define *The Room*, as a culmination of all the ideas that Kahn developed throughout his career.

The room would be the origin, the beginning of architecture [Torres Cueco 2010, p. 6]; but it was also an end in itself for Kahn, a basic space that works for all of mankind and has an everlasting character, capable of standing the test of time, as the architect could reconnect with the inhabitant.

The 1971 draft that we finish this text with, is a description of this shell or casing for man; and the design itself has this expressive value, which we have been speaking about, to 'catch dreams'.

As Umberto Eco states, "architecture is the art that tries hardest to reproduce the order of the universe, that people used to call the Cosmos" [Fernández-Galiano 1991, p. 15].

Kahn's room would be imago mundi, or a world within a world, the imaginary world that the architect sought throughout his life.

Notes

[1] We are interested in Kahn's relation with drawing as a form of education and expression. During his travels, Kahn would try not just to pick up concrete architectural data, but feelings and sensations that evoke places, [Montes 2005] he defines this as "writing with drawings".

[2] "At Salk Institute for Biological Studies, when Salk came to me and asked me to construct a laboratory, the project was simple. He said to me, 'How many square metres do the towers of the University of Pennsylvania medicine department measure?'. I told him it was about 9.300. He said, 'There is something I'd like to be able to achieve. I'd like to invite Picasso to the laboratory'. His inspiration was clear, it was in science, preoccupied by the measurable, there is a will to be in that which is, from the smallest thing. A microbe wants to be a microbe (for some ungodly reason), and a rose wants to be a rose, and man wants to be man… to express… a certain stance, a certain attitude, a certain something, which moves in one direction and not another, hammering nature non-stop to provide the instruments that make it possible. Salk, the scientist, sensed this desire for expression. The scientific, isolated from any other way of thinking, needed more than anything the presence of the immeasurable, which is the artist's territory": Kahn, Ngo 2002, p. 28.

[3] Norberg-Schulz [1990, p. 23] suggests that the *genius loci*, the dimension where life comes about and determines its character, would be translated by Louis Kahn as 'the immeasurable' or 'that which things want to be'. Enric Miralles would also define Kahn's terminology as "strange trajectories of architecture" or "that which is outside of the project": Miralles 2000, p. 21.

[4] In 1972 Kahn started to use the word 'availabilities' instead of 'institutions', once he saw the negative connotations that the term institution had for the new generation of students in the sixties: Tyng 1984, p. 79. Also, this term, availabilities, better expressed for Kahn the idea of unlimited possibilities.

[5] For Kahn, it would be fundamental to not depart from predetermined concepts or aphorisms of any type without allowing the unknown or unmeasurable to appear. The repetition and work would be the tool that would allow him to get closer, absorb and finally to personally take on, in order to specify and ascertain, that which is not only shown in appearances but also that which is hidden to the naked eye.

[6] The discussion between Kahn and Heidegger about the search for the essence of man holds several coincidences. If Heidegger established that inhabiting means existing and that man attains this through the constructions that respect the essence of inhabiting (Quarternity). Kahn suggests the return to these origins to find the common characteristics of man's existence, his institutions, and through the eternal qualities of these, he presents his architecture as a response to man. Both of these, put the man of that moment in crisis, Heidegger invites us to learn once again how to inhabit, while Kahn thinks that we should re-programme the institutions in pursuit of a new society.

[7] Anne Tyng, who worked with Kahn at that time, states that those sentences correspond to her four phase theory about cycles: geometry, nature, psyche, and creativity. As she has shown, the influence between them was mutual throughout the entirety of their professional and personal career; "each of our concepts illuminates the other": Tyng 1997, p. 210.

[8] Kahn had an extensive knowledge of the history of architecture thanks to his Beaux Arts education, which was not reflected in his work until the fifties. This subject looks at how historicist references are a constant in almost all inquiries and studies on his character. His travels around Europe, his time at the American Academy in Rome, his relationship with Robert Venturi, his references to architects of the past: Ledoux, Boulle and Palladio, or great works such as Hadrian's villa. Although Kahn always referred to these past works of architecture and situated them in their origins, many of the interpretations of his work link him to postmodern historicism. It is important to note that his work has nothing to do with Postmodernism, but with evoking and adapting previous landmarks with modern and personal language: Goldhagen 2001.

[9] There have often been parallels drawn between the concept of Kahn's concept of Form, and that of Aldo Rossi's Tipo. The diference between the two can be understood in their geographical context; while the European Tipo clings to History, the American Form of Kahn had this feeling of beginnings. What links the two is the search for a starting point, a type of figurative plan that is at the start of the project.

[10] The *City/2* exhibition happened between June 1971 and February 1972 to commemorate the future Bicentenary of the American Declaration of Independence in 1976. Kahn carried out a series of designs related to the *Institutions of Man*: The Room, The Street and The City, accompanied by texts that tried to explain his thoughts on architecture and his particular vision of Philadelphia.

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The reasons of drawing
as document and protocol for the representation

Exploring a drawing means going over the road travelled by the author while he drew, understanding the marks left by him, and the reasons that led to the final form. Actually, Drawing is structured on a strictly scientific basis: Geometry, the knowledge and use of which make "representation" a strict operation.

Geometry is an essential tool to handle the spatial expression of a drawing, to effectively and properly view it according to strictly tried and tested rules, but it is also an unequivocal speculative tool for exploring the form, by looking for its structure, from the two-dimensionality to the three-dimensionality of reality, from sign to meaning, from project to object.

Formalisms, Methods and Tools
for the Large-Scale Morphological Analysis
of Architectural Heritage Shapes*

Livio De Luca

Abstract

Historical architecture is probably one of the most appropriate areas for understanding the extent to which the cultural production of the different regions of a territory participates in the construction of a common identity. Owing to their distinct nature, as well as to their increasing diffusion, today digital technologies are opening up new opportunities for the cross-analysis of a large quantity of objects, far in space but close in their characteristics (typologies, styles, rules of composition, etc.). This opportunity could stimulate the creation of innovative scientific frameworks to improve the historical, artistic and technical study of the relationships between architectural shapes and social interactions in space and time. This question brings together the study of the semantic and geometrical natures of architectural shapes with the design and development of information systems capable of addressing experimental research on the variability of shapes. This paper presents the main lines of research that the MAP laboratory intends to conduct over the next five years on this issue.

Introduction

In recent years, various projects have been concerned with the development of methods, tools and technologies for the creation of shared digital libraries for cultural heritage (EPOCH [1], 3D-COFORM [2], 3D-ICONS [3], …). Despite significant technological advances in the development of new solutions for the digitization, processing and integration of heritage artifact data, very few experiences have focused on integrating these new technologies into innovative methodologies to promote high-impact research initiatives, particularly for the large-scale study of architectural heritage. Historical architecture is probably one of the most appropriate areas for understanding the extent to which the cultural production of the different regions of a territory participates in the construction of a common identity. Owing to their distinct nature, as well as to their increasing diffusion, today digital technologies are opening up new opportunities for the cross-analysis of a large quantity of artifacts far in space but close in their characteristics (typologies, styles, rules of composition, etc.). This opportunity could stimulate the creation of innovative scientific frameworks to improve the historical, artistic and technical study of the relationships between architectural shapes and social interactions in space and time.

This question brings together the study of the semantic and geometrical natures of architectural shapes with the design and development of information systems capable of addressing experimental research on the variability of shapes. This paper presents the main lines of research that the MAP [4] laboratory intends to conduct over the next five years on this issue.

State of the art

Over the past decade, interest in emerging technologies has inspired a large number of digital documentation projects that have demonstrated the potential of digital representation of heritage artifacts at different levels [Levoy et al. 2000; Gruen, Remondino, Zhang. 2004; El-Hakim et al. 2008]. In particular, the use of 3D digitization technologies, as part of cultural heritage documentation programs, has led to the emergence of a new generation of graphic media, useful for multiple purposes: archaeological analysis, monitoring of degradation phenomena, dissemination and representation of historical knowledge, and so on. The creation of digital representations of heritage artifacts requires methods and tools capable of digitally acquiring and reproducing the finest visual and geometric characteristics.

Reality-based 3D reconstruction is now considered the field of technological research based on the use of sensors [Vosselman, Maas 2010; Remondino, El-Hakim 2006]. Thanks to advances in photogrammetry and computer vision, the past five years have been characterized by an impressive growth of image-based geometric modeling approaches capable of automatically reconstructing 3D point clouds and dense meshes starting from a set of non-oriented photographs [Vergauwen, Van Gool 2006; Vu et al. 2009; Pierrot-Deseilligny, Clery 2009]. These solutions, based on flexible methodologies for camera calibration and orientation, facilitate the production of 3D representations by non-experts (with no knowledge of photogrammetric acquisition methods and using common digital cameras). Our contribution in this field concerns the harmonization of morphological reading methods [De Luca 2009; De Luca 2011] in specialized acquisition and processing protocols

[Pierrot-Deseilligny, De Luca, Remondino 2012] for the realization of geometrically precise digital surveys according to the requirements of architectural heritage documentation practices.

However, beyond the generation of detailed, colored 3D models, the creation of an intelligible geometric representation of architectural shapes is a much more complex problem. Research that has focused on this issue is generally based on the study of shape grammars [Havemann et al. 2004; Mueller et al. 2006]. Our main contribution in this field regards the definition of a generic formalism for the semantic-geometrical description of classical architectural elements [De Luca, Véron, Florenzano 2007]. This formalism can be used to generate libraries of parametric architectural models (such as bases, balusters, columns, etc.) as well as to measure the difference between theoretical models (taken from treatises on historical architecture) and real objects.

But the study of the morphological nature of architectural heritage shapes opens a broader question: reasoning about the shape of an object frequently implies reasoning on the identification of similarity metrics to be used for the purposes of comparison, interpretation and classification. Measuring the similarity between various digital objects has been an active research area for several years, starting from the development of computer vision analysis techniques up to the more recent approaches for 3D model analysis using algorithmic geometry. These methods now provide good results for multimedia object indexing applications [Tangelder, Veltkamp 2008], and their application in the cultural heritage domain [Biasotti et al. 2015]. This emerging field, however, opens the door to much more interesting issues for linking the analysis and classification of large collections of shapes to the broader area of large-scale spatial analysis.

Indeed, besides geometric representations, a large amount of heterogeneous data is generally collected, organized and analyzed for the study of historical architecture. The data are mostly drawn from different disciplines (architecture, archaeology, history, conservation science, etc.) and are based on various media (iconography, maps, manuscripts, etc.). Beyond the digital representation of architectural geometry (which now permits the management of quantitative data), the structuring of qualitative descriptions is a

much more important research issue, particularly because it confronts the problems of multidisciplinary interpretation. Numerous methodologies and technologies have been developed in recent years to improve the management of heterogeneous digital contents, relying mainly on formal structures (thesauruses, ontologies, etc.) capable of unambiguously describing implicit and explicit conceptual elements (and their interrelationships) [Doerr 2002] mobilized in the documentation of heritage artifacts. Some works have focused on methods for linking semantic tags (vocabulary terms and structured concepts) to 3D models [Havemann, Fellner 2008], or to a hierarchical description of architectural composition schemes [Manferdini et al. 2008]. In addition, the joint analysis of spatial and temporal data has acquired particular importance for the study of object transformations, the temporal distribution of categorized events, and the distribution of spatio-temporal data [Kapler, Wright 2005].

Our contributions in this area have focused on the design and development of 3D information systems for structuring heterogeneous data around the morphological description of architectural heritage buildings. By combining the semantic structuring of morphological descriptions with the interconnection of multiple representations, our approach [De Luca et al. 2013] has revealed the potential of semantically enriched 3D representation for several applications: the management of semantic geometric models in 2D/3D annotation frames [Stefani et al. 2013]; the spatialization of semantic annotations to describe the state of conservation [Stefani et al. 2014]; the representation of morphological transformations through dynamic geometric models [Stefani et al. 2009]; the clarification of the semantic relationship between the conceptual and physical dimensions of a heritage object [De Luca et al. 2013; Carboni, De Luca 2016].

Scientific and technological issues

In view of this panorama of apparently dispersed scientific and technological issues, the main objective of our research program for the years to come is to introduce means of rupture in order to study technical expertise and stylistic influences in the history of architecture by providing innovative tools and methods for the dimensional observation, morphological analysis and classification of architectural shapes within large-scale participatory research campaigns. As illustrated by the state of the art, this ambitious program integrates several potential advances related to the historical and computer sciences in an original interdisciplinary research framework. The three main open questions are listed here.

First, in historical architecture, shapes can be considered as an essential trend marker. Understanding the dependencies between these trends and their evolution over time requires rigorous analyses (based on cumulative approaches) of how shapes vary across territories and periods. Exploring such a complex variability of shapes requires a classification strategy to study similarities, models, and semantic and geometric exceptions. This includes the interconnection of two levels of description. At the class level, architectural shapes can have an invariable definition (a vocabulary term indicating their role in a global structure, for example: a column) generally codified by historical knowledge. At the instance level, shapes have complex characteristics (geometry, visual appearance, materials, …) that clearly distinguish them (for example: a column of an existing building, built at a particular place and time). A first challenge is illustrated by the need to establish a rigorous documentation and analysis framework for exploring the variability of architectural shapes belonging to the same architectural concept.

The growing diffusion of image-based, flexible and easy-to-use modeling tools makes it possible to envisage the opportunity to collaboratively build a large digital library of 3D architectural models based on acquisitions of real objects. But if the implementation of a participatory documentation strategy for the massive collection of digital representations of architectural shapes becomes a realistic goal from a technological point of view, the increasing mass of uninterpreted point clouds and 3D models today underlines an essential need to develop new methodologies to facilitate the processing, sorting and analysis of data in relation to issues of historical knowledge. Indeed, beyond the aspects of geometry processing, the analysis of shape semantics requires a thorough understanding and identification of relevant morphological descriptors capable of adding

intelligibility values to complex (and not eloquent) masses of geometric representations. This question raises a second challenge represented by the need to devise a new generation of tools for analysts (historians, archaeologists, architects, etc.) capable of automating heavy geometric and visual correlations.

As several historical research efforts have demonstrated, architectural vocabulary is probably the most appropriate analytical tool to accompany the interpretative reading of structural compositions as well as stylistic grammars. But even if each sub-community in the history of architecture (including the area of archaeology) has done important work in defining thesauruses specialized in particular periods or geographical areas, terminology still maintains many ambiguities, especially with regard to the study of transnational trends on a large scale and over long periods. Similar shapes may have different names in different languages, but minor morphological differences. The present level of geometric and visual details provided by 3D digitization, as well as the potential of their comparative analysis and semantic correlation, opens new, unexplored classification issues, to be studied at the intersection between terminology, morphology and representation of knowledge. As a result, the third challenge is to provide new metrics for the analysis of shapes capable of increasing our ability to discover similarities, models and exceptions in large-scale surveys.

These three issues recover the dispersed, scientifically significant tools, methods and models of several disciplines. Their integration into transversal approaches is certainly the distinctive characteristic of our program, which is at the crossroads of trends that shape the contemporary technology landscape and, more broadly, the digital humanities.

First of all, the democratization and diffusion of means of digitization, now even integrable within shared computing platforms—cloud computing—which makes it possible to concretely envisage procedures for participatory semantic survey and annotation on a very large scale.

Secondly, the recent evolution of approaches for analysis and visual recognition, stimulated by impressive advances in computer vision and deep learning in the analysis and correlation of large masses of data, here could play a role in renewing methodologies of

shape analysis and classification (art history, archaeology, conservation, …) through the identification of new models of morphological signature combining geometric, visual and semantic descriptors.

Finally, the process of harmonization currently underway in the field of cultural heritage information systems, in particular as regards the construction of domain ontologies, which now makes it possible to gather together heterogeneous, dispersed information while moving the center of gravity of approaches to documentation from a description focused on the "heritage object" to a more exhaustive description of the "plurality of viewpoints" (scientists, experts, professionals, curators, administrators, …), which, day after day, enriches the collective understanding and the transmission of the memory of these objects. This latter aspect is also an unprecedented opportunity to explore, through the analysis and correlation of masses of annotations and semantic links, the mechanisms through which communities (and even societies) construct the heritage value of these objects.

By considering our scientific contribution to the human and social sciences with the design and development of digital technologies, and not the contrary, our goal is to introduce a new generation of (generalizable) formalisms, (reproducible) methods, and (reusable) tools combining algorithmic geometry and historical knowledge for the massive and large-scale morphological analysis of shapes.

A collaborative semantic acquisition and enrichment framework

First of all, we intend to introduce (and disseminate) a rational contribution for resolving the current problem of information overload. The increasing mass of uninterpreted 3D data calls for the development of innovative acquisition-processing protocols to help analyze and sort data by spatialized semantic annotation. An innovative protocol [Manuel et al. 2014], which links the on-site acquisition of images (and their semantic annotation) to remote geometric processing (based on cloud technologies), introduces new possibilities for exploiting photo-modeling in order to obtain a comparative and collaborative analysis of large collections of shapes. This is the 'aïoli'

[5] platform, which our laboratory has recently developed and made available to the first beta users within the framework of scientific partnerships.

Therefore, on the basis of this result, we will concentrate on defining a methodology (and on developing a set of operational IT tools) to digitize masses of architectural shapes for the purposes of morphological analysis and classification using crowdsourcing (participatory collection) strategies. The preliminary analysis of the collections of selected shapes, combined with documentary research, will also gather together important sources for the development of semantic annotation methods (vocabulary terms, existing ontologies) and for the association of morphological signatures with spatio-temporal markers. We intend to carry out this work through the establishment of cooperative agreements with consortia that have already undertaken major inventory work within international networks (European Science Foundation (EFS) PALATIUM [6], Mapping Gothic France [7], Centro Internazionale di Studi Andrea Palladio [8], …).

Knowledge modeling driven by the correlation of morphological signatures

The information framework introduced by our approach of data collection and semantic enrichment merges the spatial, geometric and visual information contained in a mass of photo-models (point clouds and 3D surfaces, oriented photographs, dimensional parameters, textures, etc.) with a set of structured vocabulary terms within a domain ontology. This framework opens paths for exploration that could question the current semantic annotation and classification methods (today mainly based on qualitative attributes) by introducing relevant morphological parameters (calculated by correlation of geometric detail attributes), whose informational richness has not yet been explored in this area.

The inclusion of qualitative and quantitative attributes would make it possible to create an extensive and semantically structured library of digitized artifacts while isolating, structuring and directly illustrating architectural concepts within a terminological scaffolding. However, although the scientific literature on computer graphics has recently produced numerous works highlighting the potential for semantic annotation of 3D models, the application of geometric characteristics to the description of an architectural shape (especially when we observe heritage artifacts) requires an in-depth analysis of the relationship between the concepts of multiplicity and intelligibility. This question concerns two interconnected relationships: on the one hand, the relationship between a generic model (an architectural concept already described in historical literature) and a related collection of instances (real architectural objects), and on the other hand, the relationship between geometry (morphological characteristics) and semantics (prior knowledge). In continuity with our previous contributions on this subject [Lo Buglio, Lardinois, De Luca 2015; Pamart, Lo Buglio, De Luca 2015], one main expected result would be to introduce possibilities of annotation and correlation where semantics can be exploited in pre-processing stages (based on a priori knowledge, descending approach) and/or in the post-processing stages (extraction of similar morphological characteristics, ascending approach), by developing tools to assist analysis and human interpretation by automating very heavy geometrical comparisons.

A collaborative platform for large-scale historical research

Heritage artifacts are more often the result of temporal stratifications, modifications, additions and transformations. This aspect raises important problems concerning the annotation of shapes, since a good observation and interpretation approach must combine several overlapping semantic layers that relate to multiple states of the same object, including iconographic sources that attest to its transformations over time. Indeed, the implementation of the annotation/classification methods envisaged by this project requires a profound correlation of heterogeneous data that can be used to qualify architectural shapes. In an attempt to integrate (from a conceptual and methodological point of view), the phase of spatial data acquisition with that of their semantic structuring, the original idea of our approach concerns the desire to establish a relationship between heteroge-

neous data within a geometric-spatial dimension. This means that instead of using 'entity-relationship' links to anchor architectural shapes and associated information, geometric projection functions (formalization of spatial orientation parameters of iconographic sources) are used as a channel for disseminating relevant information (semantic attributes, spatio-temporal markers, morphological signatures) between all levels of representation (from architectural detail to territory). In addition, through our morphological analysis of shapes on the architectural level (as well as the level of architectonic detail), by observing the spatial and temporal distributions of these shapes on a geographic level, our approach aims to introduce multi-criteria and multi-level exploratory analysis mechanisms. The results of this phase of our work program will lead to the construction of an open platform, in continuity with our team's ongoing efforts to develop cloud technologies for large-scale participatory historical surveys.

Conclusions

By establishing a framework for rigorous documentation and analysis, based on innovative tools and methods aiding morphological analysis by the automation of heavy geometric correlations, our ambition is to introduce new 'shape-oriented' metrics for the study of architectural heritage. Our research program for the years to come does not follow the simple logic of deploying technological solutions for the digitization, processing and dissemination of cultural information, but it is organized around the identification of the true potential of development of digital technologies for the study of historical architecture. For this reason, our approach integrates, through a **meth**odology of interdisciplinary work, the scientific advances related to the fields of historical sciences, knowledge engineering, computer vision and algorithmic geometry, aiming ultimately at the construction of a software and human infrastructure favoring the emergence of cumulative approaches to the study of built heritage.

Notes

[1] EPOCH Network of Excellence <www.epoch-net.org> (consulted on July 20, 2017).

[2] 3D-COFORM Project, Tools and expertise for 3D collection formation <www.3d-coform.eu> (consulted on July 20, 2017).

[3] 3D-ICONS Project, 3D Digitisation of Icons of European Architectural and Archaeological Heritage <www.3dicons-project.eu> (consulted on July 20, 2017).

[4] MAP, Models and Simulations for Architecture and Cultural Heritage. A CNRS (French National Center for Scientific Research) and MCC (French Ministry of Culture and Communication) joint research unit. For further information: <www.map.cnrs.fr> (consulted on July 20, 2017).

[5] aïoli – a 3D semantic annotation platform for the collaborative documentation of cultural heritage objects. A cloud platform developed within the MAP laboratory. For further information: <www.aioli.cloud> (consulted on July 20, 2017).

[6] European Science Foundation (EFS) PALATIUM <http://www.courtresidences.eu> (consulted on July 20, 2017).

[7] Mapping Gothic France <http://mappinggothic.org> (consulted on July 20, 2017).

[8] Centro Internazionale di Studi Andrea Palladio <http://www.palladio-museum.org> (consulted on July 20, 2017).

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Characteristics of Baroque Solid Space in the Perspectival Tabernacle of Bitonti and Borromini in Bologna

Giuseppe Amoruso

Abstract

The research presents an analysis of the tabernacle designed in Bologna by Giovanni Maria da Bitonto who, with Francesco Borromini, created the perspectival gallery for the Spada Palace in Rome. The tabernacle perspective works as a projective system which accelerates the natural perspective perception and modifies environmental and spatial features, of the built scenography. The construction technique is complex if applied to architectural space: Donato Bramante realized it, for the first time, in Milan, in the choir of Santa Maria at San Satiro. The spatial fruition of perspective, usually linked to central perspective or to psychological and perceptive phenomenon, became 'real'. The projective principle is the one known as 'relief-perspective', or designed to be used as a scenography or temporary installation. The survey of the tabernacle, in the church of San Paolo Maggiore in Bologna, reveals a small illusory space and also introduces a true protagonist of solid perspective applications, Giovanni Maria Bitonti. The research presents a graphic study of the perspective concept housed in the National Archive of Bologna and an accurate reconstruction of the solid perspective, using the most advanced techniques of digital documentation. The drawing examined has a graphic scale, in Bolognese feet; the drawing is of the model representing real architecture, making it comparable with the drawing of Spada Gallery conserved in the Albertina Library in Vienna.

Keywords: solid perspective, Giovanni Maria Bitonti, Francesco Borromini, solid homology, illusory space

Introduction

In 1666, the Bolognese Antonio Masini used, for the first time, the term "*quadrature*," in referring to a perspective application that had been successful in Bologna thanks to the works of Girolamo Curti, known as Dentone [1]. It was a new illusory and perspectival model which expanded interiors as spaces for scenography, and that artists used to call the '*di sotto in sù*' perspective. Cardinal Spada, Papal Legate in Bologna between 1627 and 1630, is remembered for having had a real obsession with perspective; Virgilio Spada, on the subject of the love for perspective of the Cardinal, his brother, wrote that "[he] turned the Cardinal Legate's palace upside-down, and adorned it with paintings and excellent perspectives. From the first day he entered the large palace he started to embellish it with sequences of doors, win-

dows, perspectives, and similar things, which made it double" [Neppi 1975, p. 125]. In 1630, in the Palazzo Comunale, Girolamo Curti decorated the ceiling of the Sala Urbana, the hall dedicated to Maffeo Vincenzo Barberini, better known as Pope Urban VIII: Curti introduced coupled columns, loggias, and a greater architectural complexity of the recesses, as well as the use of circular shaped balustrades and a compositional austerity which made space perception a priority instead of depicting allegorical figures as used by other artists (fig. 1). In 1629, Cardinal Spada ordered decoration works for another hall, known as Sala Dentone: it is a *quadratura* painted on the vault and features a sophisticated architectural design that modifies the real space perception, so that the flat vault looks like a cylindrical vault.
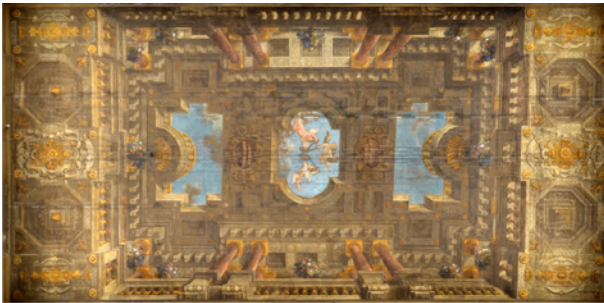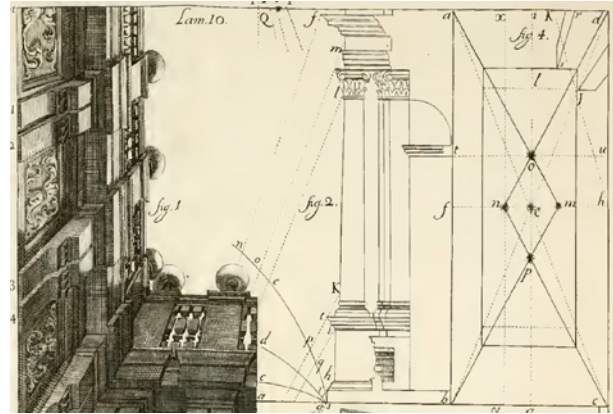
The vault is built with four curved surfaces and a flat ceiling in the middle where painters used to depict allegories or, more frequently, the sky. The *quadratura* is enriched by a big serliana opening and the perspective projection is characterized by a prevalent vanishing point. The *quadratura* projection is not based on the one-point perspective, as in the Sala Urbana and according to Vignola and Tibaldi; Curti proposed an innovation, 4 vanishing points to harmonize the real space with the illusory space; this technique was exported to Spain and subsequently described by Palomino [Palomino 1715-1724, lamina 10, pp. 176-183] (fig. 2).

This practical construction technique is used for those rooms that deviate from the ideal square indicated by treatises (in the case of a square room artists used the one vanishing point perspective) as the proportion is one to two (9 per 18 *braccia*); in the rectangular rooms, perspective perception is eccentric; because of the doors' positions, observation was always from a side, and therefore it was necessary to modify perspective projection as the practice suggested by Viola Zanini [Viola Zanini 1629].

The *quadratura* of the Sala Dentone is contemporary to the ceiling decoration of the Sala Urbana; it was painted 45 years before the fresco that Colonna, after his stay at the Royal Court in Madrid, designed for the Senate gallery of the Palazzo Comunale in 1677. The overall height of the perceived environment is equal to twice the height of the room measured from the floor to the vault.

This proportion is obtained by placing the spectator's viewpoint at the center of the gallery at a height of 5 Bolognese feet from the floor and taking visual rays from the observer [2]. The room is assumed to be proportionally composed by 2 squares whose sides are 9 *braccia* in length, and the gallery volume generates 4 squares according to a harmonic classical proportional ratio. The distance between columns creates a compositional effect; the *quadratura* is designed with an intercolumniation of 3 and 5 diameters, named systyle and araeostyle.

The continuous parapet is part of the architectural order, replacing the more classic pedestal; it also works as a regulator system as it compensates the irregularities of the room (fig. 3).

The study of the illusory frescoes of the Palazzo Comunale in Bologna, at the time seat of the local Senate and housing the Pontifical Legate apartments, presented graphical outcomes and highlighted the projective parameters of the illusory space; construction techniques influenced the real perception of *quadratura* and solid scenic space of sacred objects, environment and architecture.

The perspective of solid space

Construction technique was particularly sophisticated when it was applied to the architectural space; optical corrections, as well as other illusory effects or perspective applications, are already present in the first half of the twelfth century [3]. During the Renaissance, the concept of architectural space is directly associated with the central perspective or with the development of psychological and perceptive phenomenon. This means proposing a mathematical artifice to provoke a sense of wonder [Fano 1979]. This is the field of study that the American psychologist James Jerome Gibson called "picture perception" [Gibson 1950]. Furthermore it is interesting to recall the psychology of perspective, that is, the link between the operative tool and the concepts that it allows to be transmitted to its users; in this transformation process artists had the role of setting up specific processes of perception and experience of works creating a conflict between the experience derived from observation of the painting, with that derived from the observation of the environment in which the work was inserted.

Experimental researches in cognitive psychology have shown precisely the 'strength of the illusion' concept,

Fig. 3. Vault of the Sala Dentone, Palazzo Comunale of Bologna, Girolamo Curti with Francesco Castelli and Angelo Michele Colonna, 1627-1630 circa. Parameters of the perspective projection.

Fig. 4. Viola Zanini, 1629, p.30. Projection methods of "di sotto in sù" perspective, as painted on ceilings and vaults.
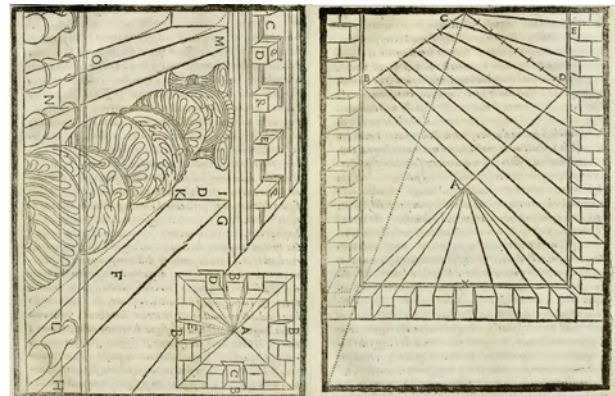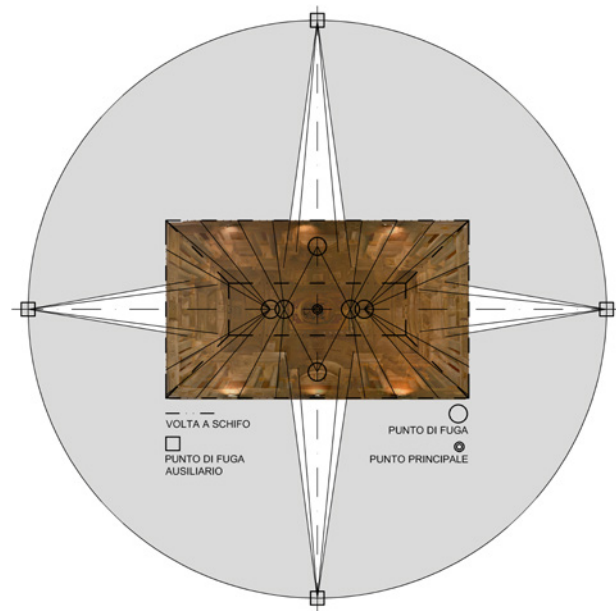
a question already pointed out by Leonardo about the reason why perspective representations do not appear deformed and unexpectedly retain their spatial coherence, even if they are observed from different and far points of view not standing in the geometrically fixed eye-point, the unique observation parameter used for their construction [Kubovy 1986]. Perspective, despite being a tool for the representation of reality, especially for its ability to improve the perception of the third dimension, cannot be taken as a mere product of visual perception. It "contributes only to create the evocative illusion of infinite spaces resumed in the synthesis of the correct geometric construction that can be performed on the plane (linear perspective) and in space (scenographical perspective)" [Fano 1979, p. 18].

In the design practice, in different ages, examples are documented in which, constructively, a three-dimensional effect was used according to perception needs; after the initial state of wonder, the spectator can recognize the signs of accelerated or delayed perspective convergence compared to that which occurs, naturally, in visual perception. This projective application is known as 'relief-perspective', otherwise known as solid perspective, built in the form of a permanent stage or as a scenography and a temporary installation, this being the most popular field of adoption (fig. 4).
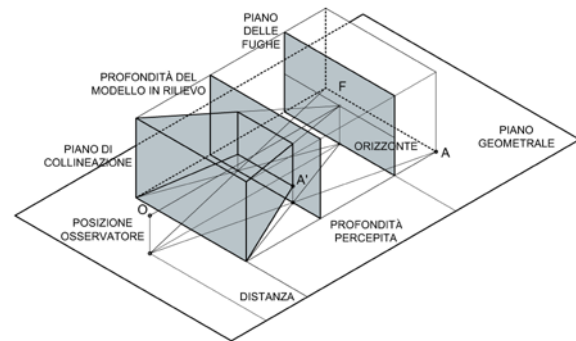
Figs. 5, 6. Tabernacle model from photogrammetric survey. 67-image mosaic processed with SFM software.

Fig. 7. The projection system of relief-perspective: the real space deformation generates a scenic space that supports the material representation.

In the *Histoire de la Perspective ancienne et moderne*, Poudra defines perspective as the "*science des l'apparences*" in continuity with the tradition of scientific studies on optics that was resumed in the popular medieval text *De Aspectibus* attributed to the Arab scholar Ibn al-Haytham, known in the West as Alhazen [Poudra 1864].

The research project identifies the illusory design parameters in relation to the use of perspective drawing and its material reproduction, from the sketch to the perspective tools for achieving perceptual effects and architectural space experience. We can scientifically determine methods from the analysis of the appearance and subsequently verify their reproducibility and variations, and also the most appropriate operational and conceptual features.

Starting from the *stiacciato* technique, popular in the field of sculpture, Bramante developed an architectural application called solid or relief perspective, from the established term in use in the artistic production of bas-reliefs. According to Poudra, "relief-perspective is an extension of the perspective plane, or rather the linear perspective is a special case of relief-perspective" [Poudra 1860, p. 1].

In his treatise Poudra speaks about a new application of descriptive geometry; he also argues that finally architects will get tools to advantageously change the interior or exterior appearance of buildings; design application has a specific practical aim but also a geometrical reason which lies in the projective process which, by means of the rules of perspective, transforms objects of the space according to a collineation process; it creates a solid homology between the real space and the space that undergoes transformation and perspective contraction.

The half-space behind the plane of traces is transformed into the space between the front plane and a parallel plane of converging lines. The infinite half-space is transformed in a finite space; briefly the projective concept of the perspective transformation of a plane is applied to a spatial object or to a half-space [Leopold 2014, p. 964]. According to this system, the two processes of image generation, the classic one according to descriptive geometry and the one of computer representation (mathematical), coincide [Migliari 2009]. This homology constitutes the perspective of figures on the 'objective space,' projected on a second space superimposed on the first. The projective geometric procedure of graphic correspondence is based on considerations relating to the correspondence of points, lines and planes according to the solid homology whose center is represented by the point of view; therefore, the

Fig. 8. Tabernacle model from photogrammetric survey. 67-image mosaic processed with SFM software.

construction of the three-dimensional perspectival image starts from the axis-plane, on which the proportional scale is the one of reality, and it is developed in the space between this axis-plane and the so-called limit-plane, locus of points at infinity of objective straight lines belonging to the above mentioned space.

This methodology of representation of three-dimensional space was necessary to build scenographic systems that had to be reduced to the limited size of a theater stage; the projective-graphics system was developed to build the scenic space into the theatrical stage to give the illusion of a great depth in a much smaller space (fig. 7). What characterizes the deformation of objects is the product of a particular position of the viewer and the figure that must produce a perfect illusion, with the model of which it will show the appearance, relations of position and shape that satisfy the following two conditions: visual rays conducted from viewpoint to the different points of the model pass through the corresponding points of the relief; all the points

that lie on a straight line in the model are thus found on a straight line in the relief and, therefore, to the two points of the model on the same plane correspond the points of the relief also located on the same plane.

These conditions may be reduced to one fundamental result, that all planar elements of the model correspond, on the relief-perspective, other parties equally planar, which are the perspectives of the first one on many and different planes and they are referred to the same position of the eye. The relief-perspective is a projective contraction of the real space that generates a space that can be described as scenographic and that supports the representation [Migliari 2009].

In this field of application, the two superimposed spaces of the relief-perspective projective transformation are both represented: the isotropic space, and the anisotropic, scenographic space.

The depth of the space that appears to be transformed in relief, the space between the plane of traces or 'collineation plane' and the plane of convergent lines produces the relief-perspective, containing it within. The relief depth, the space layer between front plane and the plane of vanishing points, determines substantially the relief-perspective. If the relief depth is zero, we deal with the conventional perspective" [Leopold 2014].

Camerota describes these achievements as "material" perspective that marks the transition from pre-Baroque space, in which the projective methods are used to "correct the deceptions of vision to save the proportional order of the architectural elements," to a new concept of space where the design addresses a "deception research by creating imaginary spaces that go beyond the physical limit of the built environment" [Camerota 2006, p. 34].

In this cultural framework Caramuel De Lobkowitz presented his theory of "*architectura obliqua*" as an application of geometric transformations that generate ellipses from circles and ovals bodies from the globes, when the orthogonality conditions that commonly affect ordinary architecture, named 'recta,' and the construction of the architectural order are not practicable.

When the ground plane is inclined or when the geometry of a façade is curvilinear, as in circular or elliptical plan layouts, the order must undergo a transformation, thus creating an oblique space [De Lobkowitz 1678].

This construction technique became very useful and frequent in scenic perspective and Bitonti also used it for his works.

The perspectival tabernacle by Bitonti

"Under minimum size, one observes a huge portico; in a small space a long path can be seen. The more distant they are, the greater appear the small objects placed in their proper places." With these words Bernardino Spada described the emotion aroused in observing the perspective gallery he commissioned to Borromini and Bitonti, completed in 1653 (Bib. Vat., Barb. Lat. 1005, 102) [Neppi 1975, p. 280]. Presenting below the graphic documentation of the perspectival tabernacle in Bologna, an illusory space of very small size, this description will fit the case of this object of sacred art designed and built by Bitonti and commissioned by Spada.

When Bernardino Spada returned to Rome, the Capodiferro Palace became the concrete testimony of the ideal residence of Bernardino, interiors and façades enriched by illusory architectures, Borromini's perspectival gallery, but also rooms decorated with illusory frescoes commissioned to Dentone and Colonna.

The real protagonist of solid perspective applications, however, was Father Giovanni Maria, born in Bitonto (Bari) in 1586 and therefore known as Bitonti.

In 1647 Bitonti—mathematician, expert of perspective, scenographer and Bernardino's personal advisor—was commissioned to design a perspectival tabernacle in Bologna for the church of San Paolo Maggiore [Sinisgalli 1998]. Bernardino also entrusted him with the construction of the colonnade at the Spada Palace, the best-known perspectival space of this century of wonders that was built in 1652, in partnership with Borromini, who was the advisor of Bernardino's brother, Virgilio Spada.

On the occasion of the enlargement of the palace, Cardinal Spada decided to build the perspectival gallery in Spada Palace: a perspectival telescope, a long alley perpendicular to the walls for about eight meters and forty-eight centimeters; its sides are very convergent, so that the architectural motif of the arch with columns built in a regular scale, which delimits the entrance, whose height is four meters and ten centimeters and width two meters ninety-five centimeters, at the end of the gallery is diminished until it reaches two meters and forty-five centimeters in height and one meter in width [Paris 2016].

The construction technique is of a theatrical type: an inclined plane with a slope of about 7% (Sinisgalli speaks of 5.5° [Sinisgalli 1998]) and a theoretical vanishing point placed behind the background.

The floor, as in stage sets, is inclined towards the small courtyard that concludes the gallery; the point of view was ideally positioned at the center of the main courtyard of the building, allowing the observer to perceive an environment of increased depth of up to forty meters.

Sinisgalli, as a result of a detailed geometric survey, verified that the gallery does not possess both the characteristics of a solid perspective, according to the projective concept which subsequently has been defined, for example by the treatise of Poudra [Poudra 1860]. The first fundamental rule, that of the convergence of orthogonal straight lines to the pictorial plane towards a single point, has been verified, while the progressive placement and foreshortening of the objects according to the distance from the point of view was not followed; the arrangement of the 12 different columns has a different and specific layout and such 'proportional alterations' follow a geometric series [Trevisan 2001, p. 19].

Before the construction of the gallery in Rome, Bitonti was commissioned to design the tabernacle in the Spada Chapel in the Church of San Paolo Maggiore in Bologna; this perspectival architecture was built in 1648 and placed on the altar one year later (figs. 5, 6).

Illustrations present an unpublished graphic study on archival documents, an accurate survey with advanced techniques of digital documentation, extracting dense point clouds from images through SFM photogrammetry and also a comparison with the perspective of Spada Gallery in Rome.

Lighting conditions and translucent, metallic and gilded materials, influenced operations of image acquisition.

The tabernacle by Bitonti addresses an architectural space with three modules, covered by a round arch and with two rectangular fronts on the sides; the 'serliana' window is surmounted by a Baroque entablature. It is symmetrically flanked by two rectangular openings surmounted by a lintel above the attic floor and a balustrade; between the arch and the two openings two columns are placed framing the space. The central arch makes efficient both the static as well as the compositional solution breaking the uniformity and rigidity of the continual horizontal entablature.

The arch introduces the spectator to the gallery enclosed in a barrel vault characterized by lacunars (a 9 x 9 subdivision of the conical surface), as common in basilicas and bringing the attention towards the focal point, at the physical end of the colonnade, a vestibule and a portal with columns and pediments, which probably leads to a second

Fig. 9. Architectural survey of the tabernacle. Sections show angular references, making construction simple.
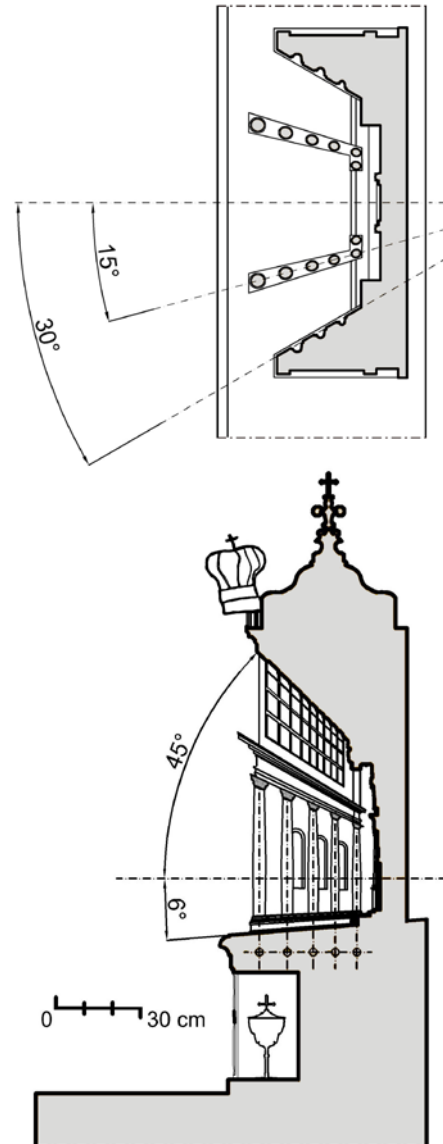
gallery built in sequence: columns, built in agate with capitals and bases in gilded bronze, are in total 12, 6 per side, with an explicit allusion to the apostles. In the side walls of the tabernacle a theory of pillars is punctuated by three niches (figs. 8, 9).

The depth of the altar, designed by Borromini, was one of the constraints and parameters which Bitonti had to consider for developing the perspectival model; to complete the residence of the Eucharist, the gallery above allowed display of the sacrament and was equipped with an indispensable accessory which compensated and reduced the inclination of the relief to a horizontal plane. In accordance with the rules of solid perspective, the ground plane is built inclined in order to improve the depth perception and accelerate the perspective.

The sketch of the tabernacle [4] shows a graphic scale of ten Bolognese feet, which means that the drawing is actually the representative model of a real architecture rather than describing a small object, part of the array of a sacred altar; the research points out, for the first time, its projective issues by comparison with the Spada Gallery drawing found at the Albertina Library of Vienna [Amoruso, Sdegno, Riavis 2016]. In the sketch, the foreground column does not fit the perspective projection and the drawing has several distance points referred to the viewpoint, the

position in which the observer is assumed to be, that is, at 2.80 meters (figs. 10, 11).

There are further features supporting the thesis that the project has a spatial, architectural and symbolic function: a statue is depicted over the top of the attic floor [5]; its height, according to the graphic scale, is about 5 feet, where a Bolognese foot measures 0.380098 meters, and is divided into 12 ounces, as also mentioned by Serlio [Serlio 1551]; the architectural order is composite (and not Corinthian, as erroneously reported on the drawing), often used in the architecture of Borromini, and Bitonti himself painted columns of the same order in 1631 in the perspectival gallery of the altarpiece for the Church of the Annunciation in Bitonto [6].

On the 3D point cloud, the inclination of the ground floor measured approximately 6 degrees, thus the same as the Spada Gallery. The inclination of the tapered-conical vault is 45 degrees, a very practical building rule; the spectator's perception is of 1 meter in depth, while the tabernacle is 0.58 meter in length. The tabernacle plan is given by angles, making the construction simple; if the central line is taken as a reference, the lateral aisles are inclined at 45 degrees, while columns are rotated by 15 degrees and form a 30-degree angle. Therefore, homology is given by planes set at intervals of multiples of 15 degrees (fig. 9).

Fig. 10. Perspective drawing of the tabernacle, signed by L. Franzini; graphic scale in Bolognese feet (Bologna, State Archive, envelope 87/4979, f. 130). The analysis highlights several distance points, depicted with different colors.
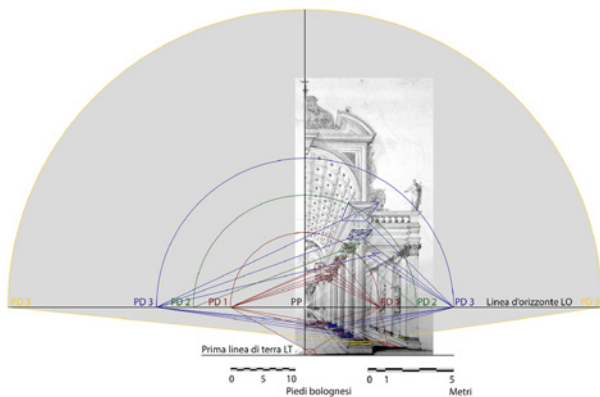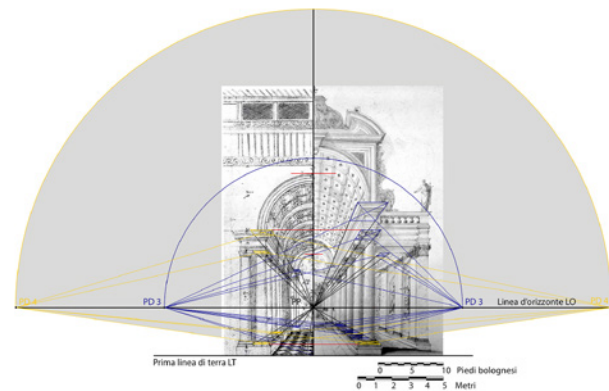
Fig. 11. Comparison between the drawing of the tabernacle (graphic scale in Bolognese feet) and the drawing of Galleria Spada (proportionally scaled).

Bitonti, in designing the tabernacle, practices Caramuel's oblique architecture taking a strong position in the controversy which also involved Bernini.

Conclusions

In 1642, the French Jesuit Jean Du Breil published the *Perspective Pratique* presenting, for the first time, the new field of scenographic design, reduced to a two-dimensional support. His *scaena ductilis* summarizes perspective and theatrical knowledge as well as scientific and empirical spatial issues and its graphic expression. The representation of scenes and their construction techniques therefore provided to architecture the place to experiment illusory effects and their relationship with real space; this widespread practical culture will enable Bernini, Bitonti and Borromini to introduce the dynamism of the observer within the space, and the acceleration of spatial perception in their relief-perspectives. The research presented several outcomes, since very often parallels and feedback are common to the works of Bramante, Bitonti and Borromini; further studies, by comparison with written sources such as the Poudra treatise, support the graphical analysis.

In the study of the documental sources and of the applications, particular emphasis was given to the graphic instruments for the representation of illusory space, through the analysis of the solid perspective of the tabernacle, described for the first time in its characteristics, and in the comparison of the projectivity of the archived drawing and of the constructed perspective.

As a future direction of research, the author will investigate the presence of a regular ideal model that originated the tabernacle, or if Bitonti followed a set of rigorous relief-perspective rules. Representation is useful and effective in the understanding and perception of space; this task is more compelling if knowledge and practical solutions from old sources of perspective and descriptive geometry are rediscovered. The reproduction of these methods, through simulation, augmented reality fruition and 3D replicas opens new scenarios for research concerning representation [7].

Note

[1] On the Bolognese school, see Giuliani 2007.

[2] Approximately 190 cm.

[3] Previous to the introduction of the study of Optics in the West.

[4] The drawing is signed by Ludovico Franzini and it is currently conserved at the State Archive of Bologna, envelope 87/4979.

[5] The statue, never realized, holds a sword, as a tribute to Paolo Spada

('*Spada*' means sword), family founder and patron of the chapel.

[6] The altarpiece is currently conserved at the Pinacoteca 'Mons. Aurelio Marena' of the Museo Diocesano, Bitonto.

[7] This research was part of the 2010-2011 PRIN *Prospettive Architettoniche: conservazione digitale, divulgazione e studio coordinated* by R. Migliari, Sapienza University of Rome; the author participated in the Polytechnic University of Milan research team coordinated by M. Rossi.

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Architectural Space in a Protocol for an Integrated 3D Survey aimed at the Documentation, Representation and Conservation of Cultural Heritage

Marcello Balzani, Federica Maietti

Abstract

Architectural space becomes the connective fabric for the creation of a protocol for optimizing 3D documentation of cultural heritage. The methodology set as a priority the unconventional features/geometries, unique and complex within heritage, avoiding the 'segmentation' of the acquired data and facilitating data access and use through an inclusive approach. The elaboration of the protocol for the advancement of data management processes is part of the INCEPTION project, Inclusive Cultural Heritage in Europe through 3D semantic modelling, coordinated by the Department of Architecture of the University of Ferrara and funded by the European Commission within the Horizon 2020 program. The project is currently ongoing, and approaching the end of the second year of development. Future actions are related to the practical application of the holistic digital documentation procedure and of the optimized 3D data acquisition protocol of nine selected case studies in six European countries. The selected sites are representative of different types of cultural heritage assets, for the implementation of the methodology and necessary tools, based on criteria that cover different historical periods, a wide range of sizes and morphologies, different states of conservation, environmental conditions and various risk factors. Planned test-beds in significant heritage sites will allow validation of the documentation methodology, the necessary tools in terms of access and interaction with the 3D digital model and the different outcomes based on an inclusive access by different users of semantic models.

Keywords: protocol, representation, 3D integrated survey, cultural heritage, integrated documentation

Introduction

The increasing development of 3D laser scanner technologies allows the creation of high definition databases based on three-dimensional morphometric data. These 'digital archives' are an extremely valuable research tool in the field of cultural heritage: 'geometric memory' is essential for the knowledge, protection and conservation of architectural and historic heritage, although there are still some limits to the exploitation of 3D models obtained by laser scanner survey. The growing number of unexploited and 'uninterpreted' 3D models points out the need for innovative methods that could increment the informative value provided by new systems for surveying and representation as well as digital data management tools.
The development of 3D models characterized by com-

plex geometries or particular conditions, such as occurs in the cultural heritage field, can still be time-consuming and expensive, and generate large amounts of not-easily-accessible data. The European project INCEPTION - Inclusive Cultural Heritage in Europe through 3D semantic modelling, funded by the European Commission within the Horizon 2020 program, proposes the enhancement of efficiency in 3D data capturing procedures and devices, especially as regards their suitability and aptitude for tangible cultural assets: heritage sites, historical architecture, archaeological sites, urban fabrics, characterized by unconventional features and geometries and always different, case by case.
The state of the art and interdisciplinary and international references consulted starting from the first research sta-

ges, together with a wide on-site experience of integrated 3D survey in various contexts, include the most recent contributions in the field of the survey of cultural heritage, representation, modelling and management of digital databases.

The main methodologies used address the problem of the complexity of current tools for the management of 3D models and the processing of results obtained by employing new technologies for representation beyond the 2D and 3D conventions. These outcomes are very often surprising, in terms of the model's navigational potential, but sometimes impoverished in the expressive 'vocabulary' of the representation of a proper reference model, which

allows the investigation of the tangible material as well as the intangible values.

Architectural space geometry is an essential tool for managing spatial representation, useful for obtaining levels of knowledge and processes of documentation and conservation; survey and representation of heritage architectural spaces are an effective tool for exploring architectural morphologies from the two- to the three-dimensionality and vice versa.

An international comparison and interdisciplinary analysis of several indicators (within documentation, data acquisition and processing) aimed at the knowledge of cultural heritage through 3D modeling and database

Fig. 1. Diagram of the integrated documentation procedure developed within the INCEPTION project. The operational phases range from the acquisition of heritage data to the semantic query of three-dimensional models.
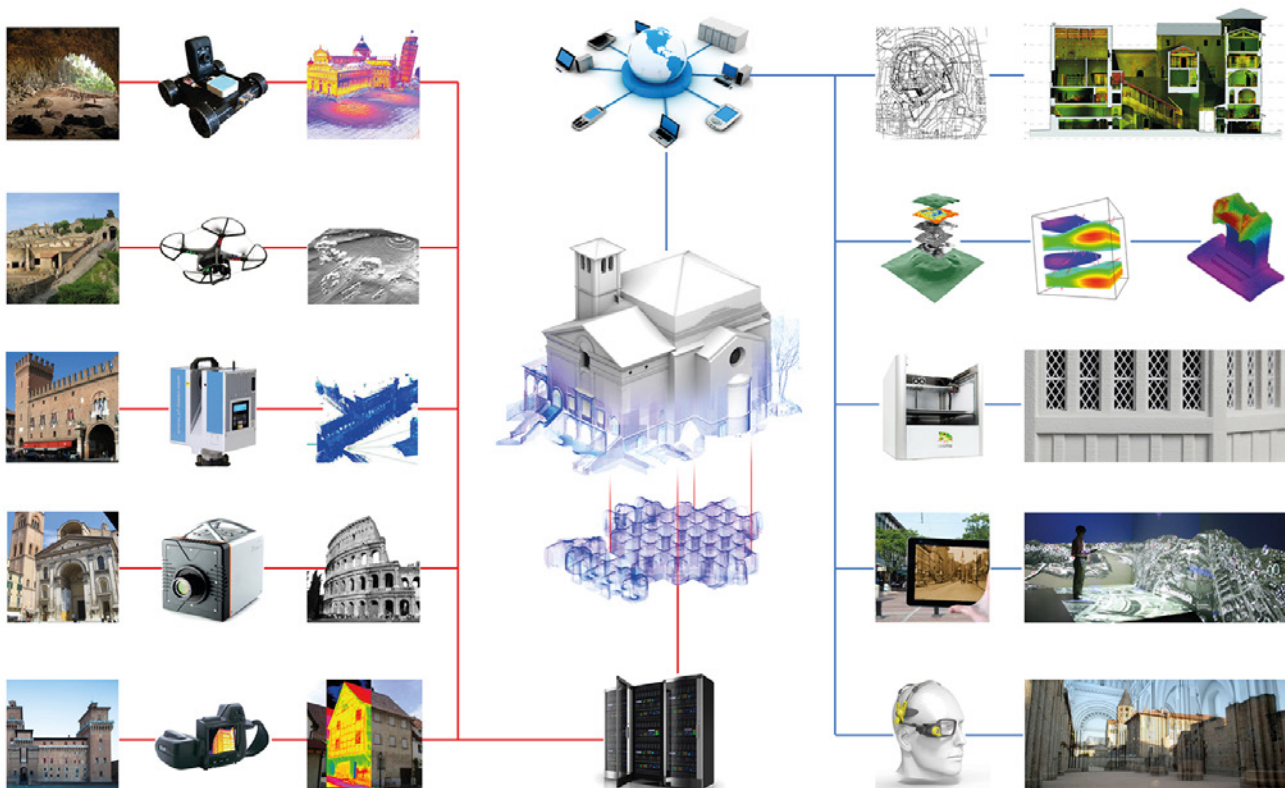
querying for data extraction are phases of the research that have already been completed, while the future steps will develop advanced 3D modeling to enhance the knowledge and understanding of cultural heritage.

Inclusive cultural heritage in Europe through 3D semantic modeling

The INCEPTION project funded by the European Commission, within the context of the *Work Programme Europe in a changing world – inclusive, innovative and reflective societies*, [1] started in June 2015. The project is developed by a consortium of fourteen partners from ten European countries led by the Department of Architecture of the University of Ferrara [2], coordinator of the project.
The research team [3] includes, in a broad manner, the different aspects of identity and diversity of cultural heritage, enhancing the documentation systems able to preserve

its memory and identity, and putting into effect one of the main challenges that the European Commission has launched with the Horizon 2020 program: to contribute to a deeper awareness and understanding of the European cultural fabric as inspiration for addressing contemporary challenges, increasing the knowledge of heritage and its different European identities. To this purpose, new technologies and digitization processes play a key role since they allow new and enhanced interpretations of our common and collective cultural heritage.
The interdisciplinary consortium ranges in the different specific fields of interest of cultural heritage, from the documentation and diagnostic analyses of heritage, to the strategies for its protection, management and enhancement, to 3D acquisition technologies, to the development of hardware, software and digital platforms for the representation and dissemination of cultural heritage, through ICT processes, to the analysis of semantic information for a wider and more extensive use of digital models.

Fig. 2. Diagram summarizing the priorities addressed by the project on the basis of the requests of the Work Programme, the main areas and approach of collaborative research, the main goals, the users of the innovations and the means of validation and dissemination.
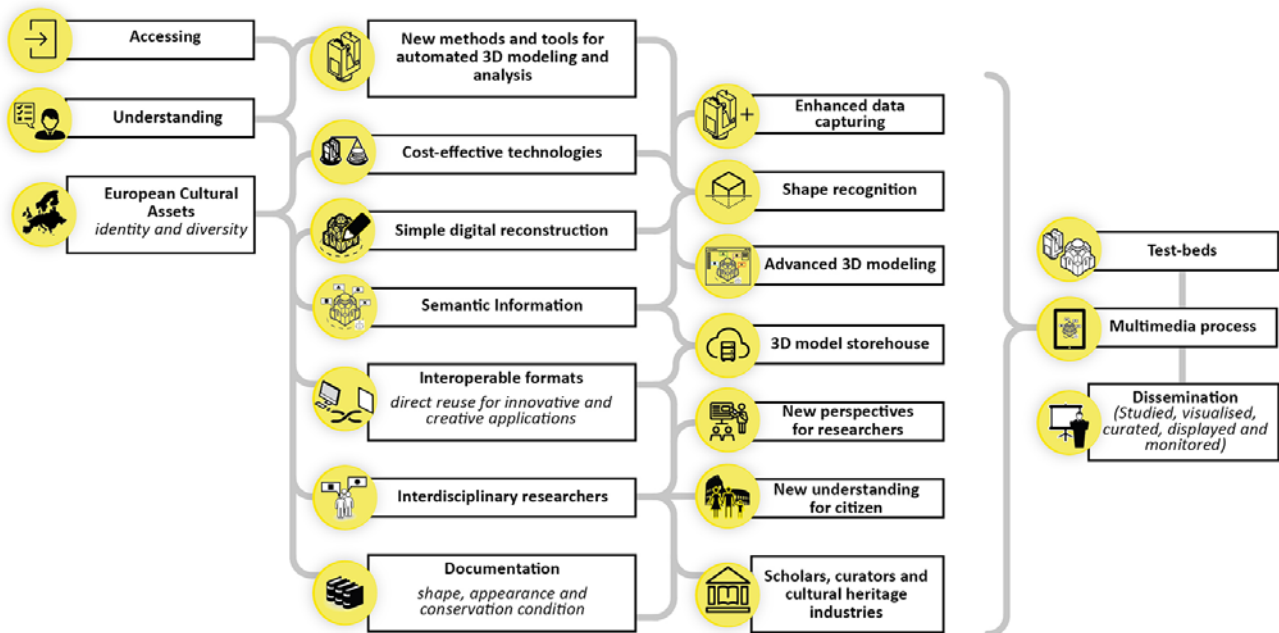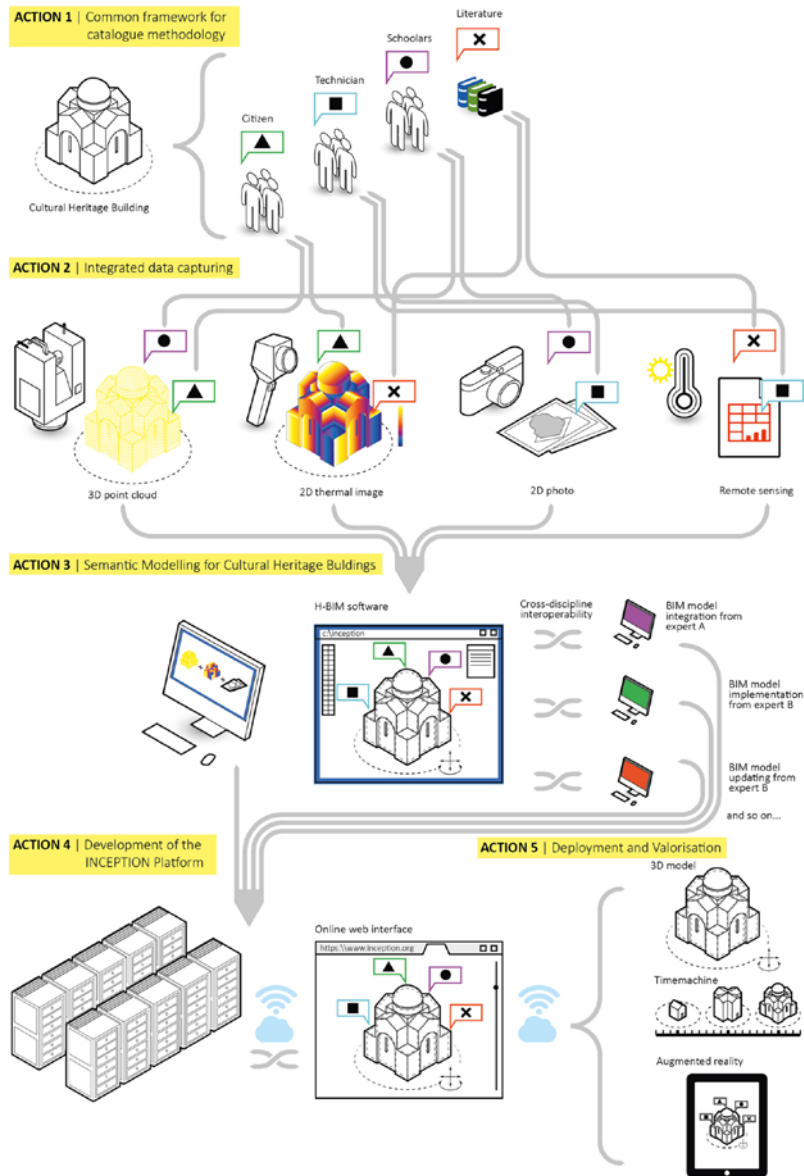
Fig. 3. The overall concept and methodology of the project: knowledge management, integrated data capturing, semantic modeling for cultural heritage architectural spaces, development of the platform, implementation and valorization.

The main objectives of the project can be summarized in the following points:
- to stimulate and augment innovation in 3D modeling of cultural heritage through an inclusive approach for dynamic 3D reconstruction of historical buildings and social environments;
- to create an inclusive understanding of European cultural identity and diversity by promoting and facilitating collaborations across disciplines, technologies and sectors;
- to develop cost-effective procedures for the 3D survey and representation of cultural heritage buildings and sites;
- to develop an open-standard semantic web platform for accessing, processing and sharing interoperable digital models resulting from integrated 3D survey and documentation following the protocols elaborated by the project.
In parallel to strategies aimed at defining a protocol able to guide the processes of digitization of cultural heritage, the project will develop nine case studies, nine pilot projects which, starting from the recognition of the specific needs and requirements of each building or cultural site, will enable the implementation of different systems of digital acquisition in order to develop three-dimensional modeling that will make the digital models usable by different categories of interdisciplinary users, populating the INCEPTION platform. These case studies will be the first test-beds for the application of the 3D acquisition protocol.

Fig. 4. The main aim of INCEPTION is to realize innovation in 3D modelling of cultural heritage through an inclusive approach. Methods and tools will result in 3D models that are easily accessible for all user groups and for multidisciplinary purposes.

The protocol for a 3D integrated survey

The overall concept and the methodology of the INCEPTION project include the definition of a shared and interdisciplinary approach to the documentation of cultural heritage, integrated survey, knowledge management, integrated data capturing, semantic modelling of historical buildings and sites, architectural spaces, development of the platform, and deployment and valorization strategies. Within the first two research areas addressed, strategies aiming at the optimization of a 3D data acquisition protocol [Di Giulio 2017] able to guide the processes of digitization of cultural heritage are among the central aims, at the base of all the next project steps. Digitization of cultural heritage requires respecting the needs and specificities of heritage sites, and innovation strategies to the three-dimensional modeling.
The optimized protocol and the definition of proposed 'added value' parameters for data capturing and management processes were developed, first of all, by critically reviewing the state-of-the-art on the data acquisition methodologies available today.
The innovation proposed by the INCEPTION project is related to the focus on the heritage spaces inherent to the digitization of the spatial context (at architectural and urban scale), one of the most important 'containers' of cultural expressions identified in the evolution of the concept of European cultural identity.
The project develops an integrated approach able to investigate the potential of spaces in order to create new cultural connections and awareness; architecture is an outstanding example of the multi-layered conceptual dimension of European heritage.
The 3D survey of historical architectural space requires a common protocol for data capturing and related enhancement of the potentialities, functionalities, and cost effectiveness of technologies and documentation instruments. The protocol considers the uniqueness of each site through quality indicators such as time consumption, cost effectiveness, data accuracy and reliability, additional data and semantic proprieties to be recorded for heritage applications, adaptability to different sites with different historical phases. The combination of innovative methodologies and protocols, processes, methods and devices is aimed

Fig. 5. The major challenges in 3D documentation for the conservation of cultural heritage in relation to the principal workflow steps.

Fig. 6. Workflow and activity indicators.
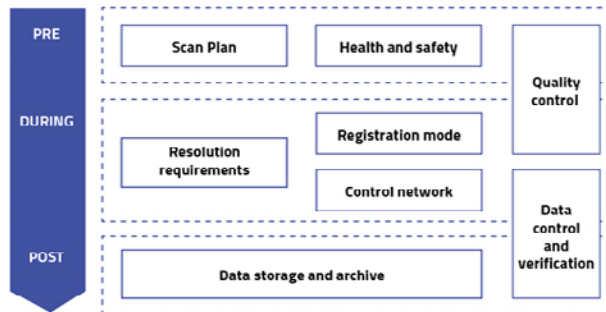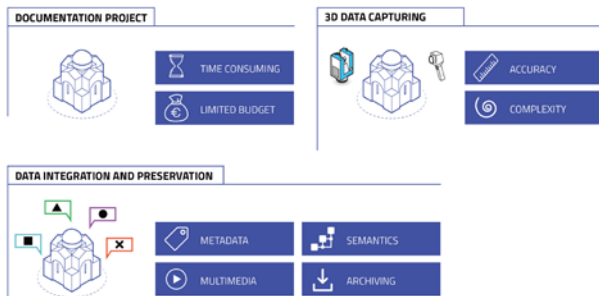
at enhancing the understanding and the accessibility of European cultural heritage by means of 3D models bringing new knowledge, collaboration across disciplines, time and cost saving in the development and use of 3D digital models. The innovative procedures and applications enable remote communication and collaboration between professionals, experts, architects, etc. and increase the operational fields in cultural heritage.

The Data Acquisition Protocol provides a workflow for a consistent development of survey procedures for tangible cultural heritage and defines a common background for the use of H-BIM models across multiple building types and for a wide range of technical users [Pauwels et al. 2013]. Furthermore, this protocol will be useful for any agency, organization or other institution that may be interested in utilizing survey procedures aimed at the creation of 3D H-BIM semantic models and their implementation for the INCEPTION platform. This protocol will be tested and further improved according to the specific test-bed procedures scheduled in the INCEPTION research project.

The DAP is intended to ensure uniformity in 3D digital survey for all the buildings that will be part of the INCEPTION platform. This protocol considers a wide range of 3D data capturing instruments [Kadobayashi et al. 2004] because of multiple users and different techniques related to specific disciplines. Furthermore, 3D survey instruments and techniques continue to evolve, and this protocol will continue to be reviewed and updated to reflect advances in industry technology, methodology and trends; in every case, application of the protocol will ensure data homogenization between surveys tailored to different requirements [Yen et al. 2011].

The survey workflow was split into eight main steps that define specific requirements and their related activity indicators:
1. scan plan;
2. health and safety;
3. resolution requirements;
4. registration mode;
5. control network;
6. quality control;
7. data control and verification;
8. data storage and archive.

Each step of the workflow must be intended as a set of questions that the technician who is in charge of carrying out the survey should answer in order to pursue a correct data capturing. Those questions become a measuring

system for verifying the requirements of the survey, and the ability of finding the right answer defines the level of quality. On this assumption, every single question becomes an activity indicator that contributes to the creation of a specific evaluation ranking. Not every activity indicator is always compulsory: if in the survey campaign only the minimum number of questions finds an answer, the capturing procedure will be classified in the lower ranking. Conversely, if each element is taken into account, the ranking will be the highest. In the case of directly measurable procedures, the specific activity indicator defines a range of accepted values. Instead, when alternative procedures are available, the protocol specifies their compliance with the evaluation categories. For this purpose, there are four incremental categories defined as following:

B: This is the minimum evaluation category for the survey to be compliant with the INCEPTION platform. It is intended to be used for very simple buildings or for the creation of low-detailed BIM models for digital reconstruction aimed at VR, AR and visualization purposes. In this case, the metric value of the model is less important than the morphological value.

A: This evaluation category is suitable for documentation purposes where the metric and morphological values are equivalent in terms of impact on the survey that needs to be preliminarily scheduled and designed. The registration process of 3D captured data cannot be based only on the morphological method, but should be improved by a topographic control network or GPS data.

A+: This evaluation category is the most suitable for pre-servation purposes because only the surveys compliant with this category could be a useful tool for restoration projects that need extremely correct metric data. From these surveys, BIM models as well as 2D CAD drawings up to a 1:20 scale are available. The project phase has more importance in respect to previous categories, for scheduling and managing the survey campaign choosing the right technical instruments to perform the data capturing. The management of data and the correction of errors in measurement are based on topographic techniques, in particular for what could concern the registration of different scans. The documentation phase will be developed organizing the information into metadata and paradata [Apollonio, Giovannini 2015]. Elements of quality control are integrated into the process.

A++: In addition to the specifications described in the previous categories, the A++ allows reconstruction of how the survey was done, in every single step, integrating a survey realized at different moments in time. This evaluation category is suitable for very complex buildings where the capturing process needs to be documented and traced in order to get the maximum control on data or when the monitoring process developed in a non-continuous time span takes place.

The A++ category could be useful even if different teams of technicians work together, simultaneously or in sequence, with different capturing instruments and different accuracies. The A++ category allows the analysis of how a survey has been performed in every single phase: moreover, this capability allows integrating a survey realized at different times.

Fig. 7. Indicator aggregation for the identification of evaluation categories.

Fig. 8. Data aggregation for each protocol category.

TO REACH EVALUATION CATEGORY A++ FROM B FOR EACH CATEGORY

Reliability

Effectiveness   Usability

■ To reach evaluation category A+ from A   ■ To reach evaluation category A++ from A+   ▢ To reach evaluation category A from B
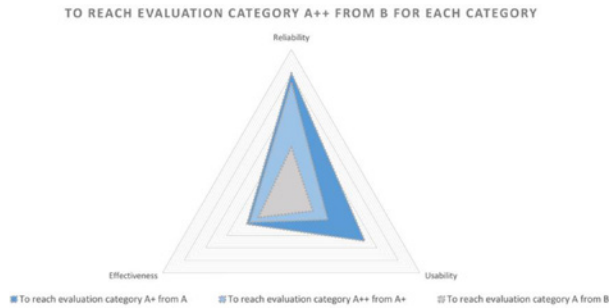
Preliminary considerations on the development of the protocol

In order to understand the impact of the INCEPTION DAP, a specific evaluation grid has been arranged, starting from the usual three standard features of quality, time and cost. Each key feature for the evaluation of benefits and added values [Eppich, Chabbi 2007] is specifically addressed by examining the main aims of the INCEPTION project.
Since the evaluation process considers the point of view of the end users, who could be either technicians or not, the features have been developed as below:
- quality can be evaluated as the reliability of the survey;
- time can be evaluated as the usability of the survey;
- cost can be evaluated as the effectiveness of the survey.
Even if accuracy and precision are key factors for technicians performing the survey [Böhler et al., 2003], they are strictly connected with the purpose of the survey and for this reason using them for the evaluation of survey quality becomes impossible, in particular from the point of view of an end user. The quality of a survey could be better described as the capability to be compliant with standards and ensure a long term support [Bryan, Barber, Mills 2004].
For this reason, the key features of a reliable survey are:
- survey maintenance: the possibility to constantly update a survey database during its daily use for ordinary purposes, enriching it with new information or minor changes;
- survey integration: the possibility to perform major upda-

tes and upgrades of a survey, adding a new part of a building or a site, previously not included, or performing a more accurate survey of already-existing parts of the model;
- technological obsolescence: because data management hardware and software are evolving faster and faster, applying strategies to avoid technological obsolescence has become a key feature for ensuring the reliability of surveys over time.
The measurement of benefits in terms of time consumption could be performed taking into consideration the usability of the survey. The more usable a delivered survey is, the more time could be saved by the end users that will deal with it. One of the main aims of the procedure, indeed, is the ability of saving time in the processing phase. The Data Acquisition Protocol and the adoption of a standard shared by suppliers and end users can bring a strong added value in terms of easy usability.
 For this reason, the key features of a usable survey are:
- common procedure: in order to ensure the full understanding of the output;
- collaboration tools: for possible data creation by different teams at different times.
The cost of a survey always depends on the final quality and time spent to perform it. For this reason, the measurement of the effectiveness could be a better parameter to consider for evaluating the added value.
For this reason, the key features of an effective survey are:
- on-field flexibility: the possibility to use different kinds of appropriate instruments in order to produce the right amount of qualitative data, avoiding those that are too expensive and therefore often underutilized;
- easy deployment: the ability to easily use the same delivered survey data for different kinds of deployment and direct application for multiple purposes;
- easy understanding: enabling the low-skilled non-technician end user to easily read and understand data provided by the survey.
In order to measure the benefits and added values of the INCEPTION DAP, typical survey and documentation processes in the field of cultural heritage have been categorized to perform a grouping of an infinite number of different single and specific cases. The main connections between survey categories and DAP evaluation categories have been identified, and the DAP has been split into three areas on the basis of requirements necessary for reaching a higher evolution category according to reliability, usability and effectiveness.

Conclusion

The integration of digital data and the possibilities for re-use of digital resources is an important challenge for the protection and conservation of historic buildings and contexts as well as for an efficient long-term management of 'geometric memory'. The need for a future reutilization of the quantitative, qualitative, descriptive data demands new applications to facilitate accessing information collected in three-dimensional databases without compromising the quality and the quantity of information captured in the survey. Furthermore, the vocation of INCEPTION for 'space' implies:
- understanding how space (defined by its geometric and morphometric characteristics) can be the connection with the temporal dimension; the space/time relation can be an understandable (and therefore inclusive) metaphor of memory (collective and European);
- understanding how space (architectural, urban and environmental) has its own dynamic characteristic that not only offers the possibility to navigate and to discover cultural heritage, but also identifies the option of choosing what to memorize in a certain time and why;
- understanding that only through space (and its complexity) is it possible to collect a high level of multi-function knowledge strongly linked to the multi-scale representation process.
The identification of the multi-function and multi-scale role of the model allows the exploitation of data, often not simple, but complex (obtained from, among others, the geometric analysis of the architectural and urban context) at different levels, over time and by different actors. Here is the value of the accessibility of the process, that until now has never been allowed to spatial scale nor realized through a mere visual navigation, often uninterpreted (an approach very far from the needs of knowledge, understanding and conservation). The integration of 3D data is consistent with the tendency of open linked data and big data for the visualization and sharing of the semantic web. INCEPTION, in this sense, would fit perfectly into the ongoing ICT research projects that identify appropriate technologies to support an ever more efficient web-based data sharing. The project will try to give a response to the use of data in relation to the various possible correlations in the cultural heritage sector (tourist development, accessibility, historical reconstructions, real-time identification of the state of conservation, etc.). Starting from the most recent innovations concerning 3D survey methodologies and digital documentation systems, the project, through its optimized protocol, aims to:
- close the gap between specialized technicians and non-technical users involved in heritage documentation;
- provide a guide to users and developers of survey technologies, sharing the planned characteristics in order to achieve the main goals in cultural heritage documentation and data capturing;
- define a common procedure for the retrieval of historical data from possible previous surveys; carry out an efficient cataloguing and digitization; augment the knowledge of geometric, surface and structural features; support the analysis of the state of conservation; provide the instruments for the maintenance of planned interventions in the short and the long term;
- identification of performance indicators to ensure the effective management of metric survey projects, focusing on the needs and requirements of heritage documentation. The optimized protocol and the proposed 'added value parameters' of reliability, usability and effectiveness will be implemented, furthermore, as input for the configuration of applications for various users.

Notes

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The reasons of drawing
as narration

As a meta-language, drawing underlies lots of specialist disciplines that designers, engineers and planners are interested in, and, by sharing their codes, it is a prerequisite for communicating any architectural adjective."Signs" show and obviously point out a recollection, a will that the drawing understands and discloses, making the user aware of the content of a message, whatever its area of application or the story it tells, even in areas that are maybe less focussed on the very "specifications" of Drawing: from the deployment of imagination in travel books or comic strips, or the fanciful exploration of storytelling that cuts across so many of today's areas of communication.

The Reasons of Drawing as Narration

Pilar Chías Navarro

The *38° Convegno internazionale dei docenti delle discipline della Rappresentazione* took place in September 2016 in Florence. It focused on the subject *The reasons of Drawing*, and particularly on the new ways of thinking, shaping, and managing new complexities, which are possible thanks to contemporary graphical and technical media and resources.

Focus 4 dealt with *The reasons of drawing as narration*, and developed their discussions around the possibilities that drawing brings when considering its qualities as a metalanguage, its limits, and its ability to set an instrumental basis to various different scientific fields to be used by architects, designers, and urban planners. All contributions coincided with the fact that graphic sign is mainly used to commu-

nicate a message, but that it also permits to follow the paths of the tracer's memory and will: "*je peux me déplacer devant lui, commencer par le haut, par le bas, parfois même aller autour*" [1].

The ability to explore the qualities and capacities of drawing as a narration has an ideal limit, which is the topic that Focus 4 intended to analyse. Although we kept in mind the traditional role of drawing as a representation tool, other possibilities introducing variables as real time and virtual reality, were not discounted.

The firts approach to these limits affected to the ancient mankind's ambition about opening a dialog with the urban, architectural and territorial reality surrounding them. This dialog has been performed directly upon their environ-

* Articolo a invito per inquadramento del tema del focus, non sottoposto a revisione anonima, pubblicato con responsabilità della direzione.

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ment, but also by means of its representation, aiming to show the daily life as well as their personal or collective achievements [Docci, Maestri 1992, p. 17]. Technical limitations reduced for centuries these expressions to hand-made models and drawings, but since photography was discovered, new ways to depict this reality were applied exponentially.

"*Nos Beaux-Arts ont été institués, et leurs types comme leurs usages fixés, dans un temps bien distinct du nôtre, par des hommes dont le pouvoir d'action sur les choses était insignifiant auprès de celui qui nous possédons. […] Ni la matière, ni l'espace, ni le temps ne sont depuis vingt ans ce qu'ils étaient depuis toujours. Il faut s'attendre que de si grandes nouveautés transforment toute la technique des arts, agissent par là sur l'invention elle-même, aillent peut-être jusqu'à modifier merveilleusement la notion même de l'art*" [2].

As a consequence, the traditional graphical methods and procedures currently coexist and complement each other with digital 3D models, by means of photogrammetric imagery and 3D printing [Chías, Cardone 2016]. The declared willingness to document the existing heritage, or just the personal concern to increase awareness [Cardone 2014, p. 11] were the traditional motivations for describing architecture through drawing. Such a valuable historic legacy is now irreplaceable before setting up the previous stages of a rigorous research on the built heritage.

Some contributions to the *Convegno* stressed the importance of the original drawings when a deep knowledge of a particular building is needed.

At the same time, they gave value to the use of modern techniques and digital tools serving to survey purposes, that opened new perspectives and approaches to the knowledge of the architecture and, by extension, to the city, the landscape and the territory. Virtual reconstructions with mapped photogrammetric images, as well as computer animations are already well-established techniques in our area of expertise.

Thanks to 3D printers, to information and communication technologies–TICs,–to apps developed for augmented reality, and even to the new diffusion tools in Internet, some wider research scopes were recently opened.

However, the ultimate intentions that lie behind the researcher's mind are never faded, for the same way that each historical period has developed its own graphic style and simbology [Docci, Maestri 1993, p. 243], its interest lie on "*non è quello affatto obiettivo della macchina, ma quello critico di uno studioso*" [Vagnetti 1980, pp. 541-542].

According to this research line, the use of drawing to rebuild the architecture or its image was developed by some interesting contributions that focused on the subject at different scales, from ornamental detail to territory.

In *Reconstruction phase architectural survey*, Adriana Arena brought to light an unpublished set of drawings about the reconstruction of the Cathedral of Messina, which were produced after the 1908 earthquake, referring both to details and to the whole building, and to measuring and colour.

Also at the architectural scale, Paola Quattrini dealt with *Adalberto Libera and "The start of a new speech" for the architectural design*. The Airone cinema in Rome, working on the example of the Cinema Airone built by Adalberto Libera in Rome. She explained the sceintific recovering of the original image of a highly demeaned architecture, that was used for other functions other than the former ones.

Other means as architectural plans and models dated four thousand years ago, helped Adriana Rossi in her *The House of Abraham* to explore the increasing levels of reading and interpretation of historical architectures throughout an evolution ending in the 3D digital models.

The urban scale was the main actor in Giuseppe di Gregorio's reasearch titled *Design and dimension of the re-constructed city. Building types of the Street Crociferi in Catania, that focused in Catania* and developed an accurate urban analysis including the architectural typologies along Via dei Crociferi, which was based on exhaustive documentation and field work processes.

Following the research line on urban spaces, Alessandro Merlo, Gaia Lavoratti and Andrea Aliperta studied the Mercati delle Vettovaglie in Florence, by exposing an interesting proposal about urban modelling as a contribution to recover the historical memory of the town.

Also working at the urban scale, Lia Maria Papa and Giuseppe Antuono developed the essential subject of *The design, between knowledge and use. The Santa Maria dell'Incoronata Church in Naples*, dealing with the case study of the church of Santa Maria dell'Incoronata in Naples. They highlighted the importance of knowledge and experience of the urban layout, but also of modern techniques as 3D models, as together become essential to disentagle the particular values of the site and its historical memory.

Working at various scales, Michele Cornieti's *Towards an Appennine architecture* dealt with the transition from the drawings that are kept in the archives to the digital construction tools as an interesting analysis method.

As a case study, he proposed the graphic language of Cesare Spighi as a way to rebuild the Medieval landscape and architecture of the Apennine Mountains. At a territorial scale, maps are proved to be an essential mean of knowledge.

Currently they are complemented by modern cartographic techniques, by aerial photogrammetry, by remore sensing images, and by digital terrain models (DTM). Among their main uses can be cited the study of visual boundaries and intervisibility.

Just talking about that, *The representation themes of territory* and urban landscape proposed by Carolina Capitanio, constituted a bridge between the urban scale and its surrounding territories, stressing the ability of drawing to identify and register the tracks of the successive civilisations on the territory, and to propose respectful actions for the *genius loci*.

Enrico Cicalò dealt with *Virtual Landscape Sciences* and the rigorous representation of landscape from the tradition of the cartographic production to the possibilities that currently bring the Geographic Information Systems (GIS), the Digital Terrain Models, and their mapping with aerial photographs, in order to develop virtual tours and to study visual boundaries.

Going one step further in the territorial researches, Francesca Fatta and Manuela Bassetta recovered the capabilities of drawing and cartography to relate the various scales, and even distant architectures in time, in their proposal titled *The graphic narrative in the map of the time*. The importance of using both traditional hand drawing and modern TICs, was stressed.

In turn, the transdisciplinary team composed by Jorge Llopis, Jose Luis Higón, Javier Pérez, Pedro Cabezos, F. Hidalgo, J. Torres, J. Serra, R.E. Martín Tolosa and Jorge Martínez, recovered the interesting *Landscape surroundings of San Francisco de Borja at Fontilles. A case study on Heritage Landscape*. They explored the effects that an isolation hospital introduced in the territory, as well as the possibilities that bring a restoration plan of such a singular architectural heritage, by means of drawing and modern immersive display systems. A second approach to the use of drawing as a narration, involved its usage as an interesting option or complement to word-based approaches. It is the case or graphic narratives appealing to allegories, metaphors, depictions or diagrams [Chías 2016a].

The proposal of an alternative narrative was defended by Alessandro Luigini in its *Virtual Storytelling*, where he explored some examples where words were not enough and drawing becam an attractive choice towards verbal transmission of knowledge. A similar path explored Rosario Marrocco in his study about metalenguages titled *The drawing of the space in the literary and theatrical storytelling*. Relationships between space, drawing, and literature were evidenced through the comparison of the mental spaces designed by Pirandello and the physical spaces produced by Eduardo De Filippo. The tradition of drawing as a complement to verbal expression reached high quality standards in the *reportages*, where notebooks and travel logs combined both means of expression for more than five centuries [Cardone 2005, pp. 7-14].

Two contemporary urban sketchers as Hugo Barros and Marianna Calia contributed to reinforce this idea that can be expressed as the "passion for drawing". A third proposal due to Mariya Komarova looked back to the 19th century tradition.

Among the spontaneous drawings by the *urban sketchers*, Hugo Barros displayed his experience in New York city in his notebooks where he explored, by means of a great variety of drawing techniques, the expressiveness and subjective impressions of the city life.

Marianna Calia followed a similar path in her *Chinese architecture and landscapes in the drawings of travel sketchbook*, where she proved to be a good observer along a set of drawings and written remarks, whose main value is the ability for studying and analysing the various building systems and architectural typologies.

Mariya Komarova in *The image of the Russian Empire in the traveller's drawings* remembered that drawing is not at all innocent, and described how it can help to create the image of the Russian towns, that were still unknown in western Europe in the 18th century.

Thanks to their ability to perceive and communicate what was being experienced, travellers throughout time took up an outstanding place in graphic narrative and power of persuasion. But they were not alone in this endeavour. Some proposals presented at the *Convegno* explored these graphic qualities by analysing the masters' drawings, but also by focusing to other aspects more related to communication as propaganda or public information.

The support of drawing in parallel discourses involving the time factor as cinema, video, or more recently virtual reality animations, became essential to travel around imaginary places. Masters' drawings are full of content and intention, and show some kind of fidelity to their concernings.

This is the point of view exposed by Carlos Montes and Marta Alonso in *Influences of the Engravings of Louis Lozowick upon Drawings by Louis I. Kahn*, where concerns even affect the exploration of the graphical techniques.

A more theoretical approach related to reading and interpretation of masters' drawings was the subject developed by Paula Lomonaco in *The Graphical representation of Significative representations*, where drawing is concerned with the reinterpretation of reality from highly subjective parameters.

Drawing is frequently at the service of propaganda, as Antonino Frenda remembered in *Representation of agricultural landscape in Chinese propaganda posters*, where the author dealt with the changes in the agricultural landscape as it drifts towards industrial landscapes, when photomontages build a new identity for old places.

Along the same line, Manuela Piscitelli focused in *The Soviet posters of the October Revolution*, by studying the way an illiterate population becomes fully aware of the new ideas through the analysis of the composition and use of both symbols and narrative codes.

Closely related with this capability for manipulation that shows the narrative drawing, are those examples where it is used for public information.

Elena Ippoliti intended to demonstrate this interesting facet in *Useful drawing and forms of Visual Language. Experiments with Visual Products in Public Communication Campaigns*, by exploring the various effective resources of visual communication strategies if applied to public information campaigns.

If previously we evidenced the efficacy of the use of parallel graphic and written discourses, the integration of movement and cinema entailed a big step in exploring the limits of imagination by means of drawing.

Kinetic sign as an element to be integrated into the strategies of architectural design was analysed by Starlight Vattano in *Hermeneutic of kinetic sign. Drawing and dance*, where relationships between drawing and dance evidenced the importance of movement in the architectural project.

Maria Grazia Cianci and Daniele Calisi dealt with the problem To narrate the unreal. *The invisible cities relealed* by means of multiple languages at the limit of their parallel discourses, *à propos* of the Invisible Cities by Italo Calvino and Miyazaki.

Going further down this track, Rosella Salerno introduced in the graphic narrative the time factor in her *A tale by Images and texts: Reasons for Drawings and Digital representation*, where the study of the interesting subject of the graphic sequences was supported by the long-term use of resources as handbooks and treatises, that are currently updated as storyboards and graphic itineraries.

This line of research led directly into the new phenomena that arose as a part of the communicartion strategies in architecture, as the use of web sites or blogs. Daniele Villa's proposal *Evolving Role of Drawing in Times of Architectural Web-Broadcasting*, focused on the permanent stream of information and the possibilities of interaction.

As the forth dimension is increasingly taken into consideration, drawing permits multiple spacetime readings. On the other hand, interaction with virtual images is already possible as evidenced by animations and mobile applets–apps–that bring the user closer to virtual reality and to smart cities.

According to these new paradigms, *Drawing, 3D reconstruction and virtual navigation. The tale about the interrupted utopia of Ferdinandopoli* is the subject proposed by Valeria Cera, Elisa Mariarosaria Farella and Domenico Iovane, whose "constructive modelling" was applied to the urban utopy of Ferdinandopoli by means of a travel round a 3D model that was mapped using photogrammetic techniques.

As a concise example, Giulia Pettoello studied the *Role of Representation in a Digital Communication System* and payed a special attention to digital processes in cultural heritage communication, by analysing the different stages and a wide range of possible alternatives to be applied to the case study of the archaeological park of Vulci in Tuscany.

Focus 4 would not be complete without studying the outstanding potential of drawing when applied to depict the various cuantitative and qualitative aspects of architecture, as for instance, its capability to simulate and define stages and settings from the perspective of "contamination between arts".

Cristiana Bartolomei and Alfonso Ippolito chose the film *The Grand Budapest Hotel* as an example of how to show the reality by means of illusion. They made evident the existing contradictions between the space represented and the space built for the cinema, and opposed the possible tours along the real space and the ideal spaces of fiction.

Perspective is considered as an intellectual polysemic artifice used in retorics of audiovisual design of spaces. This was the point of view of Enrica Bistagnino in *Perspective as a "rethorical form" in the contemporary audiovisual product*, where she proposed a renewal of the genre by questioning if it is just elitist or is really for-all.

Nazarena Bruno and Andrea Zerbi dealt also with the most theoretical aspects of the cinematographic narrative in *Drawing as a theoretical model for the cinema: from Piranesi to Éjzenstejn, from Escher to Nolan*, looking for the limits of the transgression of the rules in the search of graphic concernings in cinema.

To unveil what is imagined or designed, but not built, there is another challenge of narrative drawing that opens the door to graphic conjectures. Fabrizio Avella in *A lost opportunity: the Eden Biondo's Theatre by Ernesto Basile* followed the processes that lead from the traditional hand made cartography to 3D models, while speculated about what architecture could be and was not. He also dealt with other images of the city that bring other ways of interpretation and analysis going far beyond the possibilities of the traditional cartographic documents. A parallel discourse about the changes of paradigm of drawings in the interwar period was studied by Matteo Ballarin in *Raffaello Bibbiani and the Project of La Spezia Theater* (1926-1933), where all possible solutions were explored, offering at the same time an interesting overview of the changes of taste. To use drawing as a mean for innovating in architecture, or to look for the possible relationships to be established between contemporary art and architecture, are also interesting subjects that were explored in Focus 4. *Another Species of Space* was the suggestive title of Marta Magagnini's contribution, where the author analysed the integration of graphic methods and techniques through the experience of the exhibition space *Foundation Volume!* The complexity of relationships between drawing and typography evidences the aesthetic component of lettering from the Ancient times until the 20th century *Avant-garde* [Chías 2016b]. This facet was studied by Paolo Belardi in *Monk: From the medieval scriptorium to the digital alphabet*, where he develo-

ped the Medieval filiations of *Monk*, a contemporary digital alphabet with deep roots in the tradition of the scriptoria. Modern languages as cartoons, comic strips and other kind of illustrations in the press are particularly interesting due to their narrative qualities.

Michela De Domenico in *New languages for the architectural design* studied the limits and possibilities of the new graphic languages as the "archi-comics"—architectural comics,— and the computer aided comics, stressing the elements and the grammatical artifices and their relations with the original graphic codes.

In *The forgotten sign. A story told through images*, Massimiliano Lo Turco and Alessio Tommasetti related drawings and texts in comic and graphic novels by introducing interesting concernings in cinema, where images even may replace the text. Just on the verge of narrated reality, drawing can be seen as an end in itself.

Marcello Scalzo in *Visionary and paper architecture* studied the thought-provoking subject of paper architectures, discovering the architectural thinking underlying in the drawings of Michelucci, Maestro, Savioli and Natalini. The practical utility of drawing as an essential tool for acquiring knowledge is opposed to this unreal ludic perspective. An outstanding example is its use for disabled people, as Alessandra Meschini and Filippo Sicuranza stressed in For *"Sensible" Representation: Communicating the Form for Haptic Perception*. They showed the evolution from drawing to 3D models produced by 3D printers, that help the visually impaired people to know about architecture and the city, as shown in the blind museums.

Finally, paraphrasing Adolfo Natalini [2015, p. 78], architecture can not be conceived without images, but the variety of displays, purposes, and uses that drawing shows, become particularly evident in its narrative abilities.

Notes

[1] "I can move in front of it, starting on top, on the ground, sometimes even spin around it": Derrida 1978, p. 61 (translation by the author).

[2] "Our Beaux Arts are established, while their uses and types are fixed at a distant time by men whose capacity for action on things was insignifi-

cant with respect of what we have […] Neither matter, nor space or time are now what they were just twenty years ago. It can be now expected that if such a great breakthrough could transform all the arts techniques, it can also act on the transformation itself, and change in a wonderful way the concept of art.": Valéry 1928, p. 3 (translation by the author).

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Drawing, Analysis and Representation of space-time.
A Timeline for the Description of the Classical City

Francesca Fatta, Manuela Bassetta

Abstract

The description of the sedimentation time of architectural works and urban spaces is not an innovation, but an exigency that in the field of history has had graphic examples of great interest, which can be defined as the forerunners of the timeline.
Drawing challenges the conventional way of thinking about form and becomes a tool for the narration and classification of historical and cultural events. Here we present the results, following experimentation, of the GAIA research project entitled Young People for an Interactive Archaeology in Calabria *aimed at the development of a new educational interface which, starting from 3D models of cities of the classical world, generates a system of signs/drawings capable of correlating places, buildings and objects far removed in space and time.*

Keywords: architectural knowledge, data visualization, timeline, spatio-temporal data, semantic form.

Introduction

Throughout the history of drawing, one of the most frequently recurring exigencies has always been that of the representation of time.
Time is usually represented in the form of an oriented straight line and, in fact, the linear metaphor, often used in almanacs, calendars, charts and graphs of various kinds, reflects our everyday language when we speak about time that passes, according to a 'before' and an 'after,' according to 'long' or 'short' durations.
For this type of representation, the English term 'timeline' was coined. A timeline is a 'graphic strategy' for representing, according to a logical order, the consecutive series of events in various fields of science and culture; the sequence of events in the field of history, the temporal scansion of memorable events in the context of various disciplines, such as geology, physics, astronomy, etc. Generally speaking, more than a list in the form of a written text, a timeline consists of an actual visual representation of the line of time, a diagram in one or more dimensions whose typical shape is that of a long bar (usually oriented horizontally) whose length is marked by the indication of the period at regular intervals (eras, epochs, centuries, individual calendar dates, hours, minutes) and by classifications that contain, for each, and at varying intervals, indications of the events intended to be shown in their chronological sequence. There are many ways to represent chronological tables: from a historical point of view, timelines were, originally, still images drawn or printed on a physical support.

Fig.1. The metaphor of the Giant, Anatomia Statuae Danielis by
Lorenz Faust, 1585.

In these images, importance was given to graphic design
and to the artist's ability to communicate information ef-
fectively. Today, with the use of digital and interactive tech-
nologies, timelines are no longer influenced by the functio-
nal and spatial limits that those drawn on paper are subject
to, principally because they have become so much a part
of our culture that it is hard to think that, in its modern
form, the timeline is not even 250 years old [1]. In fact,
it would be wrong to say that a representation of events
in chronological order had never existed, because time,

before a true codification, had always been present in a
great number of drawings. From medieval manuscripts to
the Internet age, a wide range of timelines have succeeded
one another, with their forms giving life to wonderful nar-
rations [2]. This paper is divided into two parts. The first
deals with the theoretical aspects and historical examples
useful in determining the criteria for the graphic representa-
tion of an event, a period of the past or a complex project.
A drawing in this case becomes the 'graphic memory' of a
process, viewed in synthesis, particularly useful for describing
events of long-term modification, as well as for describing
multidisciplinary approaches. In the first part, the premises
for connections among related disciplines (graphic design,
InfoVis, CAD and GIS) are set forth, so as to bring out the
interdisciplinary implications typical of contemporary rese-
arch. The second part is dedicated to the presentation of
the results of the GAIA research project (Young People for
an Interactive Archaeology in Calabria) [3] which, starting
from the project of a timeline, proposes an edutainment
(education through entertainment) program for very young
participants, for the refurbished Archaeological Museum of
Locri. A new educational interface which, starting from 3D
models of cities of the classical world, generates a system of
signs/drawings capable of correlating places, buildings and
objects far removed in space and time [4].

Initial context

Together with writing, drawing is one of the few languages
capable of making time visible. Time, contrary to what we
tend to imagine, is not something that flows uniformly along
a linear trajectory, but can expand, contract, stop, suddenly
change direction, or move along the loops of an endless
maze. Michel Serres, for example, is speaking of this when
he asserts that "space flows like time" [Serres 1993, p. 62],
that is, that there exists a subjective perception of time
expressed by rhythms that reflect moods, cultural expres-
sions, scientific events, architectural configurations. Basically,
one must consider that spatio-temporal rhythm is a human
need and that the two vital psycho-physiological cadences,
the heartbeat and breathing, give us the sense of a search
for a fundamental rhythm, for an order that flows inside us.
The field of graphic representation has assimilated working
techniques borrowed from other sciences, has expanded
and updated contents and tools, developing new research
topics and specialized fields of inquiry. This paper deals with

the theme of representation in reference to the sedimentation time of architectural works and urban spaces, and for this reason it is necessary to take a look at what the description of places and facts in transformation regards. Drawing challenges the conventional way of thinking about form and becomes a tool for the narration and classification of historical and cultural events, geographical territories and architectural concepts. Some examples of critical work on this topic–which receives so little attention under a disciplinary profile–have been the subject of study by Eviatar Zerubavel in his book entitled Time Maps: *Collective Memory and the Social Shape of the Past* [Zerubavel 2005]. In this book, the scholar analyzes the cognitive models that we use to organize the past, the mental strategies that govern the preservation of memories, and that help us to connect unconnected events. The aim is to translate them into coherent narrative systems, signs of the social grammar that lies at the base of a univocal interpretation of history. What appears evident in this book, is the lack of appropriate drawings, or eye-catching graphics, able to really capture the reader's attention through a link, semantic as well, of the facts described. Yet historical examples of timelines and timewheels are not lacking, especially in the Age of Enlightenment when, according to an evolutionistic viewpoint, wide-spread interest in correlating the development of society with scientific discoveries and political achievements literally exploded [Rosemberg, Grafton 2010, p. 272].

The evolution of time charts: a few examples

Even in the very first chronologies by Greek and Roman scholars tracing lists of kings, priests, magistrates or winners of the Olympic games, a way had been shown to summarize complex parts of the history of a people, and 'tables' represented the appropriate instrument for making predictions or acquiring knowledge. In the Roman world, chronologies reflected the demands and needs of those times and, in particular, the desire to make order in a world where the forces of its complexity were uncontrolled.

From the Classical age to the Renaissance, chronology was one of the most important conquests of advanced studies. In some respects, it reached a status even higher than the study of history itself. While history was concerned with stories, chronology was concerned with facts. Moreover, the facts of chronology had significant implications that went beyond the academic study of history.

Fig. 2. The metaphor of the Hand, Anatomia Statuae Danielis by Lorenz Faust, 1585.

The human body metaphor

During the course of the early modern age, various experimentations were already being performed. Some of these were of biblical derivation; in the *Book of Daniel* we are told that the Babylonian king Nebuchadnezzar dreamt of a statue with its head made of gold, its chest of silver, its belly of bronze, its legs of iron and its feet of clay. The dream was interpreted as a premonition of the kingdoms that would have followed his, until the coming of the divine kingdom.

Thus, throughout the entire Middle Ages, the image of this statue was used in representations of time. Perhaps the best known example regards Lorenz Faust's *Anatomia statuae Danielis* (Anatomy of Daniel's Statue), published in 1585.

In different parts of the statue's body, the names of a series of ancient and modern kings are inscribed, from Persian to the German sovereigns, a metaphor of the human body (spatio-temporal synthesis) used to demonstrate a direct line of descent between the great rulers of the past and the German rulers. Another metaphor widespread over the centuries was that of the family tree, which allowed noble families to demonstrate their illustrious ancestry and to visualize their origins, just like the graphical representations based on the drawing of a hand, at the time a fundamental tool for its help in memorizing information. In addition, symbolic architectural elements such as cippuses, steles, and columns were always used as metaphors of time.

Fig. 3. The first temporal map, A New Chart of History by Joseph Priestley, 1769.
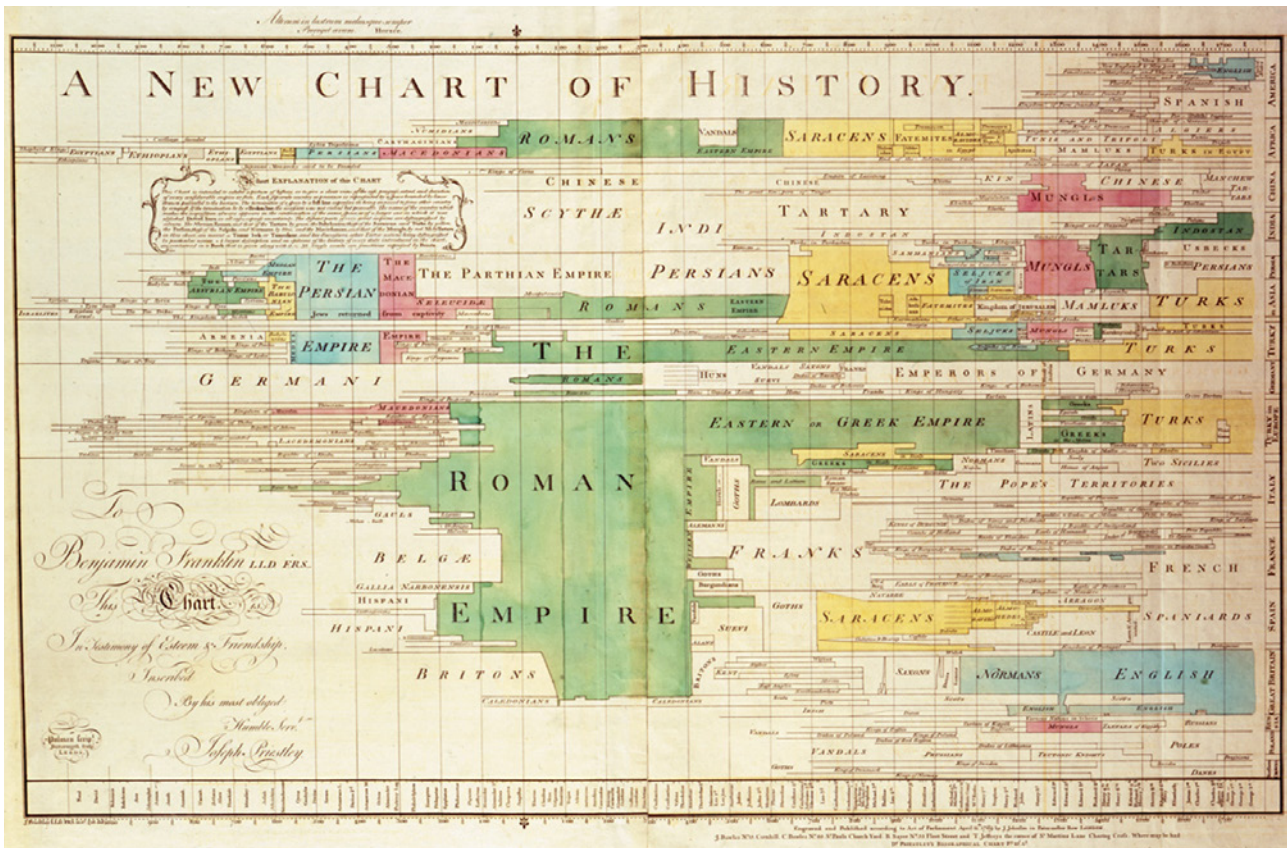
The search for simplification

After many imaginative solutions, in the mid-eighteenth century there was increasing evidence of a tendency toward simplification, a desire for synthesis, the determination to "create a visual scheme that clearly communicated the uniformity, directionality and irreversibility of historical time" [Rosenberg, Grafton, 2010, p. 11].
According to historians, the real turning point in the representation of time arrived thanks to an innovative English scientist, Joseph Priestley (1733-1804), author of numerous works and inventions. The chart that he proposed was the *Chart of Biography* (1765). The large table presented a time scale on the left and a detailed color representation of history in the center. The chart was designed to be consulted like a geographical map. In this lies the great graphic innovation: the timeline is represented on a single large page and no longer divided into several parts to be leafed through like a book; the dates are placed at regular intervals and arranged horizontally across the page, from left to right, in the direction of reading. It is a timeline in which the dates run horizontally, at regular intervals, along the top and bottom margins. This chart was the expression of a new style of thought which attempted to explain why the present was what it was. Knowledge of the past became crucial for explaining the present and Priestley's diagram provided a synoptic view of how from the past one reached the present day. Another system, characterized by synthesis and graphic efficacy, that was developed soon after timelines, is a circular or spiral representation of time. There are many historical examples of timelines and timewheels and some charts reach very high levels of aesthetic and technological refinement.

The *Temple of Time*

A representation with a three-dimensional effect regards Emma Willard's *The Temple of Time*, published in 1846, a three-dimensional projection of historic chronography created by the founder of the *Troy Female Seminary*. This representation can be considered a wonderful example of edutainment *ante litteram*.
It is an extremely effective visual metaphor in which history takes the form of a classical temple. The pillars on the right represent the centuries of the Old World, inscribed with the names of the great men who had governed them,
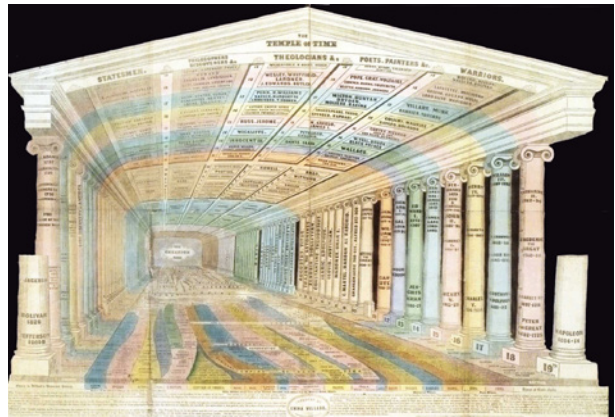
the half-pillars represent the current century, the pillars on the left representing the centuries of the New World. The five long compartments of the roof were biographical charts of important men (statesmen, philosophers, inventors, artists and warriors). On the floor, events of the time were reported.

The table, in bright colors on a black background, was very successful and many American students would have remembered historical sequences for the rest of their lives thanks to this intelligent representation.

The historical overview of the *Temple of Time* is seen almost as a desire to go beyond verbal language and to think of time streams according to other criteria.

The history of architectural modifications in a drawing

The historical premises of timelines were the foundation on which to base a project adopting associative, deductive and comparative logics in regard to the history and architecture of classical cities. The idea that artifacts are tangible education is not new. John Summerson writes "the greatest French theorist of the nineteenth century–Eugène Viollet-le-Duc–spent most of his life elucidating Gothic architecture" [Summerson 1970, p. 76]. He wrote a famous book in which he described an imaginary city to recount the evolution of rules and customs of urban societies since the end of the Roman Empire [5].

He thus underlined how the successive transformations of artifacts are inherent consequences of events, trends, facts of a context. Viollet-le-Duc's idea to build a city that would include the invariables of all the post-Roman cities

in Europe seemed an excellent source of inspiration for our reflection.

When studies on architectural heritage insist on representing and understanding the development of man-made structures, not only the key moments of their evolution should be considered, but it would also be necessary to describe the entire process of their transformation.

Today, historic artifacts are increasingly considered (or at least it is hoped that they are) attractors for our cities: physical points of reference as well as symbolic ones.

They act as tangible traces of a broad conceptual notion: the passing of time and the metamorphosis of societies and cultures that that place has witnessed. And so, when wanting to analyze and to understand those artifacts, it is important to understand that we are dealing with time (historic time) and with architecture (architecture of stratification).

Those artifacts tell us what we were and what we have become, the transformations undergone and the influences assimilated.

The points of view of archaeologists, historians, anthropologists, architects, engineers, geologists, geographers and writers on historic artifacts necessarily integrate the numerous information assets which are capable of compensating uncertain and incomplete information embracing the long intervals of time that those architectural artifacts and those places have traversed, in an apparently uniform way, according to variable physical and temporal stratification.

Therefore, the key point regards the methodology with which we can better connect the ancient artifacts that we study with the information necessary for understanding the changes they have sustained.

Fig. 6. From temporal tables to the reconstruction of the past; images taken from the text on the ideal post-Roman city by Eugène Viollet-le-Duc [Viollet-le-Duc 1879].
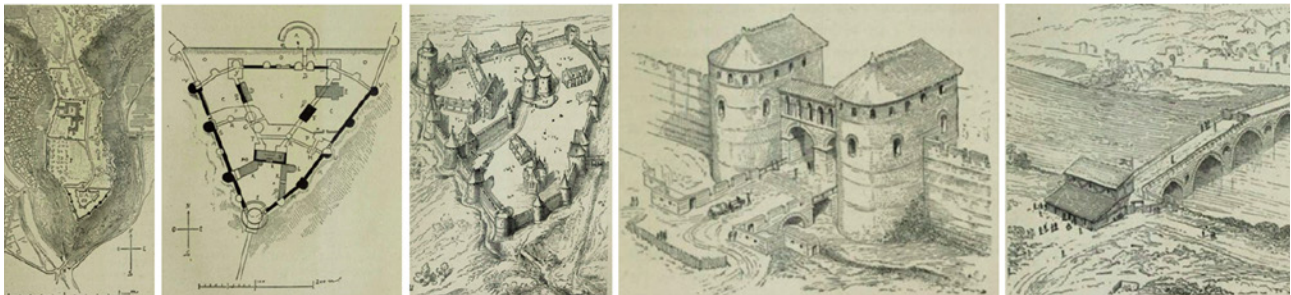
Analysis and representation of timelines:
the GAIA project

In a compelling dialectic between time and the physicality of architecture, time, in its unfolding, gives rise to mental spaces, to a representation that becomes an incessant and layered narrative.

The spatio-temporal reading of an architectural artifact is considered as a concatenation of events along which two types of links are alternated: the transitions (changes) and states (periods of stability, invariants).

The construction of drawings and models that over the years have been produced during the numerous researches on the theme of the classical city [6] is a database from which to draw, and that must be programmed according to specific, but also different, purposes.

One of these concerns the management of the dynamics of change in reference to the changes undergone by Magna Grecian and Roman urban structures.

Consequently, the structure of the timeline, in this case, is constructed on two complementary aspects:
- the description of the architectural structures (modeling and representation of architectural and urban artifacts) represented by the database;
- the reasoning on the changes through graphic schematic processes (visual chronological, geographic and thematic exploration - InfoVis).

Given a solid methodological context and efficient diagrammatic representations, it is necessary to work on the graphic representation in order to define information useful for understanding the phenomena of the transformation we intend to explain. It is important to identify, on the basis of 'families of artifacts' (urban dwellings, public buildings, access systems, connections, etc.), the temporal relationships useful for clarifying the evolutionary systems, and also able to fill any 'documentary gaps.'

In essence, this study intends to test and apply, in what we consider a visual assessment of the architectural modifications, a system for presenting information for comparison, invariants, contrasts and differences.

The GAIA project 'Young People for an Interactive Archaeology in Calabria' has been carried out in a collaboration between the Mediterranea University of Reggio Calabria (scientific director Francesca Fatta), the Superintendence for Archaeological Heritage of Calabria, Locri Museum (referent Rossella Agostino) and MAP/CNRS Research Laboratory (Unitè Mixte de la Recherche / Centre National de la Recherche Scientifique / Ministère de la Culture et de la Communication) that deals with the development of models and simulation tools in the field of architecture and historical heritage (referent Livio De Luca) [7].

The GAIA research topic is digital visualization, as a representation of a no-longer-existing past, presenting a study as an expression of a methodology that seeks to combine the informational aspects of digital visualization with scientific precision. All to the benefit of an enlargement of the field of representation, which assumes a greater consistency: maps, orientation schemes, 3D modeling, views commented by sectoral instruments, and by specialized systems in several technical and scientific areas that become linguistic dissemination.

A diachronic analysis of architectural modifications can be useful to the general public, thus able to quickly learn a few themes of the history related to the classical city and architecture; it can be a valid support in a museum or another place of culture for the acquisition of specific

Fig. 7. The reference scheme: the City of Vitruvius by B. Galiani, 1758. The wind rose is the basis for the layout of the Vitruvian city.
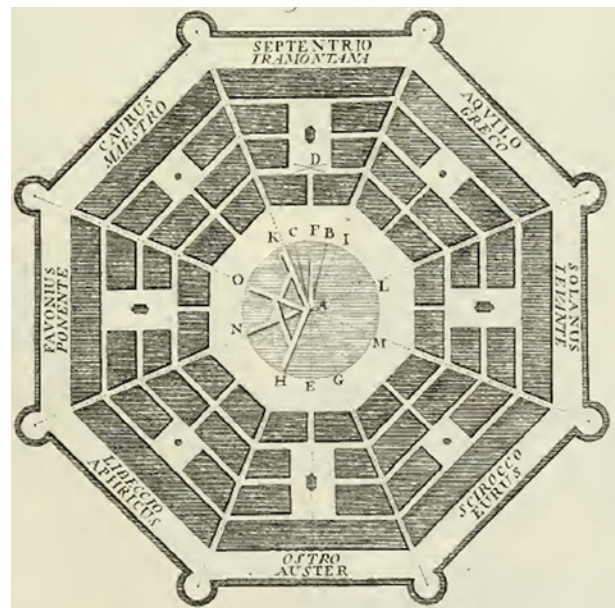
Fig. 8. Playing cards. Uncle Sam's Game of American History, New York 1851 and C.E. Morey, A New Game on the History of England, New York 1853.

Fig. 9. GAIA (Young People for an Interactive Archaeology in Calabria) an Edutainment program: Playing cards for the stoà, the theater, the Centocamere area and various objects from the National Archaeological Museum of Locri. AUGMENT augmented-reality app.
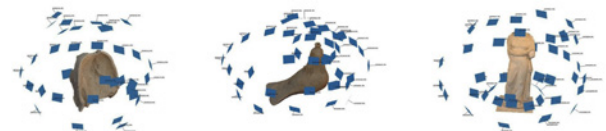
information on some historical moments, at various stages of their transformations over time. A specialized audience, instead, will be prompted to rethink the places of the classical city, with the continuous implementation of more specific information.

These readings can be used to implement a multimedia section to be allocated to museums and antiquaria for the study of the classical city and architecture through AR and VR systems, and prototyping of models; for the organization of cultural initiatives to enhance dialogue, cooperation and solidarity between the Mediterranean civilizations.

The design of a timeline for the description of the classic city

In the introduction of the research, some basic questions were raised in reference to the context and the methodologies to be implemented, or how to explain, in a scientific way, the invariant structure of the classical city, both Roman and Hellenistic, to the public of museums and places of culture, and especially to the very young people who are approaching the world of archaeology for the very first time. The results obtained in this experience are intended to give an answer to this question, starting from the experiences carried out experimentally in some Italian and French archaeological museums which also disclosed their content through the web.

Advanced technology, computer graphics and multimedia content are often united in the formalization of a whole new visual language, which does not mean betraying the scientific assumptions taken as reference. This is why the partnership between researchers in the different fields of archaeology, computer graphics and communication, and technologies in the field of survey and modeling has been able to capitalize on the experimentation presented here with the idea of activating a museum didactics section at the Archaeological Museum of Locri, in Calabria, that will provide a model for other museum sections, capable of activating network exchanges with other museums in the Mediterranean area.

The binomial protection / virtuality is frequently emphasized because it is believed that the idea of a good use of cultural heritage must be programmed, as already noted, through a widespread information system communicated through the web and disseminated through small and efficient museum facilities present on the territory pertaining

to the referring site, and which have a specific consideration for their youngest visitors.

A site, especially if not widely publicized, should first and foremost relate with other similar sites and design a common information network capable of becoming an 'attraction system' for tourists, scholars and visitors through a program of education and innovative entertainment. This has been the goal of the GAIA project, that identifies, in drawing, a role of cultural and scientific mediation, as a vision, representation, communication according to multiple approaches.

The GAIA project provides two distinct paths of consultation for gaining knowledge of Roman and Magna Grecian cities. In the first path, playing cards suitable to be manipulated by children were designed, on which the most significant and characterizing presences of the archaeological site of Locri Epizephyrii are represented (the theater, the temple and the stoà), as well as the characteristic areas of Centocamere and several objects conserved in the museum. The 3D Augmented Reality App applied to these playing cards allows students to gain access to the data sheets of the archaeological monuments of the Locri Epizephyrii site thanks to markers applied to the images. It is also possible to understand a find or a 'tomb furnishing' in their original form created with 3D models that will appear, on request, on a tablet. 3D models of the reconstruction of archaeological ruins and furnishings were carried out according to reliable scientific references.

The models allow young visitors to choose an educational path according to their preferences: the name of the object, the time of its creation, its use and much more, thanks to descriptive images and films, as well as a three-dimensional model of the reconstruction [8].

This way of viewing the objects in the museum is not a replacement for an on-site visit, rather it is designed to complement it and arouse curiosity and expectations. With these applications, young people will be the direct protagonists of the order of what they choose to see and not passive viewers in a tour of the museum.

The second edutainment path is called the Wheel of Time, an interactive multi-touch spiral graphical model that contains and identifies, in a chronological hierarchy (which goes from the seventh century BC to the fifth century AD), a list of Roman and Magna Grecian archaeological sites. This permits an analysis of the urban structure of ancient cities in reference to the main urban areas and the most important architectural works, and in relation to the

Fig. 10. GAIA Interface. *Graphic diagram of the interactive Wheel of Time model with the Vitruvian city at the center.*
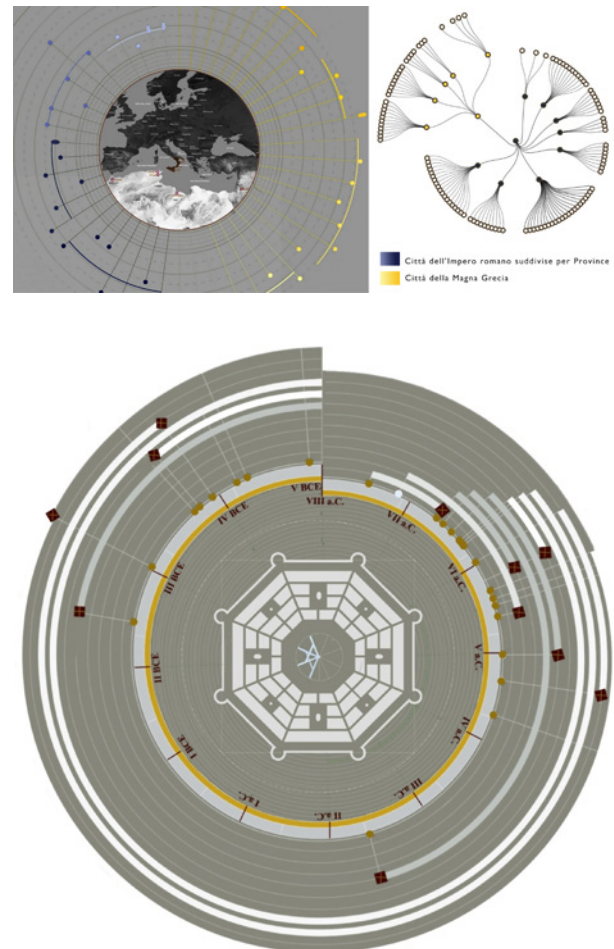
invariants of the Vitruvian city (urban configurations, public buildings, specialized architectures, domus).

Traditional drawing and infographics were joined by other powerful expressive and communicative media such as computer graphics and digital modeling. The cities visualized in the Wheel of Time are: for the Magna Grecia, Locri Epizephyrii, Sibari, Selinunte; for the Roman Empire, Volubilis, Dougga, Leptis Magna, Jerash [9]. The primary object constructed for navigation is a wheel which represents the city of Vitruvius, taken from the text *Vitruvius Pollio. Ten books on architecture* (1914). This represents a synthesis of the idea of the classic city. The "Wheel of Time" allows a chronological overview where the cities are located in time and space by 2D and 3D codes. The "Wheel of Time" thus becomes an educational game able to develop correlations between places, architecture and objects, all distant in space and time, but nevertheless related to the geographical and cultural Mediterranean area. This contribution does not intend to set an objective, but to propose a reflection. In this case, the interdisciplinary approach that integrates information technologies and architectural modeling at different scales uses the modélisation informationnelle methodology. This method aims to improve management of data with respect to their visualization regarding the temporal transformations of architectural artifacts of historical and archaeological heritage. In this way, the rules for the creation of 2D and 3D charts are designed as scientific tools for investigation and visualization.

Fig. 11. GAIA Interface. Visualization of a square matrix representing the Roman city of Dougga, Tunisia, with the identification of the main monuments, the virtual reconstruction of the Forum and of the town in the III century B.C.
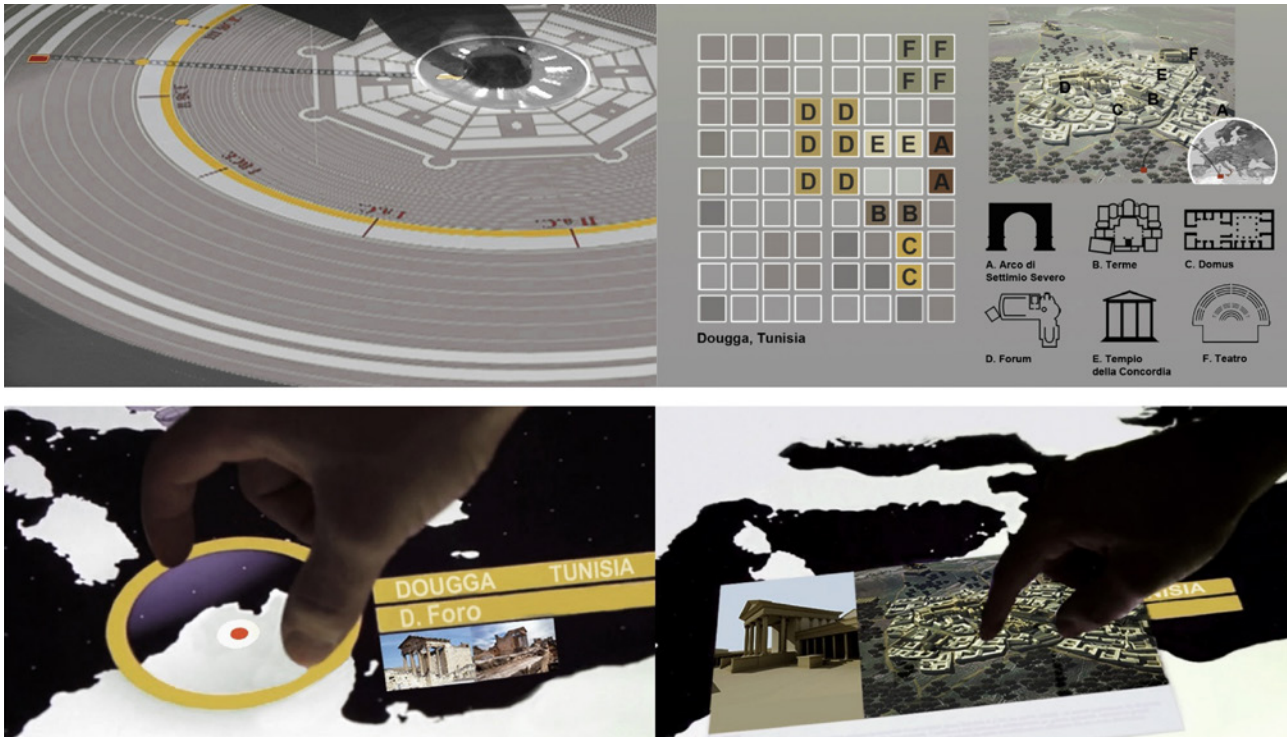
Conclusion

The objective of reading a specific urban transformation in a broader perspective prompts a reflection on how the image of an architectural heritage artifact highlights the identity of a community and the culture of reference [10]. Designing a game based on scientific fundamentals that examines cultural heritage with 3D systems of vir-

tual reality, augmented or mixed, imposes a guarantee of the quality of information, creates a dialogue between the aspects of historical knowledge and the ways of using spaces and introduces an important criterion of novelty and experimental innovation for the knowledge of the classical city, especially for young people. This research shows that abstraction and figuration can be alternative or additional ways of representing cultural heritage.

Notes

[1] An example is given by the ChronoZoom project, an open source initiative, conceived by the famous geologist Walter Álvarez, together with Roland Saekow, for a free software capable of providing effective interactive representations of sequences of events on the broadest possible time scale from the Big Bang to the present day.

[2] One timeline (from the Creation to 1753) is fifty-four feet long, mounted on turning cylinders and enclosed in a case. Another uses the different parts of the human body to show the genealogies of Jesus Christ and the sovereigns of Saxony. The diagrams created by 18th-century missionaries to convert Indians in Oregon ordered Bible stories in vertical columns. There is also the North Atlantic communication chart of Marconi's telegraph, dated April 1912: it reported where a ship was located, at each moment, in relation to other ships, and not by their geographical position; one of these was the Titanic. There are also little-known works by famous personalities, such as the historical chronology by the mapmaker Gerardus Mercator or a mnemonic board game patented by Mark Twain.

[3] The project is connected to the H2020 objectives of the *Line 2 Competitive Industries and, specifically, Content Technologies and Information Management. Technologies for Language, Learning, Interaction, Digital Preservation*, also with precise connections to the funding Line 1 Excellent Science, which supports research in ERC (European Research Council) sectors referring to Cultural Heritage.

[4] The purpose of the GAIA research project is to organize an activity of technology transfer and applied interdisciplinary research related mainly to the sector of Social Sciences and Humanities, also with the aim of promoting, through the use of emerging technologies, the development of ICT applications for surveying, cataloguing and digital preservation, study, dissemination, disclosure, innovative use and sustainability of the archaeological and architectural heritage object of the research.

[5] Eugène Viollet-le-Duc analyses military history and techniques of for-

tification through events concerning the fictional town of La Roche-Pont from the Roman age to the Franco-Prussian war. See the complete edition: Viollet-le-Duc, 1879.

[6] See volumes *Spazi e Culture del Mediterraneo*, published between 2008 and 2015, outcomes of the PRIN research coordinated by Massimo Giovannini.

[7] The GAIA research project, which lasted 18 months, was implemented by Manuela Bassetta, postdoctoral researcher for the project, who spent 8 months at the MAP-CNRS headquarters in Marseille under the guidance of tutor Jean-Yves Blaise, and 10 months at the Department of Architecture and Territory of the *Mediterranea* University of Reggio Calabria, with periodic internships at the Locri Museum.

[8] The survey techniques used range from laser scanning to photo-modeling. Among the software available on the market, the experimentation was conducted with Agisoft Photoscan. For Augmented Reality, Metaio software was used.

[9] The 3D theoretical models of the virtual reconstructions of Magna Grecian and Roman cities were elaborated within the scientific research PRIN 2009-2011 *Costruzione di un Atlante del Patrimonio Culturale Mediterraneo*. Title of the specific research: Progetto di un sistema interattivo per la conoscenza e la gestione del patrimonio culturale mediterraneo, coordinated by Prof. Francesca Fatta.

[10] In this research, the contribution of the research method of *modélisation informationnelle* by J.Y. Blaise is seen. Informative modeling is an interdisciplinary approach that integrates information technologies and analytical issues of architectural modeling at different scales. The application field regards historical and archaeological heritage, and its roots are found in the field of architectural modeling, imaging, data management and scientific visualization.

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Renewing Glances. Design and its Practice: Representing, Communicating, Narrating

Elena Ippoliti

Abstract

As 'specialists' or 'public', we are immersed daily in a world of images. This centrality of images has corresponded to a renewal in studies, theories, and methodologies of knowledge that can be derived and transmitted, especially for experiences connected to the means and forms of visualization. This is different in the discipline of drawing, however, which seems to have folded back on itself. About twenty years ago, it seemed that drawing could, or should, unfold over broad territories and that its practices participated in the construction of knowledge according to a system of specific means: heuristic, hermeneutic, referential ones.
Today more than ever, the urgency for a new understanding of logic and illogic, truth and ethics, that is, scientific and aesthetic thought, motivates the reflections and experiences proposed below. These reflections are useful in delineating the context of the need to renew the studies in drawing, along with its theories and methodologies, which can only originate through concrete practice. This is the perspective of the teaching experiences presented. These are experiences in which the exercise of drawing is an unavoidable mode due to the formation of a code of thought that can only be visual, and even more appropriately figural, because it is precisely in its writing that it acquires 'body' and 'manner.'

Keywords: visual communication, visual narration, infographics, video, composition, editing

Introduction

As 'specialists' or 'public,' we are immersed daily in a world of images. A multitude of images that we consume, produce, share, transmit, and spread every day. As far as the term 'civility of images' is worn out, our existence is undoubtedly always more interwoven with experiences overflowing with visual representations and characterized by the availability of continuously changing viewing technologies. To the evident centrality of images in the last thirty years or so, there has been a renewed flourishing of studies, theories, and methodologies for the derivative knowledge and the cognitive transmitted content, but especially for experiences connected to the modes and forms of visualization. This renewal represents only the latest battle between two irreducible strategies of thought in the cognitive relationship with reality.

These battles have been proposed many times throughout the history of Western knowledge, in perennial conflict between philosophy and tragedy, idea and imitation, logic and illogic, need and possibility, truth and ethics. To hold reason and body, thought and desire together, the conflict aggressively spanned the entire twentieth century to resolve itself in a "language of figures," changing not only the object of knowledge, but also the procedures. This new knowledge is capable of including the complexities and contradictions of the subject, as well as the experience "introducible in a concept, but figurable in a narration" [Rella 2004, p. 55] [1]. This constitutional conflict in drawing is in perennial tension between science and aesthetics; between thought ba-

sed on the difference and the rigor of measurement, and thought based on the similarity and even the perceptive homology of the forms. These two epistemological approaches have accompanied the discipline of drawing since the beginning and mark a difference between declared, intangible, rational cognition based on abstraction, and implied, totalizing, natural cognition based on imitation and experience.

Paradoxically, the full awareness of the need to address, understand, and govern this 'multiplication of images' does not seem to be rooted among drawing scholars if it is still necessary to remark how "there are many who think that our specialty is not only architecture, but rather the creation of visual images" [Cardone 2016a, p. 19].

There is no registering of a meaningful quantitative reorientation of research on "transverse themes regarding graphical investigation and communication in the area of design and cognition […] toward cutting-edge sectors in the historical, theoretical, experimental, and applicative fields" [2].

This is a regression referring to twenty years ago, when it seemed established that drawing could, or should, unfold over wide territories and that its practice would participate in constructing knowledge according to a multi-modal system: heuristics, hermeneutics, referential ones.

This reversal is perhaps even more evident, and therefore more worrying, in the context of university education where, with the consolidation of teaching representation oriented at prefiguring and controlling anthropic space, less attention has slowly been given to drawing according to more extended, diverse horizons. Today more than ever, the urgency to include logic and illogic, truth and ethics, that is, scientific and aesthetic thought in the discipline of drawing motivates the reflections and experiences proposed below.

These reflections are useful in delineating the context for situating the need to renew studies in design and the possibility of doing so, along with its theories and methodologies, according to numerous positions.

This renewal in drawing should fundamentally originate from the exercise of concrete practices because they can be "connected with the art of investigating, understanding, communicating and, ultimately, of going on along the road of knowledge and know-how" [De Rubertis 2012, p. 145]. This is the perspective in which the teaching experiences presented should be viewed [3], where the two visual proposed artifacts are expressions of two irreducible but complementary strategies of thought that precisely echo the discipline of drawing and its practices.

These are experiences wherein drawing is practiced as an unavoidable mode of forming a code of thought that can only be visual [Arnheim 1974].

The code is precisely figural and is composed over time through progressive deposits and archiving of visual memories and a thought that unfolds in writing because it is in this representation that it acquires a 'body' and formulates the thought itself [Cervellini 2012]. This means exercising practices that are proposed in the view of a more general reflection on the future of the statute of drawing, which, "finally detached from the seductive vortex of opaque mimetic images, can recover its figurative and conceptual heritage" [Dotto 2016, p. 35].

Renewed glances

There are many disciplines in the field of human and social sciences that, each with their own specificities, have assumed images as the favored object of research. If in the 1990s historical/diachronic criteria still prevailed along with heuristic models deriving from linguistics, in recent years a different perspective has been definitively consolidated, including both iconic objects and the practices of viewing and looking. This different view corresponds to a different methodological approach that involves both the 'making' of images–the different media and places of production and consumption–and the 'using' of images–the visual experience–incorporating, according to a situated view, social interaction and cultural phenomena [Pinotti 2014].

It is a true "iconic turn" [Pinotti 2014, p. 271], where the paradigm of reflections does not reside in the iconic object but in the experience made of it, that is, in the meaning it assumes for the individual and derivative cultural processes and that, simultaneously, support it. A body of research that, from the awareness that the role of images in the cultural process is close to "the idea that the visual can represent a new, important heuristic perspective, 'proposes' the visual culture as a cultural object and guides the visual analysis, assuming both the specifics and centrality in the modern era" [Sassatelli 2011, pp. 150-151].

The work of Jean-Jacques Wunenburger testifies how this 'iconic turn' regards the different areas of knowledge; he, for the first time in philosophy, used the image as a category of investigation in itself.

Aware that "the study of productions rendered in images, of their properties, and of their effects, that is, the imagination, has progressively supplanted the classical question of the imagination" [Wunenburger 2008, p. 16], the scholar retraces "the complex themes of the type, nature, and methodology, pausing on the epistemological orientations, the hermeneutics and phenomenology of images" [Cardone 2016b, p. 7].

According to a broad vision, he embraces imagination and the imaginery, encompassing the inherent double nature of each image–the matter and the mind, the thing and the idea, truth and error–he therefore recognizes in the gap between knowledge and what is represented the propulsion that ensures that each image is both the product of a cognitive operation and the fruit of a reflexive interpretation. Wunenburger makes an effort to culturally reassess the world of images, not only those that seem to need "an interpretational undertaking", but also those where the information seems to meet "the surface of the figures without any obstacles" [Wunenburger 1999, p. 272].

This thinking by and through images has, from the beginning, also accompanied the formation of modern science, contributing, in relation to tools and techniques, to the starting of the experimental method based on the principle of verification through experiment.

The image, the interface between knowledge and the world, is an exploratory practice and observable model of reality that, proceeding through successive accumulations and comparisons, allows the passage "from taxonomic orders to true propositions" [Ugo 1994, p. 40].

But also due to this process of abstraction of the notion of form, that unifies geometry and calculus, the image works to define abstract languages and models that are indispensable to the scientific formalization of theories.

A universe of images that participates in the scientific thought, in the heuristic and operational practice where "sketches, schemes, graphs, synoptic tables and diagrams" confer a visible, and not only abstract, structure to knowledge, favoring a "global cognitive path" [Wunenburger 1999, p. 318]. Images play a central role not so much for their descriptive/mimetic character as for their descriptive/notational feature, becoming available to the scientist's conjectures in gathering, isolating, and fixing some aspects– and only the essential ones–of the observed phenomenal reality through a set of signs.

An openness to 'discovering,' through the progressive elimination of redundancy, that has ensured the 'fortune' of

Fig. 1. SpreCO2 at Sapienza University (Students Francesca Romana Pelagallo, Xu Huijie, Marta Jamróz).

images in the scientific method because drawing an image is analogous to the functioning of the brain.

This, in fact, due to the truly impressive capacity for re-solution of a glance, must reduce the quantity of visual information. Therefore, if the mental image is a reduction of what is captured by sight, the drawn image is none other than "a further development of this program of synthesis" [Pascolini 2006, p. 138].

The intelligence of images was newly affirmed in science after the crisis experienced in the 1980s [4].

Due to the enormous amount of information produced by instrumental apparatus, it was necessary to "reduce com-plexity, consolidate the information" newly resolved by di-rect observation "of 'events' preselected by the apparatus and represented through appropriate codes" [Pascolini 2006, p.141].

These are particular images, the result of complex instru-mental mediations produced through 'transduction' that transport what is latent to the perceptual present, the invi-sible to the sphere of the visible [Anceschi 1992].

But representing theoretical models of both the measu-rement apparatus and the phenomenal reality, giving exi-stence to what is non-existent, the images are also, and still, representation of hypotheses.

New images of possible reality visualizing concepts of the world, for whose interpretation it is necessary to refer to further visual mediation.

In this scope, scientists should activate chains of associati-ve recalls to other images, looking for them, as with sight, in the memory of their own cultural, figurative repertoire [Pascolini 2006].

Visual artifacts for representation, communication, narration

The teaching experiences presented below were propo-sed to the students as an opportunity to reason about 'what' and 'how,' addressing content and device, measuring informative and aesthetic criteria, updating accuracy and synthesis, balancing clarity and communicational efficacy. According to this goal, some of the visual forms depicting artifacts useful to supporting public communication cam-paigns on socially and culturally relevant questions, were experimented. 'Sensitive' topics were willingly adopted over time: gender differences and equal opportunity, en-vironmental issues and the resistance to changing daily in-dividual behaviors (fig. 1), the theme of migration and mi-

grants (figs. 2-5; figs. 7-10) and the condition of the Italian university system (figs. 6, 10, 11), etc. These are conflicting, controversial arguments that cannot be 'simply' divulged, where communication cannot be limited in describing the facts, but where the facts should be made understandable, highlighting the plan underlying the events, and available to understanding through experience and participation.

The experimentation was aimed at designing the forms of understanding and communication; it consisted of two types of visual artifacts: an infographic in the form of a map, and a brief 60-second video.

These two modes of visualization were chosen precisely for their differences as expression of two forms of irredu-cible, complementary thought, capable of combining com-munication and narration, exercising different enunciative means of 'discourse' about the represented object/subject: the description and the story. In the description, the object is seen simultaneously from all points of view according to an atemporal spatiality with a "simultaneous glance that embraces and understands a stable order of places" [Marin 2001, p. 81].

In the story, the object is narrated through "the glance of a moving traveler that crosses spaces and itineraries" [Marin 2001, p. 82] and the exposition is linked to a spatiality in which the temporal dimension is present.

In the infographic, the 'draftsman' has a higher position and observes the horizon. His gaze is stretched and proceeds sequentially in search of a connective thread in the set of data that will transform it into information.

The construction of knowledge derives from logical/scien-tific thought and a communicational mode that acts throu-gh demonstrative argumentation. It tries to convince due to the reliability of the data and authority of the 'draftsman,' adopting a formalized, concrete, non-contradictory langua-ge. In the video, the draftsman is, instead, in the deep of the informational 'forest.'

He is situated at a lower height, there is a reduced field of view impeded by obstacles. Indeed, the close-up view of things allows the translation of the general arguments so that the communication reaches the public more easily, which no longer feels extraneous.

The construction of knowledge derives from narrative thought and a means of communication that acts throu-gh similarity and tries to convince through 'good stories' due to the plausibility of the experience and empathy with the character, adopting an expressive, emotional language.

These two products, which, in making a phenomenon/process/story visible and offering it for the observer/spectator's interpretation as a possible experience, differ according to their figural registers, communicational means, and narrative strategies.

The infographic's narrative strategy adopts a rhetoric organized around a central argument as if it were a documentary film [Toti 2009]. The narrative structure is designed for understanding and its scope is to transform data into information, combining them organically in meaningful visualizations, modeling forms and colors that have the power to evoke emotions and to stir up deep feelings, thus transforming the information into construction of meaning and, therefore, the story into narration.

The video narrative strategy adopts a rhetoric organized around a central character as if it were fiction. The narrative mechanism assumes an everyday story to transport the observer/spectator into the scene; it then introduces an anomaly–the extraordinary in the ordinary–to provoke doubts and wonder in order to give "sense to the immensity of things that happened, are happening, and will happen in the real world" [Eco 1994, p. 107].

As if it were a very detailed map, the video allows the trip to enter into the deep of the 'forest,' already knowing the thousand obstacles along the path. It is a detailed map that can be understood only when it is reconsidered referring to the new map of the world, infographics, which will allow the reciprocal relations and dependencies between things to be grasped, that is, to penetrate the system of knowledge. These two ways of constructing knowledge, understanding, and communication collaborate together in the system of visual communication where narration, in "giving shape to what is unclear" [Eco 1994, p. 107], embodies the ethical effort to "give shape to the disorder of experience" [Jachia 2006, p. 65].
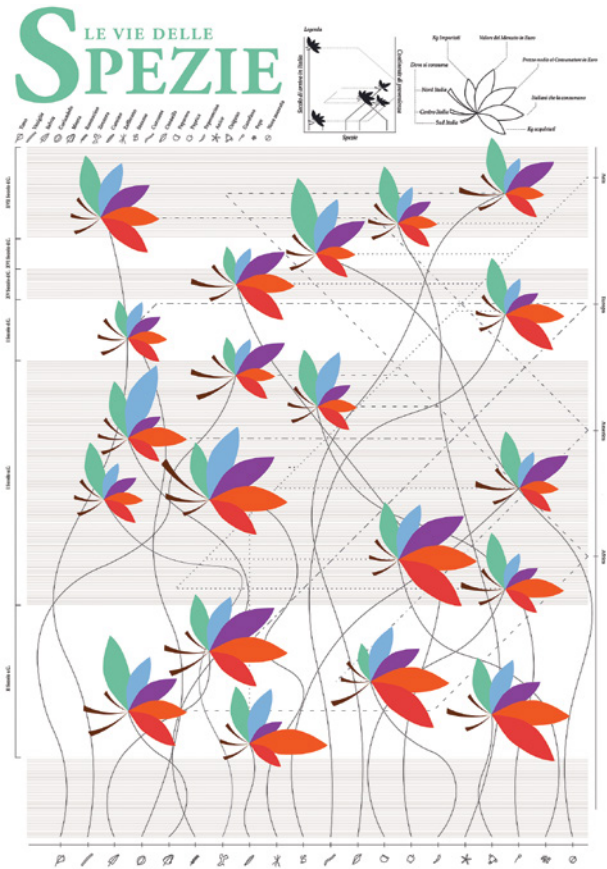
Figs. 2, 3. The Spice Routes.
(Students Alessio Caccamo, Roberta Colonna, Claudia Vespiano).
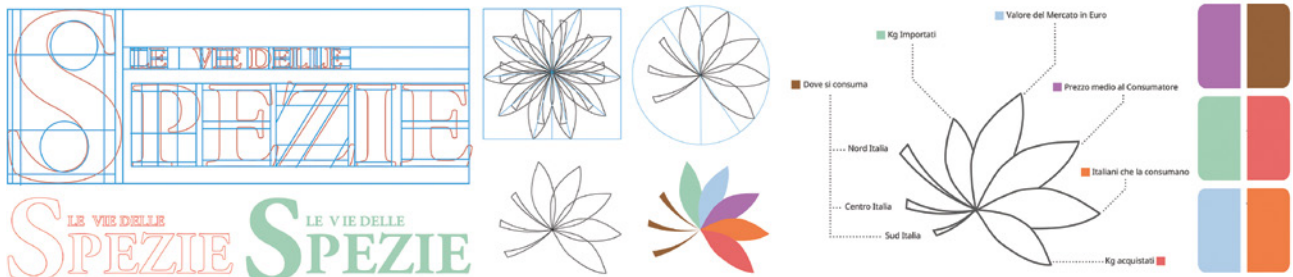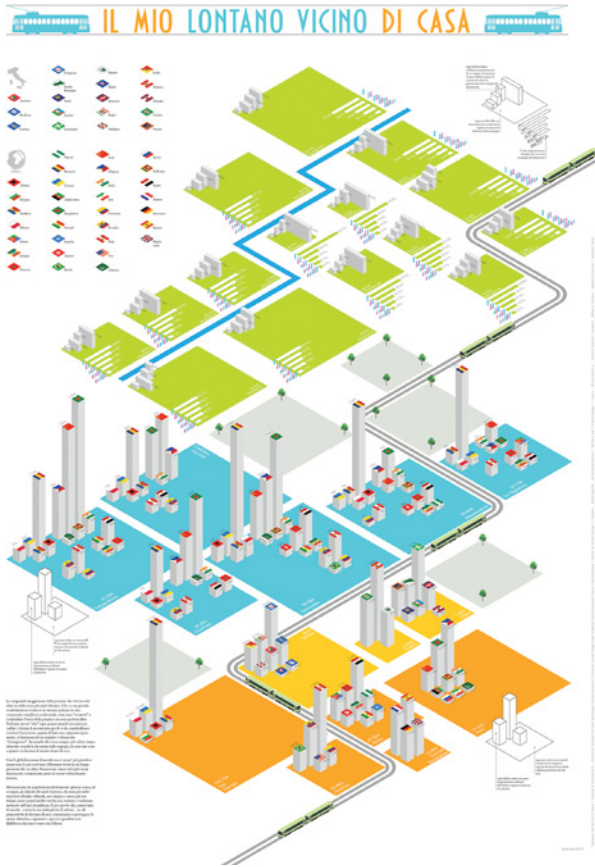
Figs. 4, 5. My faraway neighbour.
(Students Stefania Carlotti, Gaetano Corvino).

Forms, means, and relations for representation, communication, narration

In general, a visual representation or visualization is where "the interpretation of the world by man" is expressed; it is therefore statutorily a "meaningful content" [Gil 1980, p. 551]. In order to involve someone in the content, a conventional system of representation, a metalanguage, is adopted, with a lexicon, syntax, and semantics. The representation is therefore the 'body' and 'means' of communication, but also the interface that, through the 'setting', ensures the 'sharing' of the content between draftsman and observer.

Once any hesitation has been erased, it is possible to act on this inherent potential vocation, that can be found in each representation, to ensure that our 'observer', "always next to, always on top of, always running after" [Eco 1979, p. 11], is no longer found before the scene. While hesitating and doubting, the observer within the scene advances among hypotheses, conjectures, and predictions.

Having become an actor, the observer participates in interpreting and building meanings, mastering the experience of the story and getting 'pleasure' from it, leading to the effectiveness of the representation/communication/narration.

Effective narration requires plausible stories, that is, coherent, credible sequential logic and space. It is through the temporal and spatial relations that the set of events is acted upon and the narration unfolds between "storyline time, discourse time, and reading time" [Eco 1994, p. 66].

The strategy makes recourse to 'not said' things and 'already said' ones, to 'white space' and 'interstitial space' [Eco 1979] for a narration in which spatial discontinuities and leaps in time are mended by means of non-linear connections. These connections are proposed by contrasting
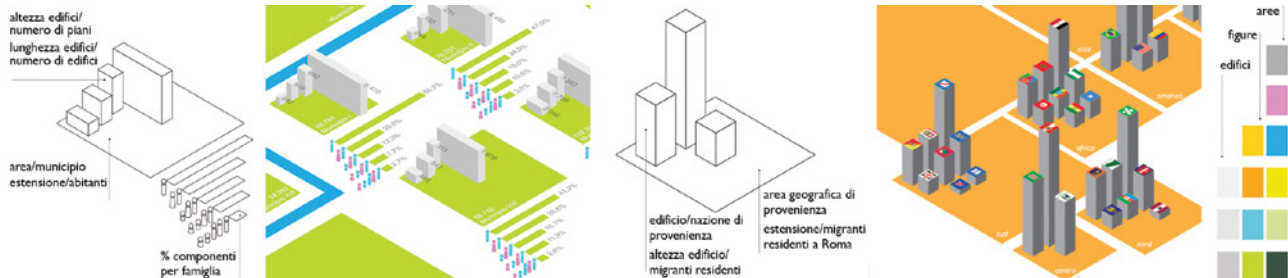
semantic figures and acting on the *fabula*, that is, on the linear time of the story, in favor of the plot, i.e., the time of discourse.

The effectiveness of the infographic is entrusted above all to the formal/expressive coherence of the 'space' that is resolved in the space around the figure and realized starting from the intimate coherence of the graphical/visual unities that form the visual vocabulary. It is therefore necessary to choose a single path between 'sign' and 'image' [Brandi 1986]: between sign, that is symbolic and, thus, aniconic, and sign, that is an image and, therefore, iconic. The sign/symbol should "increasingly closely connect the semantic content it designs" [Brandi 1986, p. 14], while the sign/image should develop the figurativeness to have "morphological appearances visually similar to what it represents" [De Rubertis 1989, p. 158]. While originating from a common schematic/symbolic root [Brandi 1986], the design of visual unities should therefore be diversified according to the chosen formal/expressive horizon, characterized as it is by an abstract/plastic form (denoted by the lowest figural density) or iconic/analogical form (denoted by the highest figural weight). It is therefore also characterized according to a different knowledge/communicational horizon of our experience, between the abstractness of the concept, which is digital and discontinuous, and the concrete weight of the phenomenon, which is analogical and continuous.

Starting from the visual vocabulary composed of forms and figures, signs and images that act as symbols, icons, and indices, and operating through a generative grammar (structure and recursive rules), one proceeds over time in the design/plan before the visual phrases and then specialized figures.

The visual syntagmata are minimum units, and thus equipped with a complete expressive form, combined according to an internal logic, operating on the eidetic properties (form, size, color, texture) and by simple transformations (displacement, rotation, translation, repetition, etc.).

Then, according to an external logic, one operates in the two-dimensional space of the representation through topological categories (position, direction, orientation, etc.), highlighting the relational properties, that is, building further syntagmatic relationships between the different minimum units.

Highly specialized figures are thus generated, such as schemes, graphs, diagrams, etc., i.e., particular systems of graphical notation specialized in expressing relationships, that is, concepts "concerning quality, quantity, distribution,

Fig. 6. In Italy? (three times four = 13) Comparing research in 4 nations, 3 universities and 3 disciplines. (Students Carolina Petracchiola, Ilaria Pietrantozzi, Daniele Proietto).
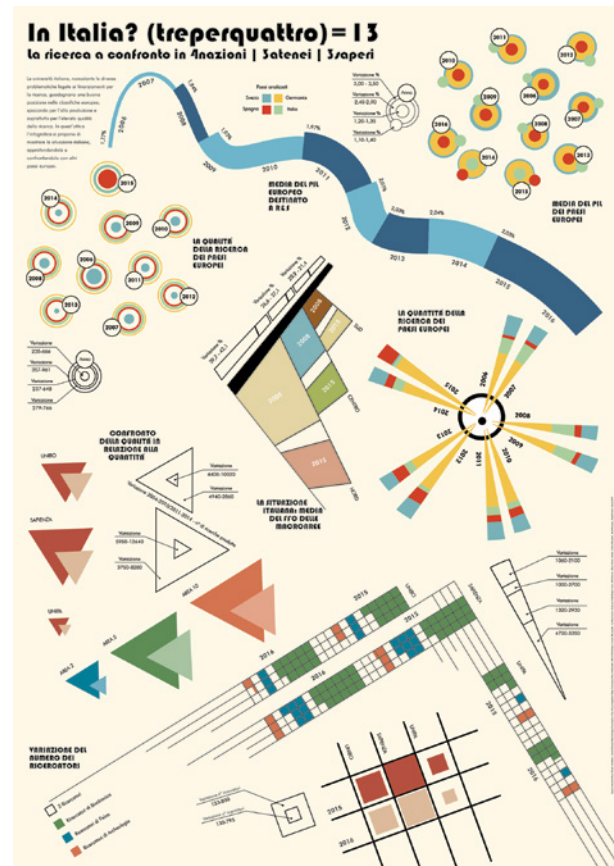
subdivision, and their modifications and variations" that "are formed and derive from acquisitions of an eminently perceptual type" [Massironi 1982, pp. 98-99].

The effectiveness of the video is entrusted above all to the coherence of the space/time composition that is created starting from the intimate coherence of the minimum units, measures of space and of narration time, i.e., the frames. By means of these, the selection is made, including and excluding not "simply 'the things,' but the feature of the object or the framed person" [Arnheim 2009, p. 307].

Through the frames, reality therefore becomes a suggestion of something larger: it first corresponds to the internal logic of the image plane through the relationships established between frame and figure.

It then echoes the external logic expressed by the relationship between visual field and depth, that is, between figure and background, and finally introduces time through the length of the movement that is described there.

The only minimum film unit with a complete narrative form is the scene, which artificially reconstructs "an action that has its spatial and temporal unit" so that only "those moments necessary for the narration" remain [Arnheim 2009, pp. 303-304].

The sequence is a unit that instead represents a complete narrative episode and, in contrast to the scene, is characterized by temporal discontinuity. By means of framing and scenes, 'decomposed' reality is reconstructed by associations and ellipses: the flow of images proposes a plausible spatial and temporal continuity, orienting the spectator's perception and interpretation.

In the ways of conceiving and giving shape, the two different products adopt analogous procedures within the logic of design. For this, they lend themselves well to an experience oriented at forming a code of visual or figural thought that unfolds in its writing.

Both ways, in fact, proceed starting from visual units that are displayed and associated according to pertinent syntactic rules and conventions so that the adhesion to this stringent set of formal norms ensures the recognition of the style and therefore the coherence of the narration.

For each genre this therefore means first defining a metalanguage. This conventional system organizes the disposition of elements (figures or characters, information or events) according to a 'time'—demonstrating the causality of the chain of narrated events—and a 'space'—equipped with characteristics to make it identifiable and recognizable.

While advancing according to "combinations of figural fragments" formative modalities, summative in nature, lead, however, towards a 'unitary *gestalt*' where "the result is something absolutely unitary, indistinguishable, inseparable" [Anceschi 1992, p. 57].

The building of meaning, which is the most authentic experience offered in both infographic and video narrations, proceeds according to an aesthetics of procedure, between the polarities of discontinuous and continuous, punctual and durative, contrast and analogy, according to the means of composition and mounting. It is through these that the narrative syntax is revealed and the "mere reality of existence […] is converted into a configuration rich in sense" [Montani 2004], and offers itself to interpretation in a continuity of emotional recalls and relationships with the spectator's cultural heritage of mental images.

This is not an art of saying, but an art of showing. It is the draftsman who, to orient the spectator's gaze, displays the set, and it is not "important whether it is the act of framing, revealing, exhibiting, or showing, or of highlighting with light, a particular position or disposition on the set, the composition of the setting or the graphical display of the layout" [Anceschi 2003, p. 9].

This way to proceed is all in the context of the "specificity of the visible and its communicational practices" [Anceschi 2003, p. 8].

And it is in this context that the visual exercises have lead the students through the forms of representation, to experience them as different ways of formulating thought itself. While constructing a representation, they highlighted the communication, detaching the object of communication from the surrounding context.

In the representation they communicated an interpretational model of a phenomenon, making it understandable through a visual language. But they also formulated hypotheses with their representation; they therefore depicted the invisible. To be effective, visual communication products should be clear and unequivocal, but also 'memorable,' that is, capable of provoking curiosity and wonder, i.e., they can only be stories told with figures.

These are stories told with figures that future architects and designers have experimented with by knowingly combining and influencing vision and narration, and interpreted as occasions to "responsibly understand the value of visual communication as a means that contributes to change for the better all the worst things" [Steiner 1978, p. 207].

Fig. 8. *All the roads that lead to Rome. Split screen technique. (Students Manlio Massimetti, Maria Giulia Nocentini, Angela Testa).*
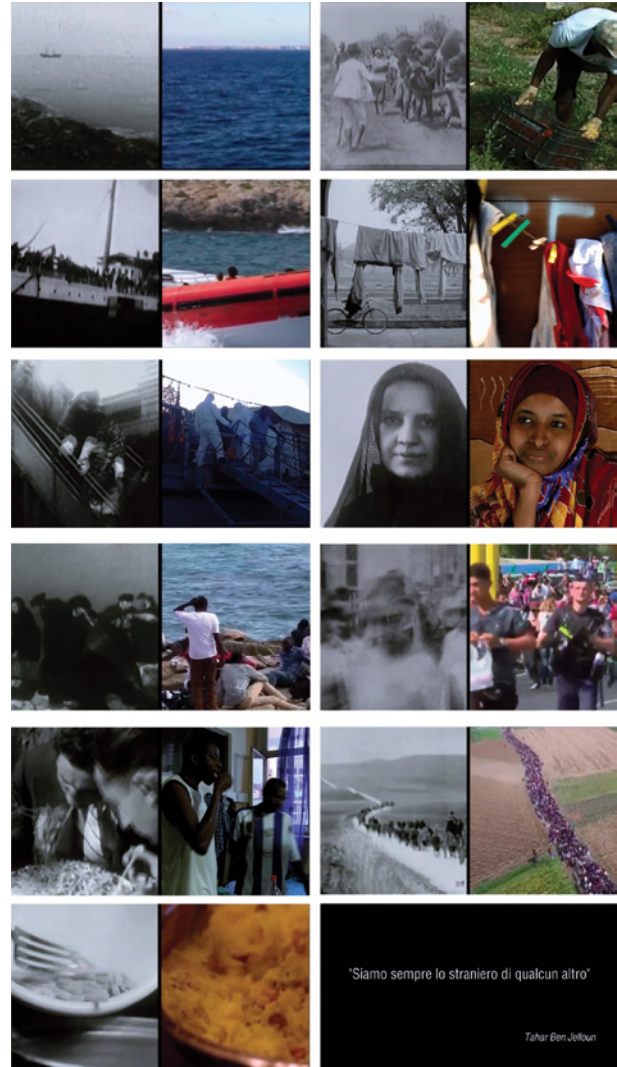
Fig. 9. My faraway neighbour. Framing and type of shots.
(Students Stefania Carlotti, Gaetano Corvino).

Fig. 10. Lest a second change your life. Editing and narrative rhythm.
(Students Simone Sbandi, Virginia Zoppi).

Conclusion

Once again, images have shown themselves to be indispensable and practicable devices not only for constructing knowledge and experiencing the world–nature, society, culture, etc.–but especially for sharing knowledge and experience.

The 'fortune' of images in the modern era is determined by the need to make intelligible a truly impressive quantity of data, this is possible to the measure in which they are analyzed, correlated, and synthesized through visualization. In advanced areas and complex systems in particular, images play a central role in communicating and spreading scientific, social, economic, political themes.

This vast repertoire and a wide range of different types of images has been shown to be the favored place of dialogue and mediation among specialists and between specialists and public.

This is because images are the first way to approach knowledge of the world–which ranges from perceptual imitation to representative thought to logical/formal thought through visual models–and only later it can be structured through numerical and verbal languages.

But it is also due to the emotional effectiveness of the images that, thanks to their 'associative/recall' mechanism, they can trigger wide ranges of emotions and, as a consequence, transmit additional information.

Graphical schemes, representations, and moving images, or even simple details of them (as historically in bestiaries, inscriptions, medieval imagines mundi, parerga, landscape paintings, etc.) activate chains of memories that relate mental images to the sensory perceptions of the external world and also with visual recollections of internal memory.

But to allow these images to truly speak, to be the place where knowledge and experience are brought together, it is necessary to activate a meta-communicational relationship among interlocutors, that is, presuming to share the same figurative and visual culture.

A culture that would place us, the public, in a condition to orient ourselves in this 'civilization of images,' allowing us to analyze, process, interpret, in other words, dominate them. A solid–but also practical–culture of what we can say figurative and visual, is even more necessary for specialists, so that images do not become "more powerful than the hands that created them" [Pascolini 2006, p. 142].

This is an awareness of the need to address this 'multiplication of images' that drawing scholars should master again. And it is a discipline that from this awareness must be able to reorient research and renew theories, methodologies, and practices, re-establishing the awareness of both the cognitive and the experiential result of the images, knowing how to comprise the figurative and visual world, eye and brain, glance and mind.

Fig. 11. *Lest a second change your life.*
(Students Simone Sbandi, Virginia Zoppi).

Notes

[1] Rella refers in particular to the research of Sigmund Freud.

[2] A deliberate use has been made of the objectives of the historical series of the journal *XY. Dimensioni del disegno* in <http://www.xydigitale.it/la-rivista-xy-dimensioni-del-disegno/la-serie-storica-di-xy-1986-2002.html> (consulted on May 29, 2017).

[3] Active collaborators in the didactic courses were: Giulia Santucci (AY 2014-2015, 2015-2016, 2016-2017), Stefano Volante (AY 2015-2016, 2016-2017) and Mauro Zennaro (AY 2012-2013, 2013- 2014).

[4] Visualizations deriving from the world of perception were "increasingly inadequate and tricky, until, with the advent of quantum mechanics, one has understood that they were not only inappropriate, but also conceptually wrong" [Pascolini 2006, p. 140].

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RUBRICS

Readings/Rereadings

Readings/Rereadings

La figurazione dello spazio architettonico by Gaspare De Fiore

Andrea Giordano, Francesco Maggio

La figurazione dello spazio architettonico in art

From 1967, when Gaspare De Fiore published *La figurazione dello spazio architettonico*, to the present day, exactly 50 years have gone by, yet the work retains the same freshness I discovered when I started reading it, for the first time, during our academic education.

Perhaps the secret is to be found in the ultimate spirit of the book, which, as the author states in the introduction: "[…] wants to be just a research proposal of this 'sense of space'" [De Fiore 1967, p. 8]. Or in the wise distribution of the information it holds: the main text is articulated in an elegant, simple and straightforward manner to reach the general public, while the footnotes deepen the problems with a scientific, accurate, and circumspect tone, proposing original critical analyses or comments on the most qualified theories, all complemented by a dense and wide-ranging bibliography on the debated topics.

Affronting the problem of architectural space, De Fiore distinguishes between its ideation and its representation, in particular by addressing the latter from multiple points of view and in a time span that embraces the whole of human history, from preclassic to contemporary art, through the representation of Roman architecture, the conceptual dynamics of the Middle Ages, the optical certainty of the Renaissance and Baroque illusionism. For obvious reasons of chronology, there are no developments after the 1960s concerning perspective. I refer in particular to the influence that the Renaissance rediscovery of Ptolemy's *Geography* might have exerted in this field [Edgerton 1975; Veltman 1980]; to the relationship between the principles of geometric optics and Medieval and Renaissance measurement techniques [Beltrame 1973; Kemp 1978]; to the theory that anticipates the invention of perspective in the thirteenth century by attributing its scientific paternity to Oxford philosophers and the first practical application to Giotto [Raynaud 1988].

However, in De Fiore's book, the main sources of perspective research and its applications to the representation of architectural space are clearly and thoroughly analyzed, paying particular attention to Erwin Panofsky's essential contribution to curvilinear perspective in the classical epoch, as reported in the famous essay *Die Perspektive als 'symbolishe Form'* [Panofsky 1924].

Fig. 1. De Fiore 1967.

But in this analysis there are also the hypotheses of an ancient perspective with the geometric principles 'rediscovered' in the Renaissance [Gioseffi 1957; White 1957], as well as the link between the medieval optical sources and the *perspectiva artificialis* [Parronchi 1958, Federici Vescovini 1965], and, finally, the developments offered by the *anamorphosis* in relation to the dynamic perception of seventeenth-century quadraturism [Baltrušaitis 1955].

De Fiore rightly identifies the first significant pictorial manifestation of architectural space in Roman times, lacking in previous centuries a minimum of representational coherence of space: "In ancient painting, that includes the long period of Paleolithic art up to Romanesque, the main interest of the artist seems to be to represent isolated figures and objects rather than the composition of a scene, and in the case of a scene, action rather than the environment and background" [De Fiore 1967, p. 37]. Having fixed this first point, the book goes into the analysis of the following centuries remarking that the general tendency of the representation of architecture is to move gradually from *conceptual* space to *optical* space (the same adjectives used widely by De Fiore in his work). The representation of architectural space in the Roman epoch is acutely emphasized as: "despite being represented in optical rather than conceptual form, figures and objects are not yet 'interdependent'; their form and size do not depend on the position of a theoretical observer, as will happen in the Renaissance, but conform to the general 'vision' of composition with greater or lesser coherence" [De Fiore 1967, p. 41].

Although in the Middle Ages every interest in the illusion of a real space is lost, triggering a conceptual process of 'flattening' forms that renounce any coherent optical three-dimensionality, the author has not missed the contribution of this historical period in reference to the evolution of architectural space when he emphasizes that: "In Byzantine painting, through the entire medieval period, the principle of the scenic space is developed; the picture plane is divided into two parts: the ground floor (the stage), and the vertical background (the backdrop)" [De Fiore 1967, p. 49]. In Footnote 11 of the chapter entitled *The meaning of architectural space* [De Fiore 1967, p. 14] the revolutionary impact of this conquest of the Middle Ages is implicitly clarified with the comparison between the 'stage set' and the 'spatial box,' the latter transformed by the scientific maturity of the Renaissance into a world beyond the pictorial surface, a universe that is 'alluded'to through the famous Albertian window.

Fig. 2. P. Veronese, The Feast in the House of Levi, Venice, Accademia di Belle Arti (De Fiore 1967, Tav. 18, p. 137).
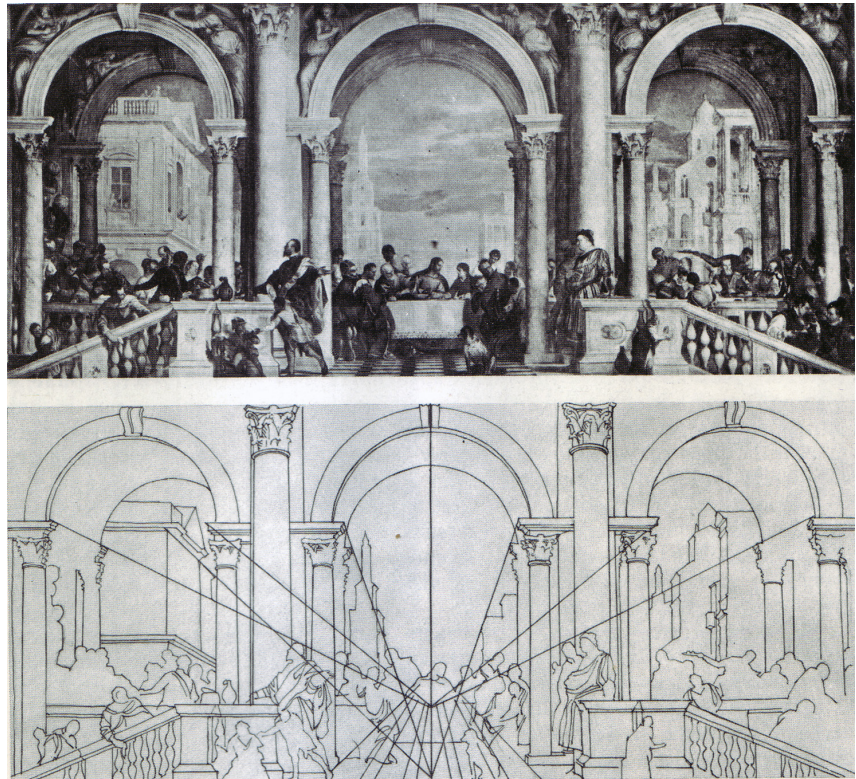
With reference to the representation of architectural space during the Renaissance, and returning to De Fiore's hope to instill new ideas in the field of research, it should be noted that a statement such as: "it is not without significance that the first practical realization and the first theoretical treatise on the representation of space in figurative arts have been made by architects; because it is not so much a matter of inventing a new system to represent spatial depth in paintings or frescoes […]; it is rather a system of unifying space […], to measure it, to make it 'for man', on which the whole world is now measured" [De Fiore 1967, p. 56], he is evidently ahead of the aforementioned positions of Renzo Beltrame and Martin Kemp, who see, in the architects education at the *scuole d'abaco* and, in particular, in the strategies of architectural survey through '*a vista*' measurements, the 'discovery or rediscovery' of perspective in the fifteenth century. However, since the Renaissance and in the following centuries, it is the *perspectiva artificialis* that puts artists and architects in a position to paint and realize architecturally proportionate and optically coherent spaces. As quoted by our author, mathematical, scientific and philosophical discoveries have unmistakable repercussions in the artistic world, obliging the observer, within the represented architectural space, to abandon his original static position in favor of dynamic behavior, especially when he is immersed in the most successful examples of quadraturism. The peak will be in the Baroque age when architecture becomes a representation of itself through solid perspectives, for which De Fiore conjures a particularly happy expression: "perspectives of perspectives" [De Fiore 1967, p. 77].

In *La figurazione dello spazio architettonico* the author moves up to the modern age and, once again, his acute interpretations anticipate the times. Quoting the great historian of French art Pierre Francastel, and in particular the effects of Impressionism analyzed in the work entitled *Peinture et société. Naissance et destruction d'un espace plastique, de la Renaissance au cubisme* [Francastel 1951], De Fiore reconnects the contemporary rupture of the traditional patterns of representation with the: "discovery of new laws that threw the principles of classical science into crisis, transforming philosophical convictions and starting a new dialectic of thought" [De Fiore 1967, p. 82]. The author, then, in the same study lists the 'tools' through which contemporary architectural space is manifested as an optical and conceptual representation at the same time: luminous values; color; photography (to be considered as technological machinery). Therefore, those briefly listed are the same 'tools' that artists today use in their maximum expression to define and to represent space in art. For example, the experiments of James Turrell [De Rosa 2007] and, in particular, the light installations called *Afrum* are 'space boxes' in which the observer is dynamically immersed, relating to three-dimensional objects made by light generated by a projector; only the observer's movement in space reveals the two-dimensional nature of these objects of light. Or even the art-historical citation made by Olafur Eliassion with his *Your Black Horizon*, realized in 2005 for the Venice Biennale on the island of San Lazzaro, an installation in which the observer is forced, in a completely dark 'space box'—recalling a *camera obscura*—, to stare at a horizontal line of intense light that runs around all four walls. The visitor, re-emerging from this sort of 'cavern' into the open lagoon environment, exploits the principle known as 'after image' and unintentionally superimposes the vision of a temporary artificial line on the natural horizon, transforming himself into a kind of entoptic projector [Monteleone 2012].

After 50 years, these anticipations and the scientific rigor in the historic analysis of represented architectural space maintain the validity of this book written by Gaspare De Fiore, a man who is obviously among the first in Italy to have understood how contemporary art continues increasingly to experiment with new possibilities that go far beyond the spatial schemes inaugurated in the Renaissance: "developing in fairly different ways, towards a compromise between imaginary spaces and effective depth, in an experience 'that combines the intrinsic qualities of color with the acute feeling of the enveloping elasticity of the atmosphere'" [De Fiore 1967, p. 89].

La figurazione dello spazio architettonico in architecture

In the volume *La figurazione dello spazio architettonico* Gaspare De Fiore uses painting as a medium for expressing his relationship with architecture. Moreover, the title of the book clearly expresses the author's intentions referring architecture to its 'figuration' throughout history, which almost seems to find a field of unilateral application for the reading of architectural space.

Today reading this volume may probably seem anachronistic, and perhaps it is, but it seems necessary for those who deal with representation and, more specifically, with the history of representation conceived as a subject of study through drawing, and not as a simple *excursus*.

Placing the text in its era is essential for analyzing the relationship between Gaspare De Fiore and architecture and for giving at least one interpretation of the phenomena that produced it. Among them, of course, Bruno Zevi and Giulio Carlo Argan's thoughts, respectively expressed in the volumes *Saper vedere l'architettura* and *Progetto e Destino*, where the 'theorization' of the spatial value, rather than the architectural body in its essence, is the protagonist. According to Zevi, following Giedion's path in Space, Time, Architecture, in fact: "architecture does not derive from a sum of widths, lengths and heights of building elements enclosing space but from void, fenced space, inner space where men walk and live […] the inner space that […] cannot be fully represented in any form, that cannot be learned and lived except by direct experience. It is the protagonist of the architectural fact. Possessing space, knowing how 'to see' it, constitutes the key to understanding buildings. Until we have learned not only to understand it theoretically, but also to apply it as a substantial element in architectural criticism, a history and hence an enjoyment of architecture will only be vaguely granted to us" [Zevi 1948, pp. 22-23].

While Zevi strictly relates interior space to architecture, De Fiore links it to sentiment and to the human spirit. In fact, in the volume, referring to space he comments the painting by Victor Hugo *Ma Destinée*, almost tracing an 'interior' rather than architectural spatiality. As Giedion does, in this short chapter De Fiore finds, in the great space of Paxton's Crystal Palace, an "effect of side-swaying reality" [De Fiore 1967, p. 151] as a value of the inner space; this short chapter highlights the continuous references of the book to painting rather than to architecture. Some interesting statements in the book reveal a "stance" on some historical/critical aspects of architecture, such as when the author intends the Baroque as a continuation rather than a denial of Renaissance classicism. Here De Fiore stands in a clear antithesis with Heinrich Wölfflin who thought that classicism is rigor, order, objectivity, logical synthesis of forms while the Baroque, on the contrary, is freedom, disorder, subjectivity, total synthesis effort and not only logical synthesis. Between the two periods, Wölfflin does not find complementarities but an irreconcilable contrast.

On the other hand, Gaspare De Fiore is closer to the art historian Arnold Hauser, author of the famous *Social History of Art*, according to whom the Baroque is not the opposition of the Renaissance but its natural continuation and completion. According the Hungarian historian there are no 'tears' but a linearity, no irreconcilable points of view, but partial aspects of a single movement aimed at unity and synthesis. And this concordance of thought is clear when De Fiore affirms that: "in the Baroque, unity becomes substantial, and the works, although rich and complex, are also more concise in a vision that nullifies the meaning of individual forms in a wider and uninterrupted breath, towards one effect" [De Fiore 1967, pp. 75-76].

The relationship between De Fiore and architecture is only in the drawing, which being substantial prevails, in the author's view, in any criticism of space. This may now appear reductive in the volume because, for example, when he speaks about Le Corbusier, he merely accompanies the brief chapter of the *Tavole* section, with three photographs of Ronchamp chapel, writing that the drama of architecture is the same as that of man. He omits any reference to spatial values in favor of a 'sentimental' one. Although highlighting the wall-light, space-light, space-sound issues, which can be studied starting from De Fiore's brief considerations, the author makes a summary reflection on the Swiss master. Something that he does not do in the descriptions of Giovanni Michelucci and Pier Luigi Nervi's work, leaving aside, in the *Tavole* section, Pablo Picasso, who, although not being an architect, certainly could have been given more attention by an extraordinary 'draftsman' like Gaspare De Fiore.

His only giving attention to the architecture of the Tuscan architect and the bold constructions of the Ligurian engineer is due to two reasons: firstly, because De Fiore can afford to make value judgments on the two Italian masters since he is not prisoner of an asphyxiating historicism; and secondly, probably because he finds in Michelucci a feeling for space, a theme dear to him, and in Pier Luigi Nervi, engineering as art, even as technique. Gaspare De Fiore finds in Michelucci the figure that combines architecture and town planning conceived as "spatial function that one lives more than one sees" [De Fiore 1967, p. 91].

In fact, Giovanni Michelucci wanted to bring the public/private conflict to a

higher or deeper level of action. At the level of *tout court* space meant as a dimension without adjectives: that dimension was for him the city. In Brunelleschi's lesson, Michelucci states that: "[space], although enclosed and privately owned, has a 'public' aspect, it does not intend to force itself to stay within a perimeter, and becomes one with the outside urban space and surrounding nature. It is 'everyone's' space. Although only one man created it, one feels that that man was gathering the 'hope of the citizens', as Vasari said". So the public space "will be the space dedicated to the free interweaving of communicative relationships […] and the 'private' one will not be a place of private property, but the moment of individual

Fig. 3. G. Michelucci, Church of the Blessed Virgin Mary Our Lady of Consolation, Republic of San Marino. Interior (De Fiore 1967, Tav. 32, p. 165).

gathering (in group life)" [Michelucci, 1972, pp. 64-65].
Describing the viaduct of Corso Francia in Rome by Pier Luigi Nervi, De Fiore 'intercepts' the questions of the architecture of the time. "It is evident that one of the directions of contemporary spatiality seems to be oriented towards a constructive and technical solution before which […] lies the other path that seems to seek in individualism […] the new living space of man, the new architectural dimension" [De Fiore 1957, p. 90].
However, why does the author look at architecture with apparent detachment both in the text and in the *Tavole* section?
De Fiore claims to move away from investigations on contemporaneity, rejecting them because, in his opinion, it is not describable, since: "after the cubist decomposition and the neoplastic and expressionist explosion, one loses the concept of spatial cube, to reach, through the temporal dimension, the concept of a fluid space, suggesting the feeling of contemporary spatiality, not entirely investigated and difficult to define" [De Fiore 1967, p. 17].
Nevertheless, it could not be otherwise. The author published the book when he was 40 years old and he was not an architectural critic or historian. He started his university career in Rome in 1950 as voluntary assistant of Luigi Vagnetti, dealing mainly with real-life drawing, and his attention to architecture was always investigated through drawing, never with the written word, without the expression of a clear judgment of value or even a clear position. Aldo Rossi writes: "From a certain point of my life I considered craft or art as a description of things and of ourselves. For this reason, I have al-

ways admired Dante's *Commedia* that begins when the poet is thirty years old. At the age of thirty, one must complete or start something definitive and deal with one's own training" [Rossi 1990, p. 7].
In this *modus* of approaching architecture, only through drawing, Gaspare De Fiore was always coherent. Even in the last years of his life, he wrote: "Drawing gives me confidence, it reveals the deeper aspects of things and people: truth rather than in objects and people is hidden in vision. The moral aspect of what 'drawing' means intrigues me. Before understanding what drawing means today I am very interested in figuring out what is the meaning of drawing for me, how it 'defines' my life" [De Fiore 2007, p. 7].
This 'moral aspect' is a constant in De Fiore's thought, and in the book is evident when he, raising some questions about the study of architecture and its relationship to history, wonders: "to what extent our means of representation can express contemporary space: not so much architecture, that obviously finds no place in the spatiality of contemporary painting, but just the feeling of space, or rather the crisis of that sentiment, so clearly highlighted by the contrast between technique and art, crucial point of contemporary civilization" [De Fiore 1967, p. 23].
This statement, contained in the chapter *La crisi del nostro tempo*, on the one hand outlines the division between science and art identified by the author, while on the other hand it is a premonition of what would subsequently take place in the relationship between drawing and architecture that De Fiore, in a sense intuited, even if, of course, he could not imagine its impact.

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[*] While sharing the positions expressed in this article, the fruit of joint elaborations, the paragraph "*La figurazione dello spazio architettonico* in art" can be attributed to Andrea Giordano, while the paragraph "*La figurazione dello spazio architettonico* in architecture", to Francesco Maggio.

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Events

Events

Study Days
Fortified Architecture. Survey and Restoration

Antonio Conte

The UID Scientific Committee has granted its patronage and logo for the *Study Days Fortified Architecture. Survey and Restoration* which took place in March of 2016 in Bari, at the Department of Civil Engineering and Architecture (DICAR) of the Polytechnic University of Bari. On behalf of UID, I would like to thank everyone for the work done and for the valuable act of dissemination provided to the entire scientific community and particularly to the education of our young people, starting, for purposes of research or simply for related learning, to construct a knowledge base strongly rooted in a territory of architectural works built specifically as castles for the defense and protection of these places.

The Organizing Committee composed by Valentina Castagnolo, Rossella de Cadilhac, Paolo Perfido, Gabriele Rossi and Domenico Catania, in close collaboration with the Scientific Committee, developed the initiative structured in three days, with guest speakers in the first two days and the third spent in visiting a few castles in Puglia.

The research group 'Architectural Heritage and Historical City' of the Department of Civil Engineering and Architecture of the Polytechnic University of Bari has been conducting research for many years on the theme of fortified architecture, developed in several studies concerning towers and fortified houses, walls and urban defenses, and castles located in the territory of Puglia, with particular attention to the alterations due to the advent of firearms, to transformations into noble palaces, to changes in functions, to the character of types and forms built in close relationship with techniques and materials.

With the two Study Days held at the Polytechnic of Bari, the intention was to open a confrontation between national and international experiences and to reflect on the subject in the field of survey and representation, history, restoration and archaeology.

At the same time as the days dedicated to the speeches of many speakers, a poster show session was set up, in which the latest experiences were compared. Among the publishing and representation activities of the research group of the Polytechnic of Bari with the Scientific Community, the first large volumes of the *Monografie di Rilievo, Architetture barocche di Terra d'Otranto*, edited by Gabriele Rossi, were also presented.

The Scientific Committee also selected five works worthy of mention for their originality and innovative value in the field of survey and representation.

The different sessions organized in communication and knowledge activities introduced different experiences in strategy and theoretical approaches to architecture and were presented with studies of great value on fortified architecture, from Angelo Ambrosi, Paul Arthur, Vincenzo Cazzato to Giovanni Carbonara. The session on general approach issues and on survey and representation methods for fortified architectural structures displayed the different cultural positions that in a different form are the product of our Schools of Architecture, from Riccardo Florio, Giovanna Massari, Carla Amici, Valentina Castagnolo, Paolo Perfido, to Gabriele Rossi and many others.

The session that developed the theme of restoration and valorization certainly received, due to its wide-spread wealth of issues and case studies, considerable interest and stimulated deep criticalities that today represent some theoretical results with advancement of research and interest of national and international importance. In this regard, I would mention the vigorous contribution of Vito Cardone, *Survey and Restoration*, at the conference International Speeches. Castles and Fortified Cities held in Pisa in 2001.

It is clear to our community that these relationships between the world of

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representation, of history and of restoration are strong cultural ties with deep roots, and the results and scientific advances of one part support the others in a continuous exchange of growth, position and critical review. These knowledge and integration processes become more apparent when dealing with the theme of fortified architecture, that contains them authentically in the complex forms of the building effort. The history and archaeology session contributed, with several essays and through descriptions and representations, to enlarge the knowledge of numerous cities and fortifications of the middle and southern Adriatic area with documentary sources and research prospects of extreme interest.

Those who did not participate and would like to know more about the contributions presented by the speakers should wait for the publication of the proceedings of the conference which, in any case, will not contain the richness of the debate and of the speeches that took place with the freshness and lucidity of oral contributions.

Certainly, the study days, developed with a seminar-like structure, made it possible to trace a possible course of a collective work of the Polytechnic that is rooted in a teaching and research organization that in the dimension of building, precisely in the materials and in the stone of these places, finds its set of rules.

The research group thus defined an ideal perimeter within which to specify methods and theoretical approaches for understanding the close relationships between documentation, survey and representation technique, between science, technique and experience and between construction and

technologies that have been improved throughout history. This history is for us a dense web in which to recognize not only the rules, the principles, the regimes and the rationality of these examples that were dealt with in the speeches and systematized in reasoning and projects, but also the dense network that Federico II and others, here in these places, have delineated over time.

The fortified dimension and the image of this territory, of a city or architecture is always defined by different values, parameters and economies, by successive stratifications, collective memories that fix the defensive or protective peculiarities and, at the same time, establish the constructive features that in history have specified qualities and vocations. In some cases, special conditions or vocations overwhelm others; it is cer-

Fig. 1. Study Days. Fortified Architecture. Survey and Restoration. Program cover.
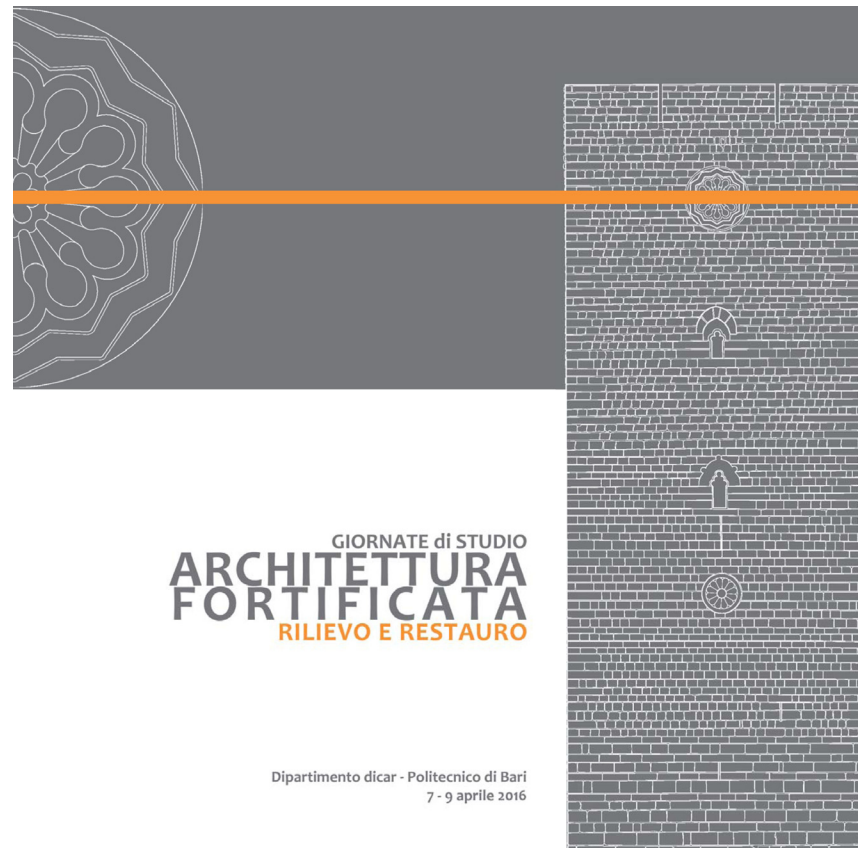
tain that, in both the cases of Puglia and Basilicata, the layout and design of fortifications left a strong sign and a still-important history, rich in connotative elements of the landscape. The entire region is covered by a network of small and large defenses, towers and fortifications that in the past played a role of control and power over the territory, and that today stand as historical and symbolic references within urban areas and the territorial landscape context.

These artifacts, belonging to different ages, are presented as historical and symbolic references, within urban areas and in a territorial context involving the neighboring regions, from the Adriatic to the Tyrrhenian sea.

The sense of this meeting and the development of multiple works of research and documentation aim to define a kind of small or partial atlas, a path of knowledge that gives us a still partially unknown heritage to be protected, valorized, restored and recovered.

The survey, from simple to complex measurement activities, that is, scanners and drones, is the first necessary step for a correct restoration and preservation hypothesis.

Philological analysis supports archival research, surveys and historical iconographies, becoming an important moment in the study representing the premise for new investigations, some skillfully exhibited with the use of new digital tools that have deeply investigated materials and technical and building technologies.

For others, the theme of fortified architecture was a pretext for more general considerations on survey, the interpretation of artifacts, the interpretations of history, as well as the applied methodologies and survey tools. Speeches were related to several complex constructions such as fortifications, castles, towers and wall systems that, starting from historical necessities, summarize in themselves elements of urban complexity. The examples enclosed a plurality of meanings and functions ranging from defense to residence, to communal spaces and spaces for administrative life, which do not coincide with a single formal idea and are compared to very different architectural types and models, taken from treatises to modern manuals.

In some researches, through deep analysis, parts and elements characterizing these fortified structures have been identified: walls, bastions, towers, walkways, crenellations, gates, entrances, moats, drawbridges, courtyards, terraces and scarp walls. These artifacts have often undergone changes to the norms and to the military principles with variations, at times of great complexity, that tend to distinguish and make them a component of the place and the city, and not separated from them.

Puglia and Basilicata are 'lands of castles,' small defensive structures located within a vast territory, and there is no city or small urban agglomeration that does not have, inside or in the immediate vicinity, a small or large castle even though today it is a simple ruin or toponym. The walls mark the permanence of a defensible urban form and define the historical limit between city and countryside.

This complex account of the memory of architectural and landscape heritage during those study days has enabled us to acquire tools for 'observing' these places with greater sensitivity and analytical spirit and with the consciousness of the value they also possess, intrinsically, for widening the spiritual dimension of the knowledge of our history.

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Events

Disegno, Memoria, Progetto

Edoardo Dotto

As part of the events for the 210th anniversary of the foundation of the University of Palermo, on December 2, 2016, the exhibition *Disegno, Memoria, Progetto* was inaugurated, in which the graphic and multimedia elaborations of the courses and researches of the Drawing area of the Department of Architecture of Palermo were shown. The event, curated by Vincenza Garofalo and Francesco Maggio with the scientific responsibility of Nunzio Marsiglia, has been elegantly set up at the exhibition hall of the former Faculty of Architecture in Viale delle Scienze. The inauguration of the exhibition was an occasion for a common reflection, which, after institutional greetings, provided for an introductory speech by Nunzio Marsiglia, followed by the views of the president of UID Vito Cardone, Francesca Fatta and me.
The exhibition–as Nunzio Marsiglia recalled in his introductory speech–documented the ways and forms in which, as part of their didactic activity, a group of faculty members in the Representation area declined discipline in its diverse and complex facets within the Department of Architecture of Palermo. Exposed works are produced in the course of a thesis, a doctoral degree, or even just as

a course practice, and are characterized not only by the high quality of the research carried out, but also by the variety of themes faced and the expressive property of the media used. They range from traditional plates, monitor animations to video clips.
In the graduation thesis proposed by Fabrizio Agnello, complex historical architectures such as the Ajutamicristo palace, the Palatine Chapel or the Cathedral are investigated, founding each reflection on documentary data and on rigorous surveys as substantive basis for carrying out research and exercising critical acumen, ending up to the original configurations of the monuments investigated through a 'graphic reflection' on their constructive events, always using an appropriate and effective graphic language. Of great interest is the extract from the PhD thesis by the young scholar Mirco Cannella on the analysis of the Palatine Chapel. In the other two theses, the applications in the BIM environment and the parametric modeling with the Grasshopper plugin are investigated with methodological clarity.
The theses curated by Francesco Maggio, many of which, with the collaboration of Starlight Vattano, relate

to unbuilt, demolished or strongly modified architectures, largely related to ongoing research on the little-known activity of female architects during the twentieth century. Starting from a scrupulous attention to archive documents, sometimes rare and obscure, using three-dimensional modeling, architectures are reconstructed with philological exactness and presented with elegant monochrome renders where the expressive matrix combines with conscious choices of graphic abstraction as it can be especially appreciated in the work dedicated to the house in Cefalù by Luciana Natoli. A similar section consisting of elegant graphical surveys, made with 'ruler and square', drawn by students of the first year of the Laboratorio di disegno e rilievo dell'architettura held by Francesco Maggio in the Master Degree course in Architecture accompanied these works.
The degree theses proposed by Nunzio Marsiglia show a series of analytical drawing applications that, starting in some cases from surveys, in other ones from project drawings or the iconographic heritage produced by *Grand Tour* travelers, propose unpublished readings of existing or unbuilt works. Particularly remarkable are

Fig. 1. *The Great Coffee of Giuseppe Damiani Almeyda, rendering of the interior space. Degree thesis by G. Di Bartolo, supervisor prof. F. Avella.*

Fig. 2. *Reconstruction of the natural lighting of the Palatine Chapel before the 16th century. PhD thesis by M. Cannella, tutor prof. F. Agnello.*

the elaborations of Giuseppe Caronia's unbuilt project for the Faculty of Architecture in Palermo or the conjectural reconstruction of the Garden of Ventimiglia in Castelbuono, which is no longer recognizable.

In the works proposed by Fabrizio Avella, in addition to a series of careful three-dimensional reconstructions of architectures, objects of common use and complex geometric systems, some unbuilt architectures by Giuseppe Damiani Almeyda are explored and reconstructed with philological attention starting from the analytical study of original drawings and presented through complex images that often perform the fusion of elegant photorealistic views and sketch drawings, wisely mixing graphic abstraction and rendering. A refined elaboration of the *Ginnasio dell'Orto Botanico di Palermo* is the result of a collaboration with Erasmus students. The student's elaborates proposed by Francesco Di Paola clearly explore the geometric structures of contemporary architectures, using the different methods of representation or, in the case of a degree thesis, parametric modeling. Other studies include the digital survey and the graphic analysis of small scenographic panel of the late 17th century oratory of San Lorenzo, made by Giacomo Serpotta. The works presented by Gianmarco Girgenti concern in particular a series of virtual reconfigurations at urban scale of the city of Palermo, among which are the reconstructions of the Conceria district and the representation of Piazza San Domenico before the overthrow of via Roma, based on historical and iconographic research. Balanced use of digital tools allows to always configure a wide variety of graphic languages, from traditional
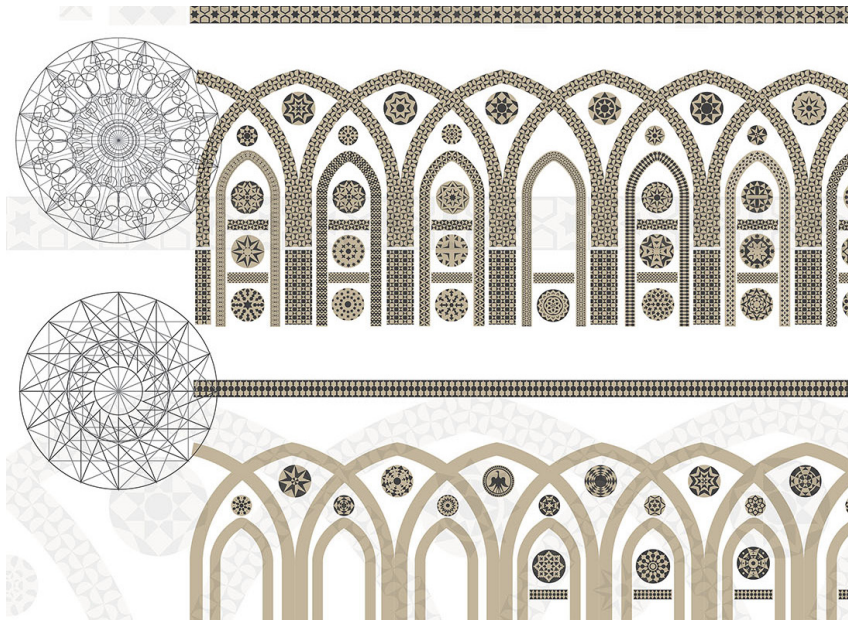
Fig. 3. Geometric decoration of the inlays of the apses of the Cathedral of Monreale. Degree thesis by F. Villanti, supervisor prof. V. Garofalo.
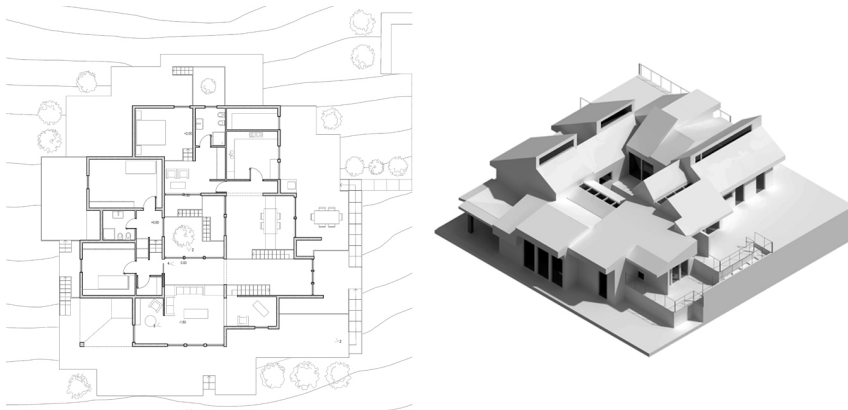

Fig. 4. Graphic reconstruction of the project by Luciana Natoli for the House in Cefalù. Degree thesis by E. Gelardi, supervisor prof. F. Maggio.

hypo-axonometric cross sections to photorealistic renders.

Vincenza Garofalo presented some degree theses concerning the graphical analysis of the polychrome tarsies of the apses and columns of some Norman monuments (the Cathedral of Monreale, the Cathedral of Palermo) outlining, after an accurate survey, the geometric matrices and showing the way of tracing with the help of sober and effective video clips. She also presented a proposal for the innovative use of the Church of San Cataldo through a videomapping project. Of great interest is the analytical study on the drawings of Theo van Doesburg's *Maison Particulière*, in which, from the cryptic drawings of the master, she is able to completely construct the three-dimensional model.

The exhibited materials make it clear that, at the Department of Architecture in Palermo, didactics and research, sometimes considered irreconcilable, can go the same way and how, in quality works where enthusiasm and rigor proceed step by step, they can support each other. Another common feature of the work is the naturalness with which the most advanced application methods are linked to the theoretical and methodological foundations of discipline. As Nunzio Marsiglia recalls in the introduction to the exhibition, the question of replacing traditional graphic techniques with the operating practice supported by the most up-to-date computer equipment has in the past stimulated "a lively debate among scholars in the area, a sort of *querelle des Anciens et des Modernes*, which often, until a few years ago, animated numerous symposia and conventions. […] One of the pos-
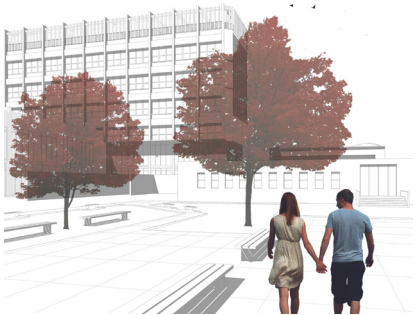
Fig. 5. *Graphic reconstruction of the project for the Faculty of Architecture of Palermo by G. Caronia. Degree thesis of S. Calia, supervisor prof. N. Marsiglia.*

Fig. 6. *Graphic-geometric analysis of the tile "San Francesco wears a poor man" by G. Serpotta. Research directed by Proff. F. Di Paola, S. Barba, G. Rizzo.*
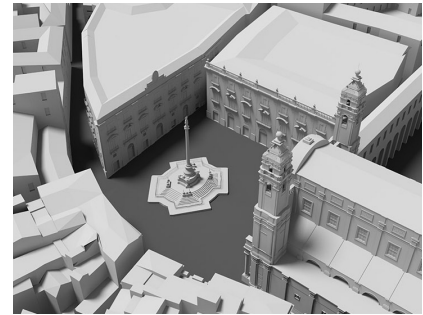

Fig. 7. *Reconstruction of the original space of Piazza San Domenico in Palermo. Research coordinated by Prof. G. Girgenti: PhD thesis by G. Campanella, degree thesis by G. Passafiume.*

sible responses at this time of transition and identity crisis is to look for critical use of new tools and is to be found in the work of many professors of the Department of Architecture in Palermo Architecture Department, in particular, in the critical use of new tools that allows for a more in-depth study of architectural geometric and morphological studies, superior to that derived from the use of traditional instruments."

This exhibition makes us consider the solidity and vivacity of the School of Palermo, which has been crossed over the past decades, as is well known, by the presence of a large group of scholars and masters of unquestioned carature, among others Luigi Vagnetti, Gaspare De Fiore, Vittorio Ugo, Margherita De Simone, Rosalia La Franca and Giuseppe Pagnano. Some of them have been attending the seat only for a limited period, some passing, others spend-

ing in Palermo their whole life. In any case, through their commitment and knowledge transmitted to motivated scholars, they left their own fingerprints, whose synthesis formed the complex identity of this group, even if their research tended to engage many students and colleagues as Margherita De Simone or Rosalia La Franca did, and when their work was based on a more autonomous path, such as in the case of Vittorio Ugo. Palermo's headquarters promoted extraordinary occasions of confrontation in particularly intense periods of the construction of disciplinary identity, as in the mid-1980s, when the methodological arsenal of the area was largely re-established, in the period when the annual meeting with Seminari di Primavera was rooted. In the early 1990s, extraordinary opportunities for verification and sharing were built, such as the Gibellina Seminar of 1994, which allowed a

whole range of young researchers to interweave their research paths and to address specific issues through drawing practice. The headquarters of Palermo has also been the protagonist of disciplinary PhD research fellowships since the first cycle and, together with other prestigious venues, has characterized thematic and methodological researches that have fueled the training of teachers who are still profitable academic professors throughout Italy.

Such a wealth of knowledge has continued to produce its fruits to this day. The professors of the Department of Architecture in Palermo, with this exhibition, reveal how solid the bond between their past and present is. Their autonomy and lucidity with which they interpret the latest intellectual challenges posed by the disciplines of Representation by exploring new paths is the best tribute they can make to their masters.

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Events

The third mission experience of the UID at the *Restauro-Musei* Trade Show of Ferrara

Federico Ferrari

Dialog with society represents the new mission that the University is facing and taking charge of. Greater openness and interaction with the socio-economic context through the exploitation of research results and the transfer of knowledge is what is required at Universities: a new objective that stands beside those of higher education and scientific research. In fact, the term 'third mission' is used with increasing frequency and sometimes with confusion or ambiguity when used to describe many of the activities that bring into direct relation universities, society and the economic and productive context. The 'third mission' is describable in its twofold objective, that of technological transfer and interaction between the world of research, society and the productive environment, named by ANVUR the 'third cultural and social mission,' that is, all activities having cultural, social, educational content, including the development of civil awareness. The concept of 'third mission,' introduced in 1963 by Prof. Clark Kerr during a lesson at Harvard with the neologism 'Multiversity,' defines the University as a community capable of serving society also with a view to its industrial, cultural, political aspects and thus capable of responding to a society which is becoming increasingly integrated in the choices and in the definition of the processes of

'technological enabling' for their own developmental strategies. The Community document, *Innovation in a knowledge-driven economy*, ratified in 2000, establishes at the level of the European Union this new commitment of Universities "in addition to their traditional roles in education and research, universities should develop a third mission: promoting the diffusion of knowledge and technologies, especially towards their local business environment" [European Commission 2000, p. 22].
The UID-Italian Union for Drawing has been active and directly committed for several years on the theme of 'third mission' and in the last three years, the *Restauro-Musei* Trade Show of Ferrara has become the place where exhibition spaces, conferences and seminars find a context in which these goals can be expressed. In 2015, during the XXII edition of the exhibition, the UID presented 100 national and 100 international experiences linked to survey in all its forms—from architectural and archaeological survey to urban and environmental survey—within the event *Italian Survey & International Experience. National & international portfolio*; activities presented at the XXXVI International Meeting of Teachers of Representation Disciplines held in Parma in 2014. In 2016 the UID was present, especially in the context

of promotion of cultural heritage, with specific case studies dealing with museums, conservation and representation. In 2017, at the XXIV *Restauro-Musei* Trade Show of Ferrara, the UID expanded its presence, in which the disciplines of survey and representation dealt with the broad topic of communication, enjoyment, exploitation, conservation of historic places, investigating the opportunities offered by the new integrated technologies, also presenting a series of case studies focused on the theme of museums and the conservation and enhancement of historic centers. On the opening day of the exhibition, Wednesday, March 22nd, the conference *Between real and virtual. Investigation and knowledge of the cultural heritage in the Virtual Museum 2.0* presented case studies in which the science of representation, declined precisely in the theme of museums, becomes central for the development of innovative applications of research and of operational achievements: from the museum at the scale of the historic town, up to the relationship with aspects of digital documentation for the exploitation, development, dissemination and communication of cultural heritage. The various speeches, introduced by Mario Centofanti after the greetings of the president, Vito Cardone, and moderated by Marcello Balzani, cov-

ered all the themes of the area as well as the contamination between universities, productive reality, social implications and didactic activities. Francesca Fatta (*Mediterranean* University of Reggio Calabria) illustrated the *Tools and Techniques of survey and prototyping for an interactive museum. Some examples in Reggio Calabria and Lipari*; Andrea Casale (Sapienza University of Rome) presented the project for the *MUVAT_Amatrice. The prototype for the Virtual Museum of cultural heritage and the community of Amatrice*; while Anna Marotta and Elena Marchis (Polytechnic University of Turin) introduced the theme of platforms and virtual reality with a speech on *The Citadel of Alexandria in the European network, in the virtual network,* followed by the presentation of Alberto Sdegno (University of Trieste) entitled *For a haptic museum: the tactile sculptures of the character heads by Franz Xaver Messerschmidt.* Elena Ippoliti (Sapienza University of Rome) closed the conference with a synthesis regarding the latest issue of DisegnareCon 17 (2016) entitled *Virtual Museums. Communication and/is Representation.*

The exhibition space at Pavilion 2, realized by the team from the representation area of the Department of Architecture of Ferrara, is configured as a container element for the different experiences of the UID and of the ICAR/17 area, at a national and international level, so as to become a hybrid element for the communication of 360° research.

Experiences relating to historic centers were presented to the public of the *Restauro-Musei* Trade Show which spotlighted experiences on the safety of cultural heritage, on survey in emergency situations, on the methodologies aimed at the protection and conservation of cultural heritage. There were thirty-nine digitally-exhibited projects, eighteen Universities (University of L'Aquila, Uni-

versity of Cagliari, University of Catania, University of Florence, Marche Polytechnic University, *Mediterranean* University of Reggio Calabria, University of Naples 'Federico II', Second University of Naples, University of Padua, University of Parma, University of Pavia, University of Pisa, University of Rome Tor Vergata, University of Salerno, Polytechnic University of Turin, the International Tele-

matic University Uninettuno, University of Urbino 'Carlo Bo', IUAV University of Venice) and the scholars involved were over one hundred and fifty.

The exhibition space was also strategic for promoting the 39th International Meeting of Teachers of Representation Disciplines in conjunction with the XIV Congress of the UID of Naples (2017, September 14-16) entitled *Ter-*

Fig. 1. In 2015, survey experiences were presented in the UID exhibition area during the event Italian Survey & International Experience. National & international portfolio.

Fig. 2. In 2016, case studies on the subject of museums, conservation and representation were presented in the UID exhibition area.

ritories and Frontiers of Representation. In relation to museum topics, the videos related to the case studies of the conference presented at the exhibition *Between real and virtual. Investigation and knowledge of the cultural heritage in the Virtual Museum 2.0* were displayed, as well as an interactive animation for the vision/consultation of the issue of DisegnareCon 17 (2016) entitled *Virtual Museums. Communication and/is Representation* edited by Elena Ippoliti and Piero Albisinni.

In addition, always relating to the 'third mission,' the Technical Scientific Committee of the UID decided to give visibility to the contents of the researches of the young doctors of the area by organizing a space dedicated to the PhD theses awarded or

mentioned with the 'Gaspare de Fiore' Silver Plaque, theses inherent to the ICAR/17 Drawing scientific-disciplinary sector presenting particularly relevant results. Six theses were selected for the years 2014, 2015, 2016 linked to the main themes characterizing the *Restauro-Musei* Trade Show:

- Michela Ardito (Sapienza University of Rome). *Modelli navigabili per la comunicazione dei Beni Culturali. Il disegno di progetto del "quadrato piacentiniano" della Città Universitaria di Roma.* Tutors: E. Ippoliti, A. Casale;
- Francesca Porfiri (Sapienza University of Rome). *Prospettive illusorie nei cortili di palazzi storici: analisi, interpretazione e valorizzazione. Il fondale scenografico dipinto da Antonio Galli Bibiena a Bologna.* Tutors: E. Chiavoni, L. Carlevaris;

- Stefano Giannetti (University of Florence). *Analisi sistemica di un processo creativo medievale. Il Duomo di Sansepolcro e San Francesco ad Arezzo.* Tutor: M. Teresa Bartoli;
- Matteo Flavio Mancini (Sapienza University of Rome). *Ragione e intuizione nell'illusionismo prospettico.* Tutors: L. De Carlo, R. Migliari;
- Floriana Papa (Sapienza University of Rome). *Il sistema ferroviario come bene culturale. Il caso della stazione di Latina, già Littoria. "Dal cucchiaio alla città."* Tutors: C. Cundari, M. Martone;
- Alessio Bortot (University of Venice – IUAV). *Emmanuel Maignan e Francesco Borromini. Il progetto di una villa scientifica nella Roma barocca del XVII.* Tutor: A. De Rosa.

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Events

Uniscape En-Route Seminars

Paola Puma

In 2016 the *Uniscape En-Route Seminars*, whose V edition was represented by the successful *Landscape & Archeology* conference, was held again in Italy; the conference has been promoted by the Centro Studi Vitruviani in Fano in collaboration with Università Politecnica delle Marche in Ancona, Uniscape, Università degli Studi di Urbino, Distretto Culturale Evoluto *Flaminia Next One* and the Municipalities of Fano, Fossombrone and Cagli [1].

The travelling feature of *Uniscape Seminars* has found along the via Flaminia– during the conference it was possible to appreciate how the most important of the Roman consular roads for the technical solutions that came to us in the bridges and in the structures was– the happy occasion to welcome from 23rd to 25th of June 2016 a profound thought on the many meanings that landscape takes in contemporary European culture when it relates to archeology, one of its most important constituent and identity imprints [2] about the comparison of multiple readings of intertwining between *Archeology, Landscapes, Contemporary Places* (Andreina Ricci's opening report, from Università degli Studi di Roma 'Tor Vergata'). Her speech has contextualized the main issues that contribute to defining the thematic field of the conference:

from the lexicon (which differentiates, in particular, the meaning of cultural heritage used in Italy from that used in France in relation to which parts of the landscape must be recognized the inheritance and the value of 'heritage') to the relationship between *heritage* and *landscape* (often only conflicting because of the unbalanced and restrictive assumptions taken over the decades) and the question of project (often set without exploring the infinite possibilities we have to explain and deploy the contemporary spirit in archaeological ruins and predominantly reduced to the only choice between the 'contrast'–the reuse of modern buildings or industrial archeology 'furnished' with ancient remains–, and the reuse of buildings or archaeological complexes without verifying the real sustainability of the work).

The problematic relationship between the remains of the past and their contemporary location (both in urban and rural landscapes) has come into the everydayness of the many design solutions practiced everywhere but is also the subject of easy slogans that have contributed to endanger the cultural heritage management system in our country.

The theoretical dimension of the aforementioned issues has neverthe-

less been carried out in continuity with a propositive line drawn by reorienting conservation to a series of items: from the responsibility of co-planning (involving archaeologists even after excavations), to a careful project (that provides the steps for the quality identification, not univocal or time-consuming, that contexts must safeguard), to the renewed role, finally, it must be entrusted with preventative archeology to bring it away from the distortions of the past and to avoid the many open wounds left in the territory by conflicts between archeology and environment.

Five rich sessions of speeches and posters–articulated in four main topics and carried out in the perfect location of the theater of Fortune in Fano, the church of San Filippo in Fossombrone and the Municipal theater of Cagli–accompanied the 80 participants in the discussion of the 30 communications and 45 posters centered on the landscaped continuum leaved over the centuries by archeology.

The focus of the first session, chairman Paolo Clini, was archeology intended as a deposition of knowledge through the developing of the documentary heritage of digital surveys and 3D reconstructions for virtual archeology and AR for the interpretation, monitoring,

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conservation and spreading of archae-
ological remains (Topic 2-Archeology
and digital documentation); the spe-
cial issue of *SCIRES, SCIentific RESearch
and Information Technology* (Vol. 6, No.
2/2016) hosts 13 selected papers from
this conference theme.
*From planning to valorization of wide-
spread heritage: co-design and virtual
museums* (Sofia Pescarin, Cnr-Itabc)
is the keynote speech that has devel-
oped the theme under the point of
view of the archeology landscape as a
key factor for the development of local
economies: from rural tourism to the
'landscape in action' of eco-museums
and participatory processes (Topic
1-*Smart Landscape*).
But Archeology today also goes to
the form of a true 'heritage indus-
try' of industrial archeology of road
infrastructures and 'knowledge indus-
try' by the enhancement of religious,
gastronomic, historical routes. (Topic
3-*Smart Industrial Archeology*): the
topic was introduced by the keynote
speech *Places-People-Technology Chal-
lenge: Connections and intersections
between public open space and digital
technologies-Cyber park as a smart
public space*, of Carlos Smaniotto
Costa (Universidade Lusófona, Lis-
boa). The speech has debated the
concept of Cyber park both as an
advanced facility of livable urban pub-
lic spaces (by locals and tourists) and
as an inevitable tool for obtaining the
data needed for proper design of en-
vironments. On one side, ICT is, in fact,
the element of relationship (which no
longer has technology as an added el-
ement, but as intrinsic one) between
people and environment and on the
other one is an important factor in
project enhancement and, above all,
of social inclusion promoted from
citizen participation in the develop-

Fig. 1. The conference's session in the Church of San Filippo in Fossombrone.

Fig. 2. The visit to the Forum Sempronii Archaeological Park in Fossombrone.

ing of information platforms assumed as foundation of the decision-making processes of the institutions.

The via Flaminia in the Marche. An archaeological itinerary (Mario Pagano, Soprintendenza archeologica delle Marche) is the speech that opens to the vision of economic strategy, but it is also a report of the experience already under way that sees the Marche, with projects *Flaminia Nextone* and *GAL Montefeltro and Barco Officina Creativa*, as the leading region about the transformation of the model from 'industrial district' into 'evolved cultural district' (Topic 4-*Sustainable heritage enhancement and cultural districts*).

The paper *Integrated strategies for the promotion and communication of widespread cultural heritage: a pilot project in the Distretto Culturale Evoluto Flaminia Nextone* (by Giulia Crinelli, Paolo Clini, Ramona Quattrini, Francesco Leoni) illustrates a project of valorization of the hidden heritage existing along via Flaminia, between the Passo Scheggia and Fano, for the establishment of a widespread museum that reveals the many tangible and intangible values often obscured by vegetation, the lack of maintenance or, even worse, obliterated by the modernization of road infrastructures.

In order to activate the design process of a structure that promotes sustainable forms of tourism, after the first phase of surveys and 2D and 3D representations , 4 focal points of the museum have been identified, among which the Ponte Mallio in Cagli represents the access to the system, reinforced by a coordinated image system that uses the shape of the stones that paved the consular road and including the logo, the app, the signage and the website.

In the 63 essays published on *Careggi Papers/UNISCAPE En Route No. 4, Landscape and Archeology* can be traced the development of communications and posters. All the 30 speeches have been reviewed to confer the best paper award to *Achieving Impact: benefits gained by both archaeologists and the communities in whose landscape they work*, by Patricia Duff.

The speech focuses on the need to find tools to look at the activities that revolve around archeology (from the excavation phase to the archaeological museum and to tourist enjoyment) as a real factor in cultural, economic and social development and promotion. In this premise, the lecture has presented the experience of the ArchaeoLink group, born at the University of Cambridge to create a structure of facilitation among archaeologists and communities where they work and accompany them in stakeholders engagement paths. Three case studies have carried out as a successful example of achieving the goal of trans-

forming on a positive impact on local populations, interventions on the cultural heritage and historical landscapes of Eleusi in Greece, Troina in Sicily, Vela Luka in Croatia.

Finally, the mention of the best poster, given to *Archeology/Landscape: a double-reciprocal influence*, by Giovanna A. Massari and Martina Tava: through the perceptual geometry that comes from the theory set up by Kevin Lynch we can also read the natural landscape, by giving to the settlements the role of nodes and references, to the lines the role of paths and margins, while the surfaces are territorial complexes that sometimes follow slow rhythms, sometimes undergoing dynamic accelerations that we can now effectively represent with the digital graphics techniques and virtual modeling in 4D. The techniques of digital representation, in fact, allow to highlight in space and time the indissoluble links between landscape morphology and anthropic forms of archaeological settlements.

The case study, made up of the spectacular castle of San Gottardo in Mezzocorona (Trento, Italy), shows exemplarily how the complex, while still in critical conditions of conservation, preserves intact its powerful reference role of the landscape around where the lines-roads and the areas-settlements from which it can be perceived gravitate on.

Notes

[1] The conference was held with the patronage of UID (Unione Italiana per il Disegno); CEIT (Centro Euromediterraneo di Innovazione Tecnologica per I Beni Culturali e Ambientali e la Biomedicina); TICCIH (The International Committee for the Conservation of the Industrial Heritage).

[2] The program was developed in Fano for the opening session, some excursions at the Riserva Naturale Statale Gola del Furlo in Fermignano and at the structures of Ponte Mallio in Cagli and the social dinner at the Rocca Malatestiana in Fossombrone during the second day; the closing conference took place in Cagli.

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Events

Recent Italian Events on BIM

Alberto Sdegno

In the last few years, several important events related to BIM have taken place in Italy. As known, BIM is the acronym of Building Information Modeling, a work system for structuring information during the process of building design. Professional associations as well as the academic world have been exploring its potentialities, with an aim to upgrading study programs, or as a new field of work to be developed in scientific research.

It should be remembered that BIM is the result of a long experimentation that, although it has been defined in detail only in the last decade, lays its foundations between the 1960s and 1970s. Among the most active researchers in this field, Charles Eastman [1] is certainly to be counted: starting from the 1970s, he has had a number of significant results that have led to today's information management system.

We have to remember, however, that the BIM should not be considered only as an advanced representation tool of a three-dimensional model. In fact, this data system requires several agents to work in close relationship with one another, to share information: the designer, the draftsman, the structural engineer, the technologist, the plant engineer, but also the customer, the firm and the builders, including the people who will be dealing with the future maintenance of the building.

In the debate on BIM, Italy currently occupies a marginal position, as few professional studios have adopted this protocol. England and the United States, for years, have adopted technical codes based on specific requests from their respective institutional bodies in order to improve the quality of work associated with the construction world, but also to have a general reduction of construction costs. In general, all Europe is gradually starting to adopt the standards set by BIM, while a certain delay is reported in South America and in the Asian countries.

This wide range of professionalism enables a good public participation in events organized on this subject, accompanied by an ever-expanding group of students involved.

Among the first initiatives, the *Modellazione 3D e BIM* (3D Modeling and BIM) Conference on May 8-9, 2015, organized by the Faculty of Architecture of the Sapienza University of Rome, must be remembered, which has been replicated in the following years. The first day, dedicated to many topics related to advanced processing (from modeling to image management to 3D printing), dealt with the creation of specific workshops for architecture and design, graphics and animation, engineering and prototyping, while the second day focused on the specific themes of BIM.

After about one year (April 21-22, 2016), Sapienza University organized a second edition, entitled *3D Modeling & BIM - Applicazioni e possibili sviluppi futuri* (3D Modeling & BIM - Applications and possible future developments), with a remarkable increase both in the number of participants, and academics from various Italian universities, and in terms of contents and experiences. This is documented by the book (in Italian and English) edited by Tommaso Empler [2]–the organizer of the event–gathering together all the papers and further contributions to the themes of the initiative in more than 600 pages. Papers include those by Jean Pierre Monclin on the experience of moka-studio; by Massimiliano Lo Turco on the theme of the definition of a national protocol; by Antonella di Luggo on the relations between Heritage and BIM for knowledge and management of cultural heritage; and Carlo Bianchini's work on the possible relationships between 3D acquisition, modeling and BIM.

In 2016 we had two more contribu-

Fig. 1. Screenshot of the website of the scientific journal DisegnareCon, No. 16, 2016, dedicated to BIM dimensions.

tions to BIM that need to be mentioned: the Issue No.16 of the online journal DisegnareCon [3] directed by Mario Centofanti on 'B.I.M. Dimensions,' containing eighteen essays and the afterword of the editors Roberto Mingucci, Stefano Brusaporci and Stefano Cinti Luciani; and the BIM debate day entitled *Brainstorming the BIM model*, organized by the Polytechnic University of Milan on November 25th and moderated by Cecilia Bolognesi. In the first case, network publishing enabled experiences to be shared widely, as the texts were published in both Italian and English, while the single day debate allowed reflection on similar topics, comparing activities and optimizing logical processes connected to Building Information Modeling.

In both cases, contributions were often centered on the relationship with the existing architectural fabric and the use of new BIM technologies to enhance knowledge of heritage. This twofold concern was addressed at the meeting at the Polytechnic, which was organized into two separate sections, namely: *Il modello BIM e l'antico* (The BIM model and the ancient model) with essays by Carlo Bianchini, Fabrizio Apollonio, Raffaella Brumana, Stefano Brusaporci, Andrea Giordano, Paolo Borin, Tommaso Empler, Cettina Santagati; and *Il modello BIM ed il progetto per le nuove costruzioni* (The BIM model and the project for new constructions) with essays by Giovanni Chiabrando, Anna Osello, Graziano Mario Valenti, Massimiliano

Lo Turco and Maurizio Bocconcino, Carlo Zanchetta, Salvatore Barba, Vincenzo Donato and Cecilia Bolognesi. The introduction by Stefano Della Torre, Rossella Salerno and Vito Cardone set the general terms of the discussion, and reflections by Livio Sacchi, Cristiana Achille, Andrea Rolando, Angelo Ciribini and Claudio Vittori Antisari, on activities in earthquake areas, of great relevance, brought the topic to the dramatic present of the recent devastating earthquake in Central Italy.

Before the start of the third edition of the yearly BIM meeting at the Sapienza University of Rome, held in April 2017, another event devoted to these themes attracted the interest of professionals and students, entitled *BIM e HBIM tra ricerca e professione: esperienze scientifiche*, (BIM and HBIM between research and profession: scientific experiences) organized on March 6, 2017 in Bastia Umbra by the University of Perugia within the Expo-Casa fair. The event was presented by Paolo Belardi and chaired by Valeria Menchetelli, with the participation of Simone Monotti, president of the Federazione degli Ordini degli Ingegneri dell'Umbria (Federation of the Orders of Engineers in the Umbria Region)–who organized the meeting together with the 'Pietro Vannucci' Academy of Fine Arts of Perugia–and Vito Cardone, president of the Unione Italiana per il Disegno (Italian Union for Drawing). The session was attended by scholars and academics who presented the state of the art of their experiments in the field.

The topics of the seminar were: the digitization of built heritage (Simone Garagnani); BIM as a support in the innovation of the building process (Mar-

Fig. 2. *Image of the third edition of the workshop 3D Modeling & BIM, Sapienza Università di Roma, April 19-20, 2017.*

cello Balzani, Marco Medici and Federico Ferrari); the state of art of BIM for historical heritage (Carlo Bianchini); knowledge and project through BIM and Database (Mario Centofanti, Stefano Brusaporci and Pamela Maiezza); HBIM modeling between survey and metadata management (Paolo Clini and Ramona Quattrini).
The third edition of the *3D Modeling & BIM* workshop hosted at the Sapienza was dedicated to project, design and proposals for reconstruction, and

was held in the Valle Giulia campus in Rome, on April 19-20, 2017. This last event, compared to the previous ones, witnessed a remarkable participation by both students and teachers–from all over Italy–and by professionals, and was enlivened by a large debate concerning the introduction of these new technologies in professional practice. The contents of the papers presented and the ensuing discussions showed a higher level of awareness in the reflections on the

topics. It also showed a further maturity both in terms of content and for the discussions at the end of the presentations. After the introduction of Tommaso Empler (chair of the event), the greetings by Renato Masiani (vice-rector of the Sapienza University of Rome), Anna Maria Giovenale (dean of the Faculty of Architecture of Sapienza University), Carlo Bianchini (director of the Department of History, Design and Restoration of Architecture of Sapienza Univer-

sity), Vito Cardone (president of the Unione Italiana per il Disegno) and Edoardo Bianchi (president of the Associazione Costruttori Edili Romani, vice-president of the Opere Pubbliche ANCE), there was the introduction by Livio Sacchi, president of the Ordine degli Architetti, Pianificatori, Paesaggisti e Conservatori della Provincia di Roma (Order of Architects, Planners, Landscape Architects and Curators of Rome) who provided a general framework of reference on the subject, recalling the substantial change in design procedures in the BIM environment, based mainly on the circularity of the process thanks to alternation and complementarity of skills. Among the other papers of the morning, Francesco Ruperto addressed the issue of digitalization of the construction industry.

The two days developed with plenary sessions dedicated to the theme *BIM per il nuovo* (BIM for new buildings), *BIM per l'esistente* (BIM for existent buildings) and 3D Modeling. In the first session, there were contributions concerning the BIM regulations (Pavan), the validation of the BIM model for new construction (Bolognesi), the use of responsive surfaces with BIM (Sacco and Calvano); in the second session, topics related to advanced survey were discussed, both for the reconstruction of memory with HBIM models (Di Luggo, Scandurra, Pulcrano, Tarantino), and for the application of point clouds for building (Gioscia); some case studies have also been described, such as Louis I. Kahn's project for the Congress Hall in Venice (Sdegno, Cappochin), and the Villa Sarmatoris in Salmour (Lo Turco, Chiabrando, Farina, Galleano, Naretto), and that related to the façade of the basilica of San Michele in Pavia (Parrinello and Mattion). The last session, on 3D modeling and other more general topics, addressed the themes of university education (Carnevali), the use of parametric representation in research (Filippucci, Bianconi), digital representation for the dissemination of historical treatises (Baglioni, Fasolo, Mancini), photogrammetric survey and autostereoscopy (Quattrini, Nespeca, Mancini), the modeling of vaults in the drawings by Leonardo da Vinci (Di Bernardino, Carpiceci, Colonnese), digital modeling in naval production (Russo), the restitution of visual models for virtual museums (Casale, Ippoliti, Paris).

It was an intensely busy day of work which demonstrated the great attention paid to the topic by academics and professionals, and is to be considered a major achievement of the Italian University in recent years, directly involving the professions of architect and engineer. The role of the Italian Union for Drawing has proved to be of great relevance, not only for its activity of support and patronage, as a scientific society, but also thanks to the active work of many of its members, both as organizers of the various initiatives, and as valuable speakers.

Notes

[1] Eastman, C., Teicholz, P., Sacks, R., Liston, K. (2011). *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors*. Hoboken: John Wiley and Sons.

[2] Empler, T. (ed.). (2016). *3D Modeling & BIM. Applicazioni e possibili futuri sviluppi / Applications and possible future developments*. Roma: DEI - Tipografia del Genio Civile.

[3] Since 2015, the address of the journal has been: <http://disegnarecon.univaq.it> (consulted on July 15, 2017). The archive of the previous issues (2006-2014) is also available on internet at <https://disegnarecon.unibo.it> (consulted on July 15, 2017).

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