diségno 8.2021

unione italiana disegno
8.2021

diségno

ISSN 2533-2899

english version

diségno

8.2021

CONNECTING. DRAWING FOR WEAVING RELATIONSHIP

diségno

Biannual Journal of the UID Unione Italiana per il Disegno Scientific Society
n. 8/2021
http://disegno.unioneitalianadisegno.it

Editorial office
piazza Borghese 9, 00186 Roma
redazione.disegno@unioneitalianadisegno.it

Cover
Paul Klee, Revolving house, 1921. Detail.

The articles published have been subjected to double blind peer review, which entails selection by at least two international experts on specific topics.
For Issue No. 8/2021, the evaluation of contributions has been entrusted to the following referees:
Fabrizio Agnello, Piero Albisinni, Marinella Arena, Marcello Balzani, Carlo Bianchini, Enrica Bistagnino, Stefano Brusaporci, Massimiliano Campi, Maria Grazia Cianci, Alessandra Cirafici, Francesco Di Paola, Tommaso Empler, Laura Farroni, Federica Maietti, Marco Muscogiuri, Pilar Chías Navarro, Sandro Parrinello, Maria Elisabetta Ruggiero, Salvatore Santuccio, Giovanna Spadafora, Roberta Spallone, Marco Vitali, Andrea Zerbi

Consultant for English translations Elena Migliorati.

Published in June 2021

ISSN 2533-2899

8.2021 diségno

7 *Francesca Fatta* — **Editorial**

Cover

9 *Agostino De Rosa* — So Distant, almost Close

Image

22 *Mario Ridolfi* — *Love Knot*

23 *Massimo Mariani* — Mario Ridolfi's *Love Knot*

CONNECTING. DRAWING FOR WEAVING RELATIONSHIP

Prometheus. Theory and Technique

29 *José María Gentil Baldrich* — A Reflection on the Spanish Expresión Gráfica Arquitectónica at the Zaragoza Congress "*Pingui Minerva*"

35 *Alessio Bortot* — The Sphere between Stereotomy and Cartography. From Stony Traits to the Representation of the Cosmos

47 *Giorgio Buratti, Sara Conte, Valentina Marchetti, Michela Rossi* — Weaving Ontology. Patterns of Textile Structures from the Knot to the Digital Lace

59 *Matteo Del Giudice, Emmanuele Iacono* — Algorithmic Approach for the Application of Graphic Standards in the BIM Environment

Metis. The Mutation of Form

73 *Francesco Cervellini* — Connecting. Notes and Exercises for a Theory of the Practice of *Disegno* of the Visual Form

87 *Pablo J. Juan-Gutiérrez* — Reversible Ideas, Irreversible Drawings. Time as a Connector in Architectural Drawing

97 *Nicolas Turchi* — The Architecture of Spacetime: Memory as a Project

109 *Starlight Vattano* — Bodily Simultaneity in Avant-garde Art. Graphic Readings and Schemas

Mnemosyne. The Construction of Memory

123 *Giuseppe Amoruso* — The Crown of Thorns of Notre-Dame de Paris, Mythological Representations of Memory

131 *Salvatore Damiano* — Drawing Space in the Places of Myth: Luigi Moretti and Sicily

143 *Giuseppe Antuono, Valeria Cera, Vincenzo Cirillo, Emanuela Lanzara* — *In-between Places*. Multi-Scale Digital Hybridations of the Campania Caves&Quarries System

157 *Ilaria Trizio, Francesca Savini, Adriana Marra, Andrea Ruggieri* — The Virtual Tour as a Digital Tool for Linking the Disciplines of the Drawing and the Archaeology of Buildings

169 *Fabrizio Agnello, Laura Barrale* — Reconnecting Past and Present with Old Photos. Reconstruction of the Church of the Stimmate in Palermo

Hermes. The story of Place and Things

183 *Alessandra Cirafici* — Armed Architecture/Weapons of Architecture

197 *Elena Ippoliti, Andrea Casale* — Representations of the City. The Diffuse Museum *The Esquilino Tales*

211 *Graziano Mario Valenti, Alessandro Martinelli* — Aspects and Criticalities of the Fruition in Subjective of the Digital Space: the 'First Person View'

221 *Giorgio Garzino, Maurizio Marco Bocconcino, Mariapaola Vozzola, Giada Mazzone* — From the Representation of Urban Vulnerability: the Drawing of Graphic Abacuses for the Project

RUBRICS

Readings/Rereadings

237 *Massimiliano Ciammaichella* — Remember, You Are an Artist, Not a Scholar. Six Drawing Lessons by William Kentridge

Reviews

247 *Ornella Zerlenga* — Massimiliano Ciammaichella (2021). *Scenografia e prospettiva nella Venezia del Cinquecento e Seicento. Premesse e sviluppi del teatro barocco.* Napoli: La scuola di Pitagora editrice

250 *Francesco Maggio* — Elena Ippoliti (2020). *Il disegno per Gaetano Rapisardi. Progetti per Siracusa tra cronache e storia* Milano: Franco Angeli

253 *Andrea Giordano* — Veronica Riavis (2020). *La Chiesa di Sant'Ignazio a Gorizia tra architettura e pittura. Analisi geometrica e restituzioni per la rappresentazione tattile*. Trieste: EUT Edizioni Università di Trieste

256 *Eduardo Carazo Lefort* — Roberta Spallone, Marco Vitali (2020). *Sistemi voltati complessi: geometria, disegno, costruzione*. Canterano (Roma): Aracne editrice

259 *Enrica Bistagnino* — Alessandra Cirafici, Ornella Zerlenga (2020). *WordLikeSignMovie. Content switch*. Napoli: La scuola di Pitagora editrice

262 *Emanuela Chiavoni* — Giorgia Aureli, Fabio Colonnese, Silvia Cutarelli (a cura di). (2020). *Intersezioni. Ricerche di Storia, Disegno e Restauro dell'Architettura*. Roma: Artemide edizioni

Events

267 *Cecilia Bolognesi* — *Documentazione & Digitale 2020 Rome*. Knowledge and communication of Cultural Heritage

270 *Elena D'Angelo* — Workshop 3D Modeling & BIM. *Digital Twin*

273 *Letizia Bollini* — *Remediating Distances*. Presentation of IMG Journal 3/2020

276 *Alessandro Luigini* — Second Annual Travelling Meeting of the *XYdigitale* Project and the *XY* Journal

281 — **The UID Library**

285 — **UID Awards 2020**

Editorial

Francesca Fatta

An introduction

Issue No. 8 of *diségno* represents an 'exception,' or rather a 'variant' of the program of events of the Unione Italiana per il Disegno; a necessary variant, in adaptation to the pandemic wave that has changed the life of the entire world for over a year.
The 42nd International UID Conference entitled *Connettere. Un disegno per annodare e tessere / Connecting. Drawing for weaving relationships*, which should have been held in mid-September 2020 on the Calabrian shores of the Messina Strait area, was postponed to the following year, same period. In substitution it was decided to organize a Study Day on the discipline in reference to the current hardships that the pandemic has imposed on us.
The Covid-19 pandemic will, therefore, leave a trace even in the life calendar of the UID, and on the uninterrupted sequence of the forty-one annual conferences that to this day have characterized the association's scientific structure.
The Study Day took up the themes that had been previously established for the Conference, the Proceedings of which were published by Franco Angeli in open-access reflecting, and in fact launching, a further focus, which then became the call of the conference to be held next September in Reggio Calabria: *Languages*, *Distances*, *Technologies*.
In the current issue, continuing the rhythm of our journal's even-numbered issues, we have thus decided to give an account of the results of the book of the *Proceedings*, inviting the authors of the papers evaluated in double peer review with the highest score to produce a long paper on the proposed topics.

An acknowledgement

Since March 2021, diségno has been indexed in Scopus. This is an important step forward for the growth of our still young publication, which aims to achieve full recognition as a Class A disciplinary scientific journal.
I would therefore like to thank both the Editorial Board and the Editorial Staff.

Issue No. 8

This issue, which we have defined as 'atypical' in light of its previously described characteristics, is intended to define a moment of reflection on the Proceedings of the conference *Connettere. Un disegno per annodare e tessere/ Connecting. Drawing for weaving relationships*, and features the contributions of the Study Day held on 18 September 2020.
The *Cover* has been entrusted to Agostino De Rosa, with an *overture* that deals with the theme of 'connections' in relation to languages, distances and technologies, following a path that starting from the '*segno-di-segno*' unfolds towards deep, intimate and archetypal considerations.
This is followed by a comment on the design of Mario Ridolfi's famous *Nodo d'amore* (*Love knot*), chosen precisely for the intertwinings and weavings evoked by the subtitle 'drawing for weaving relationships.' The comment has been entrusted to one of his former students, Massimo Mariani, currently Councilor of the C.N.I. - Consiglio Nazionale degli Ingegneri d'Italia (National Council of Italian Engineers), responsible for Culture, who gives us a brief but intense testimonial of the Master's work.
The four Topics are introduced by José María Gentil Baldrich, professor emeritus at the Escuela Tecnica Superior de Arquitectura de Sevilla, for the theme *Prometheus: theory and technique*; Franco Cervellini for the theme *Metis: the mutation of form*; Giuseppe Amoruso for the theme *Mnemosyne: the construction of memory*; and Alessandra Cirafici for the theme *Hermes: the story* of places and things. I am particularly pleased to present this sequence of keynotes that effectively 'connects' different generations of scholars, belonging to different contexts and backgrounds, yet all of them decidedly linked to the various aspects of the discipline.
The columns that are a regular feature of all the issues of our journal present an overview of the vitality of Drawing and of its researchers.
Massimiliano Ciammaichella, in *Readings/Rereadings*, leads us to reflect on William Kentridge's *Six Drawing Lessons*.
This is followed by reviews of a selection of the monographs produced this past year, and of some of the events, seminars and congresses held in the last six months.
Starting with this issue, there is a new column which will be present in the even-numbered issues, concerning the prizes and awards that the UID presents, as is customary, during the activities of the annual conference: the UID Golden Awards, the "Gaspare De Fiore" Awards, and other prizes that may have been conferred.

Issue No. 9 and the future

Our editorial team is already working on Issue No. 9: a thematic issue, as is now customary, which will deal with the theme of *Visionary Drawing*. We are moving towards the renewal of UID's governing direction and bodies and a new structure for the Scientific Committee, Editorial Board and Editorial Staff. It is important to consider how, in these four years of life, *diségno* has grown thanks to the work and dedication of our entire scientific community, whose members, in their different capacities as authors, editors, reviewers, have believed in it.
The experience of the journal founded by Vito Cardone continues and will always be renewed, we are sure, at its very best.

So Distant, almost Close

Agostino De Rosa

"Verily within me,
within the chamber of my thought, Truth,
neither Hebrew, nor Greek, nor Latin, nor barbarian,
without the organs of voice and tongue,
without the sound of syllables, would say:
'He speaks the truth'"

Saint Augustine, *Confessions*, 11, 3, 5

Introduction

It was with some hesitation that I initially accepted the invitation extended to me by my friend and colleague Francesca Fatta to reflect on the theme of *Drawing: distances, languages, technologies* during the opening of the Study Day organized by UID (Italian Union for Drawing) and held online on September 18, 2020. The three (actually four) terms evoked in the title of the Seminar correspond to the same number of existential and experiential categories that, never as in these months of pandemic, have taken on ambiguous and contradictory meanings, previously unimaginable. The physical (but not social) distancing has forced us to reflect on how important proximity is for the human race and how by now this can/should be expressed not only through in-person contact, but also mediated by other communicative structures, all focused on the visual, but unable to solicit in us a satisfactory overall response of mirror neurons, and to act in the synesthetic field on all our senses. Thus, the inadequacy and limitations emerge of a technology that we thought we could dominate, but that we discover, instead, to be dominating our working days and our relationships, now remote and opaque in that mentioned algid distance. However, many have pointed

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editorial director's responsability.

out how the pandemic has once again placed language at the center of the communicative scene, in its multiple articulations, semantic and segnic, becoming the only *locus* to which we entrust our thoughts and desires, now disembodied. I have, therefore, attempted to start from this very last lemma, 'language,' to offer my friends and colleagues my point of view on the question of Drawing, moving on to my personal interpretation of the idea of distance, private and global at the same time, and finally closing with an example of technological archeology which, it seems to me, could resolve the *aporias* raised by the dismal times in which we live.

Languages

Those who teach subjects related to the field of Drawing know very well the importance of the evolutionary study of linguistic forms, capable of subsuming in an icastic and paradigmatic way how the name given to things has historically been translated into calligrams, in ideogrammatic languages, and into phonemes, in the alphabetic ones. I would therefore like to share with you the analysis of a few ideograms taken from Japanese, showing how the graphic elements that connote them open a sign universe that is already a drawing, a graphic hypostatization of actions and behaviors, but also a symbol of the anthropology reflected in that language. Immediately afterwards, I will attempt to deal with a word belonging to a phonetic language, which, however, seems to play in vain in these days of global uncertainty, and which will lead us to the next chapter of this narrative.
Let's start with the two *kanji* (certainly of Chinese origin and used in Japanese writing in conjunction with the hiragana and *katakana* syllabaries) that indicate, respectively, the action of 'seeing' and that of 'hearing,' that is, two of the actions, along with 'speaking,' that we have most exercised in the lockdown period. The ideogram '**見**' (fig. 1) indicating 'to see' in *on'yomi* reading, of Chinese derivation, is read 'ken' [1]: it is composed of two lower strokes, executed with the same number of brushstrokes drawn with a quick and sure gesture by the master calligrapher, to synthetically represent the motor action of the legs (originally a man) in walking; and the ideogram '**目**' (*moku*) indicating the eye, placed in the upper part of the *kanji*. This calligram summarizes the whole Far Eastern poetics of seeing (and therefore of representing), characterized

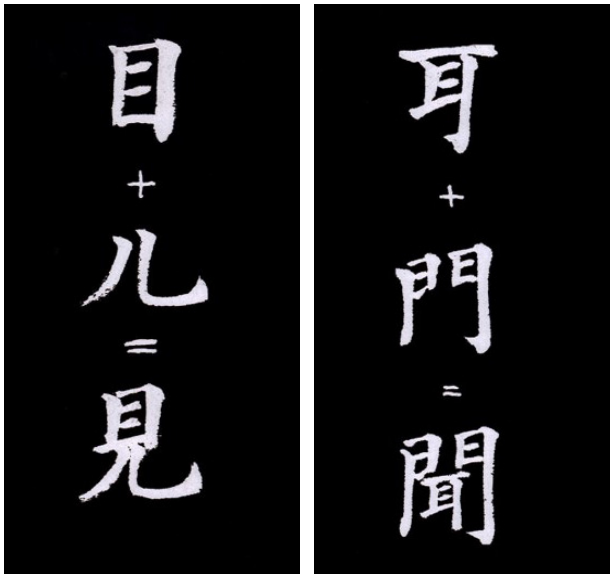


Fig. 1. The Japanese kanji **見***, 'to see', and its ideogrammatic articulation.*

Fig. 2. The Japanese kanji **聞***, 'to listen', and its ideogrammatic articulation.*

by a continuous and unstoppable dynamism of the observer, by his/her incessant kinematism that probes space in an ambulatory manner, without perspective depth, but rather actively concentrated in overcoming the material objectivity of things, lifting the veil of Maya that hides them from our understanding, and revealing their intimate archetypal essence. The difference with the established way of seeing space, typical of Renaissance painting but, in general, of the whole Western scopic approach to knowledge, is obvious: compared to the motionless and cyclopean European ocularcentrism, in Japan 'to see' is to move one's body to discover a non-homogeneous and anisotropic space, in a process of consubstantiality between human eye and divine eye. The *kanji* for the verb 'to hear,' **聞** (*kiku*) (fig. 2), on the other hand, is conceptually articulated in the opposite way, being composed of the calligram of the ear, **耳** (*mimi*), inserted below the symmetrical calligrams indicating twin portals (**門**), thus suggesting that the listener places or centers his ear at or

within the frame of the empty space between the pair of doors in order to hear the sound coming from the area beyond the threshold: 'hearing' thus becomes a static as well as passive action in that scriptural and anthropological context, in consonance with the non-melodic, rhythmic, and just-intoned structure of Japanese music. In the West, on the other hand, 'hearing' is a dynamic and active action, as demonstrated by the articulated and 'perspective' structure of continental music, in being based on the idea of 'movement' and temperament. The two examples cited above show how ideogrammatic language is conveyed by signs capable of containing an expressive world, I would say *in exergo* an anthropology, which describes a world. But an alphabetic language close to us has similar capabilities: classical Greek. A word that precisely in these recent months has placed us in continuous check is 'truth' constituting –together with the related adjectives (verism, realism, etc.)– a controversial aspect of the Western gnoseological process, as it is historically returned to us by the myth of the cave, offered by Plato (428/427-348/347 B.C.) at the beginning of Book VII of *The Republic* [2] (*Πολιτεία*, 390-360 B.C.).

The most subtle interpreter of the Platonic allegory was certainly Martin Heidegger (1889-1976), who dedicated to this chthonian myth his course held in Freiburg between 1931 and 1932, then incorporated it into the volume *The Essence of Truth* [see Heidegger 1997], published later, in 1942. Without going into an exegesis of the Heideggerian text [3], I would like to emphasize here how the German philosopher indicates precisely in the concept of 'truth' the central driving force of his text, recognizing the myth of the cave as the greatest contribution of the Greek philosopher to Western knowledge. Commonly understood as conversion 'in the light of knowledge' the term 'truth' (in German "*Wahrheit*"), in relation to Plato's myth, is offered by Heidegger through two semantic, by no means homophonic, versions: first as *ἀλήθεια* (*alétheia*) (fig. 3), a Greek word that can be translated as 'truth,' but that is composed of the prefix '*ἀ*' (privative alpha, 'not') and the verb '*ληθεύειν*' ('to unveil, disclose, reveal'), indicating what is emancipated from oblivion, *λήθη* (*lèthe*, something that emerges into view but was concealed until now. Under this critical light, *ἀλήθεια* can be translated as 'unveiling' (or 'disclosure'), 'that which is not hidden,' in German, *Unverborgenheit*: in other words, truth is given through a denial of what is hidden. In its most intimate semantic nucleus, truth therefore conceals a negation: not an assertive lexical particle, as one might expect, but a negative one: "its expression is *privative*" [De Rosa 2021, p. 33: italics are used in the original text]. As if to say that truth implies its own negation. This semantic ambivalence, exquisitely Greek, evidently conflicts with the analogous Latin term 'veritas,' much more stolid and granitic, devoid of ambiguity, and characterized by an exclusively positive meaning, modeled on the idea of similarity. According to the interpretation provided by Heidegger, the notion of truth as 'disclosure' has nothing to do with the idea of truth as 'conformity' or 'concordance.' For the German philosopher, Plato considered this revealing action of truth in its most intimate workings, presupposing the experience of the veiledness of the entity, of the anguish that the awareness of its presence exerts on man, as necessary for him to yearn for the unveiling of what was previously hidden: truth is born from this dialectic, as the myth of the cave exemplifies in an adamantine manner. For Heidegger, it was Heraclitus (535-475 B.C.) the first philosopher to clarify how "Nature loves to conceal Itself" [fragment DK 22 B 123, Eraclito 1980, p. 19], thus identifying in this refined attitude the expression of a voluntary opacity to the visibility of the entity: "In this statement by Heraclitus finds expression that fundamental experience *with which*, *in which* and *from which* one began to look into the essence of truth as a dis-veiling of the entity" [Eraclito 1980, p. 36; Mecacci 2006, pp. 164 et seq.: italics are used in the original text.] It is precisely the Platonic myth, according to Heidegger, that diverts the negative path of the Greek notion of truth, directing it towards the concept of *ὀρθότης* (*orthótes*, *adaequatio* in Latin), the correctness of the *logos*-supported vision, which is further dealt with in another famous book written by

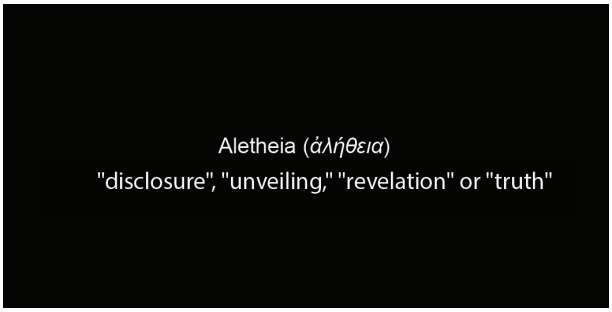


Fig. 3. The word ἀλήθεια (alétheia) and its possible translations.

the German philosopher, *Plato's Doctrine of Truth*, published in 1942 but actually dating back to 1930-1932 [Heidegger 1987]. Plato explains its function and the relationship of dependence on *ἀλήθεια* [4] in the dialogue entitled *Cratylus* [Plato 2003], which again sees Socrates as protagonist. This is an eminently anthropic action, which emerges when one attempts to give a name to things: this association is therefore arbitrary, and would indicate how idea and thing are made to correspond, according to a process reducing being to an object of man's evaluation, for Heidegger the premise of the contemporary primacy of subjectivity and the eclipse of being. Despite the criticism aroused by the Heideggerian hypothesis of a pre- and post-Platonic truth in classical philosophical thought –one thinks, for instance, of the criticism [5] raised by the classical philologist Paul Friedländer (1882-1968)– truth as denial remains a fascinating hypothesis rich in speculative insights, which indicate that even in what one believes to see there is a part hidden from our gaze: a "blind spot," or a place where being exercises selective blindness. The theme of revelatory "sight" is therefore dominant in Book VII of *The Republic*, first with a critical reflection on the deception of seeing (on the part of the prisoners), then on the blindness perpetrated by the retinal overexposure to the light of the torch or of the sun (on the part of the philosopher who escaped from the cave); blindness only partially recovered by the return to the phenomenal world, since the destiny will still be, for the philosopher freed from his chains, that of re-entering the cave and its obscured luminosity: an eternal return to darkness that, however, can take on another meaning, if analyzed with a different critical approach.

Distances

Among the many images that figuratively render this Platonic archetype, the one that seems most interesting to evoke here is the version executed in 1604 by the Dutch engraver and painter Jan Pietersz Saenredam (1565-1607), entitled *Antrum Platonicum* [see Hirschmann 1915] (fig. 4) and today preserved at The British Museum in London. The engraving [6], printed by Hendrik Hondius (1573-1650), was a copy of a painting (1598) which is now lost [7], by Cornelisz Cornelis, called Cornelis van Haarlem [see McGee 1991] (1562-1638), and was commissioned by the Dutch humanist Hendrik Laurensz Spiegel (1549-1612) [see Verwey 1919; Buisman 1935; Orenstein 1995; Veldman 1990], who wanted a faithful restitution, in iconographic terms, of his Catholic interpretation of the Platonic myth, as he had developed it in the poem *Hertspiegel* (*The Mirror of the Heart* or *Spiegel's Heart*). The image was offered by Spiegel [8] as a tribute to his nephew, the physician Pieter Paaw (1564-1617), professor of medicine at the University of Leiden, famous anatomist and founder, with Jacobus Bontius (1592-1631), of the botanical garden of that university, and bore, on the upper margin, the following quotation, in capital letters, from the *Gospel of St. John*: "LVX VENIT IN MVNDV[M] ET DILEXERVNT HOMINES MAGIS TENEBRAS QVAM LVCEM. IO. 3. 19" [9].
The lower border presented, instead, distributed over three columns (separated by elegant projections of conical helixes), a long epigram describing the image, presumably signed by Spiegel himself [10].
Although incomplete, *Hertspiegel* was published posthumously in 1614 with seven of the nine books originally intended, each dedicated to one of the Greek muses. *Book III*, introduced by the image of Melpomene [11], the muse of tragedy, is the book in which the author again proposed, in a Catholic interpretation, the myth of the cave imagined as a cavity similar in shape to the human heart, where men, though free to move about (and not chained, as in *The Republic*) consciously decide to remain in the darkness staring at the shadows cast by a lantern suspended in front of them, rather than going towards the exit of the cave to attain that true knowledge provided, in this case, by the light of Christ. The multiplicity of subjects (mostly male) represented by Saenredam was meant to allude, with all evidence, to the human race in its entirety: there are different kinds of people (peasants, orientals, some belonging to professional guilds and occupied in diverse trades, soldiers, clerics, some wearing turbans and others togas) engaged in a heated discussion. On top of the wall, behind them, one does not see the miniatures described by Plato, but rather statues [12] representing several capital vices (greed, lust, envy) and theological virtues (faith, hope and charity) [13]. Only a few men on this side of the wall choose to turn their gaze towards the artificial light: the wise men depicted on the left, with their gaze focused on the light source; but even they are deceived, being convinced that this is the true light and that they have already attained the true knowledge of the world to which, however, they turn their backs: they are, according to Spiegel, pseudo-philosophers (we recognize the presence among them of a magician with a typical

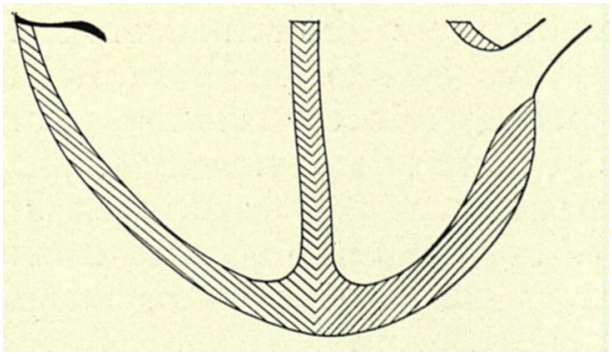
Fig. 4. Jan Pietersz Saenredam (1565-1607), Antrum Platonicum, 1604. Fondo Calcografico Antico e Moderno from Fondazione Biblioteca Morcelli Pinacoteca Repossi (Brescia), inventory number 100502.

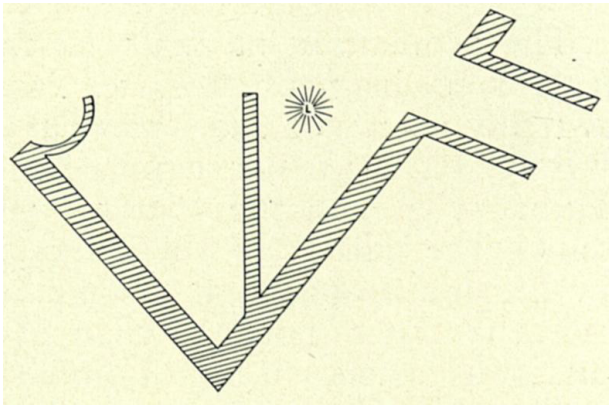
truncated-cone hat). Only a small group dares to leave the cave to attain the truth provided by the knowledge of Christ: these are the three men depicted outside the tunnel, who renounce the world and convert (the meaning of "*convert*" is precisely "to turn completely around"). Still faithful to the Platonic tradition, this is the description of those who, now aware of what the truth is, try to make the occupants of the cave, still victims of ignorance, share in it. However, the former are looked upon with distrust and fear, as depicted in the episode that takes place below, in the center of the image. The discrepancies between the Platonic tradition and Spiegel's version can perhaps be attributed to the interference of a similar theme, developed by Aristotle, and brought to us through a quotation given by Cicero in *De natura Deorum* [14]. From the reading of the text, some details emerge that show a greater closeness of the chthonic scenography imagined by Spiegel and depicted by Saenredam to the Aristotelian cavern, more than to the Platonic one: first of all, the lack of chains forcing the prisoners to stare obtusely at the projected shadows, but also the nature of the statues placed on top of the wall that divides the cavern depicted in the engraving into two ideal halves. These, but also other themes, suggest that the image of the "*Speloncke Platonis*" was not necessarily intended as an illustration for the third book of the *Hertspiegel* –where the myth is described– given its large size (27.2 x 44 cm) in comparison to the smaller size of the printed edition of the poem, which was published, up to its fourth edition, without any interspersed illustrations: only in the 1694 version does the image of the *Antrum Platonicum* appear accompanying the text, in a version engraved by Joseph Mulder based on Saenredam's original. Albert Cornelis de Jong [de Jong 1930] points out that there is another configurative element in the represented space which distances the engraving from the contents of the poem: the fact that Spiegel repeatedly claimed that the cave of the myth should resemble, as we have already said, a human heart [15], without ever giving rise in the engraved image to this desire. John Baptist Knipping supposes that perhaps this resistance was due to an intrinsic inability of the engraver or, better, to Spiegel's reluctance to be guilty of *ὕβρις* with respect to Platonic orthodoxy. However, the neurologist Pierre J. Vinken [16] believes that this resonance between the rhetorical space of the engraving and the structure of the heart is obvious, if referred to the image that the anatomy of the time had already defined for this organ. In particular, Spiegel himself could have had access to the canonical representation that the heart had assumed in the first half of the seventeenth century, thanks to his direct relationship with his nephew and dedicatee of the engraving, the previously mentioned Pieter Paaw, who had studied at many European medical institutions, including the University of Padua, under the guidance of Hieronymus Fabricius or Girolamo Fabrizi d'Acquapendente (1533-1619), where he had had the opportunity to consult both the *Tabulae anatomicae* (1600, now preserved in the Biblioteca Marciana in Venice) of his teacher and the famous *De humani corporis fabrica* (Basel 1543) of Andreas Vesalius (1514-1564). In particular, Paaw also had a profound knowledge of Vesalius' *Epitome*, a work divided into six chapters that constituted a sort of summary of the *Fabrica*, for the use of medical students. Paaw himself curated an edition of the *Epitome* with numerous autograph glosses where, in the fourth book, it was possible to find a very detailed description of the human heart compared, in its form, to a pine nut flattened in front and behind, consisting of two alveoli or internal chambers. In particular, for the author "the atrioventricular valves are situated between the vena cava and the pulmonary veins on one side, and the ventricles, respectively right and left, on the other. The atria are indistinguishable from the great veins that converge there. The right and left ventricles have separate connections to the pulmonary artery ('vein arteries') and the aorta, respectively. The innermost structure of the heart consists of a muscular wall, thicker on both the left and the right, and a septum that exhibits 'cavities' (perforations)" [Vinken 1960, pp. 133, 134]. This is an image of the heart that differs little from that already provided in the second century by Galen (129-201 ca.) and that, without interruption, had survived unchanged up to the threshold of the seventeenth century, except for the fact that Paaw insisted on the absence of holes in the septum that separates the heart into two parts. According to Vinken [Vinken 1960, p. 135] this configuration must have been acquired by Paaw during his stay in Padua, on the basis of the studies of Realdo Colombo (1515-1559 ca.) concerning pulmonary circulation (or small circulation) which outlined the basis of the modern notion of blood circulatio discovered by William Harvey (1578-1657) a few years later [Harvey 1628]. It was therefore potentially this anatomical image of the heart that Paaw could have transmitted to his uncle Hendrik Laurensz Spiegel, who would then develop a literary image reflected in

Saenredam's engraving: "to illustrate his interpretation of Plato's allegory, Spiegel needed a diagram of the heart, one side of which had to be left open, so that the observer could see the inside of the organ from above. To this end, he omitted its base" [Vinken 1960, p. 135]. Vinken then outlines a section of the heart muscle whose base has been elided along the line connecting the wall of the aorta to that of the right atrium (formerly thought to be part of the vena cava), and, of course, without perforations of the interventricular septum, whose existence had already been refuted by Galen. Starting from the graphic reconstruction performed by Horance Lance Flint [Flint 1921] of Galenic cardiac circulation, Vinken compares this scheme (figs. 5a, 5b) to a plan of the Platonic antrum delineated by Saenredam, noting remarkable formal similarities. The *Antrum Platonicum*, delineated by Spiegel and Saenredam, thus maintained the same dual spatial and symbolic articulation of the Galenic heart, characterized as it was by a more 'popular' area (where the figures observing the shadows projected onto the bottom of the cave are found), corresponding to the right cardiac ventricle, where raw blood was supposed to arrive, and a more 'emblazoned' space (occupied by the pseudo-philosophers), which played the role of the left ventricle, where raw blood, heat and pulmonary air converged, transforming into blood endowed with vital spirit [17]. On this last space shone the flame of the suspended torch, *analogon* of the *pneuma zoticon* (*πνεύμα ζωτικόν*) of Aristotelian matrix, whose source, for Galen as well, was to be found in the heart, seat of the passions [18]. Thus, the engraving of Saenredam seems to tell us that there exists a place that we believed to be distant, very distant, and that instead is close, very close. We have understood this by studying a remote, very remote cave: so remote that it seems to have been at the beginning of everything, even of our civilization. We thought it was in another nation, in a distant country, under age-old cliffs, inside caves where the Eleusinian Mysteries were perhaps celebrated, in the dark, in caverns without light, because those who frequented them had to dwell in the shadows, like goldfinches, who are kept in the dark to make their song (desperate because of their blindness) even more melodious. Then we discovered that this cavern was a heart, so not as distant as we thought, on the contrary: so close that we never realized we had always had it near us. As in Edgar Allan Poe's *The Purloined Letter* [19], it was right before our eyes, in plain sight, but we had never

Fig. 5a. Pierre J. Vinken (1960), schematic image of the heart hypothesized by Galen, modified from the description provided by Pieter Paaw.

Fig. 5b. Pierre J. Vinken (1960), planimetric restitution of the Antrum Platonicum after Saenredam.





noticed it. Perhaps this could be better said by explaining that someone had put it on display precisely in that way so that we would not notice that it was right there, in understanding that an apparently innocent drawing, illustrating a mythical allegory, actually hides a map of our lives, visible only when we have given up seeing it, making us blind.

Technologies

I don't know how much good the experience of the pandemic has done us: my impression is that it has intensified the egoism of those who were already egoistic before it broke out, and that it has dug a deep furrow of separateness, of 'remoteness' from the world in the most sensitive among us. I have the constant feeling of being on the edge of something, and my disorientation (already at perturbing levels in pre-pandemic times), but especially that of those around me, is tangible, disturbing. I have to thank a dear friend who, precisely during the lockdown, called my attention to a hauntingly beautiful film, *The Whispering Star* (*Hiso hiso boshi*, ひそひそ, 2015) by Japanese director Sion Sono, which seems to restore this sense of remoteness that I could not name nor describe plastically. The answer, as is often the case, comes from the East, which is not only a geographical East, but also an East of the mind. In the film, humanity has been drastically reduced in the universe due to some unspecified environmental disaster: eighty percent of the population is now composed of androids, and humans are a residual, endangered species. Machine ID 722 Yoko Suzuki (fig. 6) is an android (played by Megumi Kagurazaka, the director's wife and muse), on board Rental Spaceship Z (fig. 7), an improbable spaceship modeled after a traditional house, uprooted from its earthly foundations and equipped with thrusters. Thanks to 67 MAH Em, the vintage onboard computer (as vintage are all the interior furnishing details, from the kettle to the Bunsen burners to the dripping faucet), Yoko travels from one star system to another, delivering packages to surviving humans: inside them are simple items like a hat, a pencil, clothes, the fragment of a film. For her job, Yoko reaches many desolate planets, cities, and beaches (figs. 8, 9). She doesn't understand why humans do not choose teleportation, as though materially receiving objects could imply an inescapable emotional element. Whispering Star is one of the planets reached by Yoko: there, any noise over 30 decibels could kill the inhabitants. So the android tiptoes to the recipient's address to deliver a package with mysterious contents. Here Yoko walks along a long, winding corridor, between thin shoji panels, behind which we can glimpse the daily life of the local inhabitants, now projected in the form of shadows (fig. 10): a Platonic cave of a remote future, in my interpretation. The settings chosen by the director are the post-apocalyptic ones of Fukushima Prefecture, after the accident at the Ōkuma nuclear power plant caused mainly by the Tōhoku earthquake of March 11, 2011, and even some of the actors were chosen among the inhabitants of that tormented region. The film is shot in a poignant black and white, the only moment of color being reserved for the landing of the spacecraft on the planet Earth. I'll be silent here, and I hope you enjoy this moment in solitude, even if it lasts only a few seconds: you can't help but be moved by it. "This is a film about memory," says Sion Sono in the accompanying director's notes. "A prayer for people around the world whose lives are threatened every day." The director seems to warn us, back in 2015, that the destiny towards which the world would seem to be running is that the whole universe would be reduced to the dystopian situation of Fukushima.

What, however, has resonated strongly in my imagination is the delivery of those almost empty packages, filled only with tenuous memories, summarized in the fragment of an object, apparently residual but essential for survival, perhaps only mnesic, of those who receive it. Objects of a now-remote technology, but full of residues of a past full of memories. I think that many of us received those packages in the days of the lockdown, and I'm certainly not alluding to those delivered by Amazon: maybe some of us will try to decipher their contents in the future, but most of us have left them aside and will leave them closed *ad libitum*, out of fear.

I too, on November 7, 2019, made use of a residual technology, similar to the one described by Sion Sono: I was in Tel Aviv, Israel, for a teaching staff meeting, when at six in the morning (dawn in Italy), I received the news of the death of Anna Sgrosso, my teacher and lifelong friend, whom many of you knew. To say what her presence has represented in my life, both academic and private, is too complex to sum up in a few lines. Especially in my private life, I would say. I met her in 1989, so we had known each other for 40 years, years in which I learned to love her. It wasn't difficult: she was a woman full of humanity and kindness, despite the fact that some may have perceived her as edgy and difficult. But she wasn't like that at all: those who really knew her,

Fig. 6. Sion Sono, The Whispering Star (Hiso hiso boshi, ひそひそ, 2015). Frame.
Fig. 7. Sion Sono, The Whispering Star (Hiso hiso boshi, ひそひそ, 2015). Frame.
Fig. 8. Sion Sono, The Whispering Star (Hiso hiso boshi, ひそひそ, 2015). Frame.
Fig. 9. Sion Sono, The Whispering Star (Hiso hiso boshi, ひそひそ 2015). Frame.

Fig. 10. Sion Sono, The Whispering Star (Hiso hiso boshi, ひそひそ 2015). Frame.

know what she was capable of with a smile, a hug or just with the comfort of her wisdom, lavished with full hands in times of need. The last year of her life was tiring for her, and also for those who stood by her side. Both Andrea Giordano and I were close to her as much as possible, together with her family, and I must say that even in that final phase of her existence, Anna was unique and great: gentle and likeable, ready to joke even in very critical moments. Impossible not to adore her: that's it, more than loving her, I adored her. It was impossible to do without her. Once I told her what, in the novel *A Passage to India* by the British writer Edward Morgan Forster, one of the main characters, Doctor Godbole, told Mrs. Moore, an elderly English lady who had come to India for the celebration of a romantic encounter, in that remote land, of one of her protégés, Miss Adela Quested, which would never take place. Meeting her alone in the moonlight in a Hindu temple, Doctor Godbole told her, "You are an ancient soul." This is what Anna was: an ancient soul who gave us love and wisdom. On that fateful day, when my Israeli colleagues had planned for me to visit Jerusalem, I would have liked to have been somewhere else, but it was impossible to get back to Italy in time to pay my last respects to Anna. I am not a believer, but I suppose I have spiritual inclinations, at least it seems so to me, at times. And therefore the only thing I could do that day was to leave a small note between the cracks of

Fig. 11. The Kotel (Western Wall), Jerusalem, Israel. November 2019. Photo by Andrea Muddolon.

the Kotel, the millenary wall and the holiest site in Judaism (fig. 11), thinking that Anna, perhaps, would not have minded and that perhaps my message would have reached her: it contained a drawing, a prayer, I mean, that has no need of words.

Notes

[1] Regarding the drawing of this as well as other *kanji*, see: Ben She.Yi Ming 1997. See also: Knudsen 2018; Murase, Barnet, Burto 2002; Sato 2014.

[2] See Plato 2007. On the chronology of *The Republic*, see: Thesleff 1982. On the theme of the Platonic cave, see also: Badiou 2013; Herman 2013; Collobert, Destrée, Gonzalez 2012; Vegetti 1999. An interesting treatment of the theme of the Platonic cave in relation to contemporary art is developed in the doctoral dissertations Giammarioli 2007-2008.

[3] A comprehensive analysis of the Platonic text, of the Heideggerian text in relation to the theme of seeing/not seeing, see my De Rosa 2021.

[4] On this subject, see Borody 1980, in particular, the paragraph: *Orthotes Eclipses Aletheia*, pp. 61 & foll.

[5] See Friedländer 2014. For students of Heidegger, the term *alétheia* would be one of those Greek words of non-Indo-European origin. Thus, the initial *alpha* would not be privative at all, hence negating *lethe* (oblivion or forgetfulness), but, if anything, a durative prefix, which emphasizes it. More generally, on the question of Heidegger and language, see Travers 2019.

[6] The copy of the engraving consulted for writing this essay is the one conserved in the Fondo Calcografico Antico e Moderno of the Fondazione Biblioteca Morcelli Pinacoteca Repossi in Brescia, inv. no. 100502. On the history of the engraving, see Vinken 1960, pp. 125-142.

[7] We learn of this from van Mander, K. (1604). *Den Grondt der Edel vry Schilder-const...* In K. van Mander, *Schilder-Boeck*. Amsterdam: Jacob Pietersz Wachter, VII, 45, fol. 32 verso, 33.

[8] Vinken 1960, p. 129, states that in all likelihood a copy of the engraving of the "*Speloncke Platonis*" was also in his possession, namely at his house on the outskirts of Amsterdam, in the district of Meerhuizen.

[9] The full quotation would read: "*Hoc est autem iudicium: Lux venit in mundum, et dilexerunt homines magis tenebras quam lucem; erant enim eorum mala opera*". In the *CEI Bibbia* there is following translation [in Italian]: "*E il giudizio è questo: la luce è venuta nel mondo, ma gli uomini hanno amato più le tenebre che la luce, perché le loro opere erano malvagie*": Conferenza

Episcopale Italiana (Ed.). (2008). *La Sacra Bibbia. UELCI. Versione ufficiale della Cei*. Bologna: Edizioni Dehoniane Bologna, p. 1465.

[10] ["Most men, immersed in darkness / constantly wallow and perish in vain pursuit. / See how the gaze lingers on the shadows of objects, / so that all love and admire the images of objects, // and fools are deceived by the vain images of things. / Some men, more than others, under the pure light / separated from the stupid crowd discover the insults and make direct and balanced judgments / of the shadows of things: // They can recognize the projected darkness of error, / the true and good things, and strive to bring / others from the dark night to the clear light, / because these do not love the light and their intellect is very deficient." see Burucúa, J. E. (2017). Transcendences in the Italian Renaissance. Regarding a Wood Panel by Jacopo del Sellaio and a Miniature by Reginaldus Metropolitanus. In G. Melville, C. Ruta, (Eds.). *Experiencing the Beyond: Intercultural Approaches*. Boston/Berlin: Walter de Gruyter GmbH, pp. 159 & foll.

[11] "Melpomene, 'she who sings,' the Muse of tragedy, wearing a tragic mask, the club of Heracles or a sword; she normally has her head surrounded by vine leaves and wears *coturni*, the typical footwear of tragic actors": see Ferrari, A. (2018). *Dizionario di mitologia greca e latina*. Torino: UTET, p. 481. See also: Betti, S. (1836). *Sulla Musa Melpomene dissertazione detta alla Pontifica Accademia Romana di Archeologia*. Roma: Tipografia della R.C.A.

[12] According to Pierre J. Vinken (see Vinken 1960, no. 19, pp. 136-137) the last four figures would be less easily identifiable iconologically. The first of these four figures would appear to be wearing a jester's hat, holding a flail-like object, perhaps personifying *stultitia* (foolishness). The following figures represent falsity and pride, capital vices often evoked in the *Hertspiegel*. The last figure holding a star could be identified with ambition. The fact that the vices and virtues illustrated in Saenredam's print do not correspond exactly to those mentioned in the second book of the *Hertspiegel* leads critics to believe that the image was not meant to be inserted into the text. According to Vinken, the figures crowning the wall refer to the types of vices and virtues described in the so-called *Tabula Cebetis*, a treatise on human life by the Theban philosopher Cebetus, who lived in the first century B.C., and particularly in its iconographic version (1592), engraved by Jacob Matham based on an original by Hendrick Goltzius and now preserved at the Rijksmuseum in Amsterdam: see Vinken 1960, pp. 137 ff. See also Weddigen 2003.

[13] The citation from St. John, at the top of the print, and the choice to include statues of the theological virtues and some capital vices are a clear indication that the Catholic Spiegel offers, through Saenredam, a Christian interpretation of the Platonic myth, where ignorance is the non-knowledge of Christ.

[14] Marco Tullio Cicerone. *De natura deorum*, II 37, 95-97. This is the first of Cicero's three theological works, written in 44 B.C. and consisting of three books: see Bos, A. P. (1991). *Teologia cosmica e metacosmica. Per una nuova interpretazione dei dialoghi perduti di Aristotele*. Milano: Vita e Pensiero, pp. 295 & foll. On the relationship between Plato and Aristotle, see: Herman 2013.

[15] The same position is also held by Knipping 1939-1940.

[16] See Vinken 1960, pp. 133 & foll. The hypothesis was later expanded in Vinken 1999.

[17] In classical antiquity it was believed that blood was generated by the heart, while yellow bile in the liver, black bile in the spleen and phlegm in the brain. See, on this subject: Nuland, S. B. (1988). *Storia della medicina. Dagli antichi greci ai trapianti d'organo*. Milano: Mondadori,.

[18] See also: Latronico, N. (1955). *Il cuore nella storia della medicina*. Milano: A. Recordati, 1955.

[19] See Poe, E. A. (1998). *La lettera rubata*. Parma: Franco Maria Ricci.

Author

Agostino De Rosa, Department of Architecture and Arts, Iuav University of Venice, aderosa@iuav.it

Reference List

Badiou, A. (2013). *La Repubblica di Platone*. Firenze: Ponte alle Grazie.

Ben She.Yi Ming (a cura di). (1997). *Specification on the Stroke Order of Modern Chinese character*. Shanghai (China): Yu Wen Press.

Borody, W. A. (1980). *Heidegger on Plato's cave alethology*. Tesi di M.o.A. (Philosophy), McMaster University (Canada), December 1980.

Buisman, J. F. (1935). *De ethische denkbeelden van Hendrik Laurensz Spiegel*. Wageningen: H. Veenman & Zonen.

Collobert, C., Destrée, P., Gonzalez, F. J. (2012). *Plato and Myth: Studies on the Use and Status of Platonic Myths*. Leiden: Brill.

de Jong, A. C. (1930). *H. L. Spiegels Hertspiegel, uitgegeven en taalkundig toegelicht door A. C. de Jong*. Amsterdam: H. J. Paris.

De Rosa, A. (2021). *Cecità del vedere. Per una storia alternativa delle immagini*. In corso di stampa.

Eraclito. (1980). *Frammenti e testimonianze*. a cura di Carlo Diana, C., Serra, G. (a cura di). Milano: Arnoldo Mondadori Editore/Fondazione Lorenzo Valla.

Flint, H. L. (1921). *The Heart: Old and New Views*. London: Lewis.

Friedländer, P. (2014). Alétheia. Un confronto dell'autore con sé stesso e con Martin Heidegger. In P. Friedländer, *Platone*. Milano: Bompiani.

Giammarioli, M. (2007-2008). *Il mito della caverna platonica nell'arte del Novecento*. Tesi di Dottorato di ricerca. Sapienza Università di Roma, AA. 2007-2008, relatore prof.ssa A. Sbrilli; correlatore C. Marrone.

Harvey, W. (1628). *Exercitatio anatomica de motu cordis et sanguinis in animalibus*. Francofurti: Sumptibus Gvilielmi Fitzeri.

Knipping, J. B. (1939-1940). *De Iconografie van de ContraReformatie in de Nederlandent*. Hilversum: Brand.

Heidegger, M. (1987). *Segnavia*. Milano: Adelphi.

Heidegger, M. (1997). *L'essenza della verità*. F. Volpi, H. Mörchen. (a cura di). Milano: Adelphi.

Herman, A. (2013). *The Cave and the Light. Plato Versus Aristotle, and the Struggle for the Soul of Western Civilization*. New York: The Random House.

Hirschmann, O. (1915). Beitrag zu einem Kommentar von Karel van Manders, "Grondt der edel vry schilder-const". In *Oud Holland*, vol. 33, pp. 81-86.

Knudsen, S. (2018). *Japanese Calligraphy: Shodo*. Copenhagen (Denmark): BoD.

McGee, J. L. (1991). *Cornelis Corneliszoon Van Haarlem (1562-1638): Patrons, Friends, and Dutch Humanists*. Leiden: Brill Academic Publishers.

Mecacci, A. (2006). *La mimesis del possibile: approssimazioni a Hölderlin*. Bologna: Edizioni Pendragon.

Murase, M., Barnet, S., Burto, W. (2002). *The Written Image: Japanese Calligraphy and Painting from the Sylvan Barnet and William Burto Collection*. New York (USA): Metropolitan Museum of Art.

Orenstein, N. M. (1995). *Hendrick Hondius and the Business of Prints in Seventeenth-Century Holland*, Rotterdam: Sound and Vision Interactive.

Platone. (2003). *Opere Complete. Volume 2: Cratilo, Teeteto, Sofista, Politico*. Roma-Bari: Laterza.

Platone. (2007). *La Repubblica. Testo greco a fronte*. M. Vegetti. (a cura di). Milano: BUR Rizzoli.

Sato, S. (2014). *Shodo. The Quiet Art of Japanese Zen Calligraphy*. Clarendon (USA): Tuttle Publishing.

Thesleff, H. (1982). Studies in Platonic Chronology. In *Commentationes humanarum litterarum*, 70. Helsinki: Societas Scientiarum Fennica.

Travers, M. (2019). *The Writing of Aletheia. Martin Heidegger: In Language*. Oxford-Bern-Berlin-Bruxelles-New York-Wien: Peter Lang International Academic Publisher.

Vegetti, M. (1999). *Guida alla lettura della Repubblica di Platone*. Bari: Laterza.

Veldman, I. M. (1990). *De Wereld tussen Goed en Kwaad late preten van Coornhert*. L'Aja: SDU.

Verwey, A. (1919). *Hendrick Laurensz. Spieghel*. Groningen: JB Wolters.

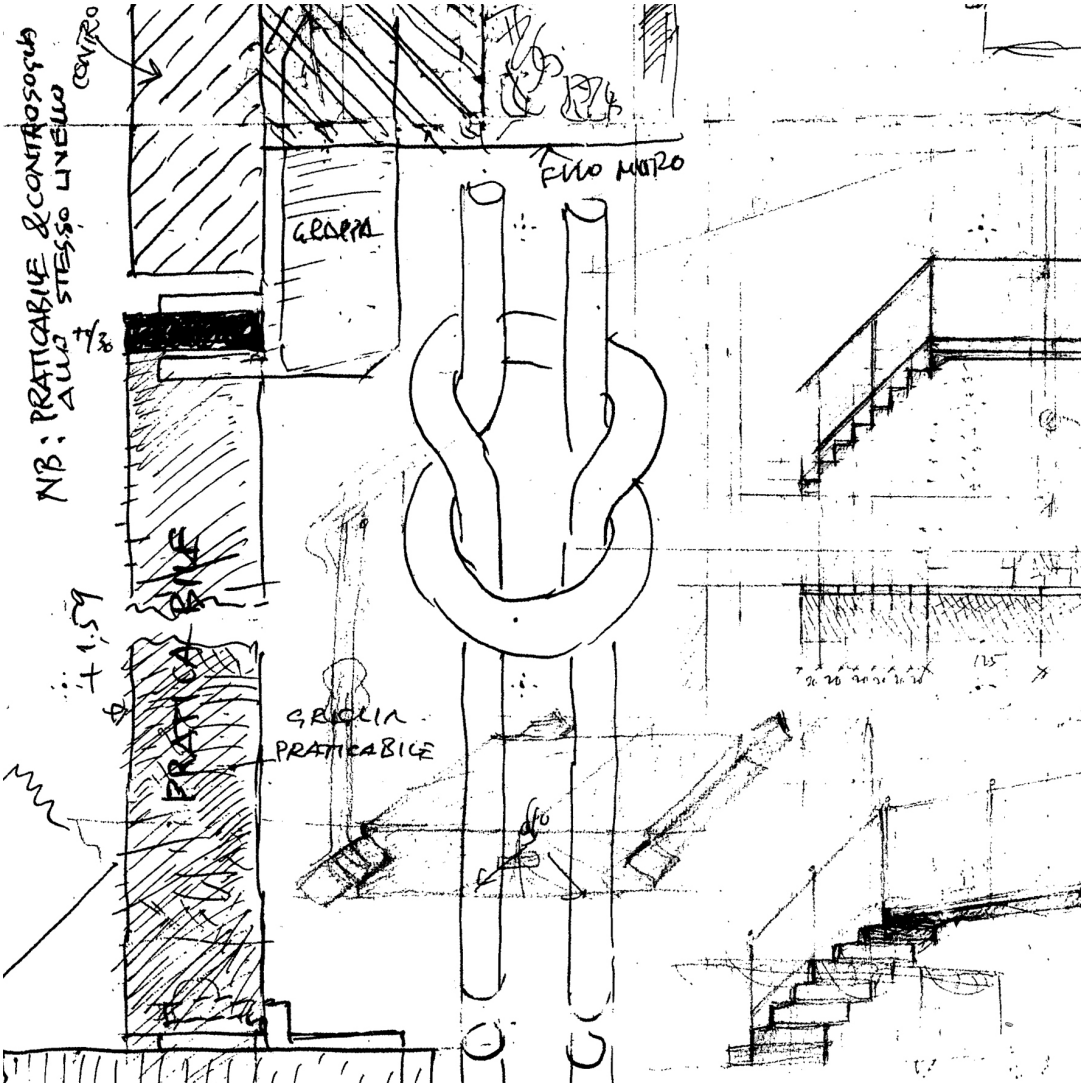
Vinken, P. J. (1960). *H. L. Spiegel's Antrum Platonicum: A Contribution to the Iconology of the Heart*. In *Oud Holland*, vol. 75, pp. 125-142.

Vinken, P. J. (1999). *The shape of the heart*. New York, Oxford: Elsevier.

Weddigen, T. (2003). Italienreise als Tugendweg Hendrick Goltzius' Tabula Cebetis. In *Nederlands Kunsthistorisch Jaarboek (NKJ) / Netherlands Yearbook for History of Art*, vol. 54. Leiden: Brill, pp. 90-139.

Love Knot

Mario Ridolfi



Mario Ridolfi's *Love Knot*

Massimo Mariani

My memories of Mario Ridolfi are infinite in number, all of them as clear, even in the smallest details, as those we preserve of our loved ones, of our teachers.
I can see him drawing *Casa Lina* and the *Love knot* in front of me; I always sat at the first table directly facing his desk. He drew with a fine-pointed Pelikan fountain pen on '*carta burro*,' a translucent tracing paper of minimal thickness used for architectural drawings, that allows you to superimpose successive ideas and correct them.
In his brown leather bag, Ridolfi kept his small bottle of black ink and a roll of this paper. I never saw him throw away any of the sheets of paper he had drawn on, not even the ones he rejected immediately because he was not satisfied with the solution.
And I was there, in front of him, learning to draw perspective views and observing him.

I went searching for Casa Lina in Marmore. I knew it very well, because I had seen it designed step by step. I found it, and it was perfectly identical to the one drawn.
The summer of 1984 was ending.
I needed to ask him for some important advice regarding my professional future. I needed my Maestro. I hadn't seen him for about twenty years.
I walked up to his door and looked in, calling out to him, hoping not to disturb. It was early in the afternoon.
He answered me, turning his attention away from a switched-on television that he was watching from a minimum distance, something I immediately found unnatural.
He politely invited me to come in and sit down and asked me who I was. Together we recalled our common past (his past… mine was irrelevant: I was only a former student of his course).

This article was written upon invitation to comment on the image of Mario Ridolfi, not submitted to anonymous review, published under editorial director's responsability.

On the white formica-topped table, to the left of the television, was a 'blueprinted' drawing of the plan of a building that, it seemed to me, already existed: in fact, it was a survey restitution, which he later told me was part of the ongoing project for the renovation of Ancona's City Hall.
The personal matters that had prompted me to go looking for him were completely forgotten when he confided to me, in despair, that he could no longer see.
He had completely recovered from the painful after-effects of the 'blow' to his hip, as he called the car accident in which he had been injured. The compensation, he told me, had enabled him to build Casa Lina. He was eighty years old, in good health, but blind.
I remember every word of our confidential dialogue filled with his suffering, but nothing could have led me to imagine his future, which was to end only two months later.
I must confess that what I remember most from those moments is that drawing, lying on the table, waiting to be taken up again and continued.
To the *Love knot*, a few thoughts from an episteme that accompanies me.
In this, the ideal beauty of form and feeling is revealed: sensitive vision becomes intellectual, philosophical and religious vision.
In Ridolfi's creation, the intimate qualities of the thought that formed it take on an important role and are perceived by the observer with his mind's eye.
Its beauty is 'true,' it is 'beauty itself,' it is in the domain of the intelligible not obscured by the 'imperfection of matter'; it is in the idea identified in an order of aesthetics, in the ontological universality that characterizes it. Its function is one that allows us to descend from the particular to the universal, to elevate ourselves from the imperfect to its essences of truth, it is 'abstraction as an epistemological mechanism that generates a creative power deflected from the real towards the universal.'
The *Love knot* was born from Mario Ridolfi's desire to give identity to a design that diversifies creative thought by drawing on his experiences and ascending towards aesthetic essence and feeling.
There is a distance between the observer and the 'knot,' the same distance that contains 'respect' and 'sacralization'; it joins beauty and the ethical dimension equally between the idea of 'beautiful' and 'good,' in symmetry, in consonance.
The 'knot' is an expression of Ridolfi's spirit, in which he has transferred his identifying presence, that does not imitate reality and that identifies the 'Kosmos' as ancient meaning, the same that gives us spatiality and temporality.
His creation moves us; its meaning sparks a unique feeling.
This work has a value, in the sense that it is the bearer of a value, that of the 'beauty' that Ridolfi has conferred upon it; a supreme value, such as the 'good' and the 'true' that become a metaphor for the 'goodness of the soul' and a symbol of the spiritual quest in feeling.
Ridolfi expresses himself between craftsmanship and philosophy, between the manual and the intellectual. And the beauty of his idea is alien to rational determinisms typical of the restitution of reality; it is an idea of inspirational free expression.

Credits

The *Love Knot by Mario Ridolfi* is taken from: Ridolfi, M. (1997). *Mario Ridolfi. Manuale delle tecniche tradizionali del costruire. Il ciclo delle Marmore, a cura di F. Cellini, C. D'Amato.* Milano: Electa.

Author

Massimo Mariani, Engineer and Architect, National Council Italian Engineers-Culture mandate, ricercheapplicate@libero.it

CONNECTING. DRAWING FOR WEAVING RELATIONSHIP

Prometheus. Theory and Technique

Sciences of Representation, Didactics, Integration of Knowledge

A Reflection on the Spanish Expresión Gráfica Arquitectónica at the Zaragoza Congress "*Pingui Minerva*"

José María Gentil Baldrich

Introduction

It is hard to choose a topic for intervening in a conference of this kind. It is a decision especially difficult if one wants to consider representing the general character of Spaniard assistants away from academic concerns and personal extravagances (as one may even say). Indeed, not everyone usually agrees about the great interest of these two aspects, although one is convinced of it. For such a reason, I have chosen a supposed 'survey' about the current studies and interests of the Spanish Expresión Gráfica Arquitectónica: a state of art's synchronous cut. Of course, there is no such survey. However, a procedure has been used: a contributions' analysis from the last congress of EGA. Such analysis allows access to a reflection similar to a survey and provides an approximate view of the whole. The last meeting of EGA titled *El Patrimonio Gráfico. La Gráfica del Patrimonio* (*The Graphic Heritage. The Graphic of Heritage*) was held virtually between the 4th and 6th of June 2020 in Zaragoza. The meeting was the number XVIII, a sign of continuity since the already distant first congress held in Seville in 1986. Before Seville, a previous meeting was held in La Coruña in 1984. Since the congress held in Valencia in 1990, the meetings started to be called 'International', as a way of expansion outside our borders. Nevertheless, 'International' is a bit pretentious denomination: these congresses should be called 'Hispano-Italians' or 'Italo-Hispanics', referring to the two core nations that support them. There is limited external participation: only a few Portuguese and Latin American participants can be found. Besides the quality achieved within the congresses and the naive use of English for a better diffusion, our works' incidence is very small in the Anglo-Saxon world if not non-existent. And I suspect that something similar must happen with the Italian congresses.

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editorial director's responsability.

The Spanish Expresión Gráfica Arquitectónica

In Spain, the Expresión Gráfica Arquitectónica Area of Knowledge comes from the fusion of old subjects from the traditional curricula: Descriptive Geometry, Technical Drawing and Architectural Forms Analysis. The theoretical reflections on graphic language were almost inexistent in the sphere of Spanish architecture before the 1970s. At that time, such a conceptual lack applied not only to our academic field but also to others. Back then, there were scarce but significant writings in the worlds of Architectural Composition or Architectural Project that inevitably had to incorporate (consciously or unconsciously) the graphic matter that supported their ideas. What could have been read in those years that affected our area of knowledge were either drawing cards or academic discourses. Today's Area of Knowledge was constituted and carried out in the first half of the eighties. The foundational theoretical body and the names of teachers who intervened in its consolidation and changed completely the situation have been written down and can be found [Gentil 2003; 2016; Montes 2010].
Nowadays the dissemination and development of the Spanish Expresión Gráfica Arquitectónica ideas are based on two pillars: the *EGA* Journal and biannual congresses. The former is directed by Ángela García Codoñer: it has been published since 1993 and it is already in its 40th issue. The journal has achieved a scientific prestige that makes it one of the most important in the academic world of architecture: it has been internationally indexed and is fundamental within the recognition of academic merits in Spain. Also, in 2013 it has been included within the Italian ANVUR as an A-class journal for the scientific sectors of architecture. Several bibliometric analyses of *EGA*'s production had been carried out [Linares 2010; 2015; 2018], providing an overview of addressed topics. Spanish journals like those in Architectural Composition or Project would also like to be included in similar considerations by following the example of *EGA*. Nevertheless, they do not reach the same level of recognition: the existing important journals to date are historical journals in arts and construction promoted by official bodies. On the other hand, the second important column is our biannual congresses, which reached the XVIII call in 2020. The number of academic papers presented in these meetings is higher than those presented in the journal, despite the former is held every two years. In fact, in the last celebrated encounters [Linares 2016], the number of presented articles approached two thousand.
Finally, in Spain, two other university organizations are sharing some common interests: those coming from the area of Engineering and those from the Building one. The former, INGEGRAF (Graphic Engineering) brings together the area of knowledge of Graphic Expression mainly from Engineering. The latter, APEGA (Graphic Expression Applied to Building) is present in the then Middle Degree Technical School and gathers indistinctly the two areas of *Expresión Gráfica* in Engineering and Architecture. Although these organizations do not have such a solid and continuous presence with their journals magazines as EGA, they have had plenty of activity holding congresses: INGEGRAF meets annually and has reached the XXIX meeting, while APEGA its XIV edition. The Italian presence has been common within these congresses. In particular, Vito Cardone was invited as a speaker to the last edition of APEGA to be held in Seville in February 2019. He sent the article although he could no longer attend personally to expose it, unfortunately [Llorens et al. 2019].
These areas of knowledge elaborated their bibliometric analyses as well, and they can be found and consulted [Rojas-Sola et al. 2008; López-Chao, Amado 2020]. It should be emphasized that unlike in Italy (I think), these organizations are completely separate from the architecture, although very often there is crossed collaboration among teachers due to their common interests.

A current analysis

Two main publications emerged from Zaragoza's Congress: a full edition published by Springer International [Agustín et al. 2020a], and a narrowed volume of proceedings published by the University of Zaragoza [Agustín et al. 2020b]. The former has three volumes with a total of 2032 pages and has been mandatorily written in English. To perform an analysis of a material with such a length would imply a disproportionate dedication, not even consonant with a general panorama. On the other hand, the unique volume of the proceedings brings together all the articles in 885 pages in a format limited to four pages per communication. In this case, the contributions have been written indifferently in Spanish, Italian and some in English, according to the choice of the participant. Paradoxically, it happens that in this reduced version appear 203 communications while in the extended publication only 173. Perhaps, this happens because some participants do not have sources enough for the translator. Note that a total of 266 articles appeared in the first seventeen years of EGA, which helps to realize the significance of the number of contributions used for this reflection [Linares 2010].

The above-mentioned bibliometric studies always emphasized a larger presence of the general architectural subject above the specific one for drawing. Yet, this latter subject should have been the predominant one by logical derivation of its name. The same happens with the communications collected in the Zaragoza congress, but this does not represent any surprise since it had already been expressed: "This means that our interests and fields of study are very broad, not limited only to Graphic Expression. Far from understanding this as a criticism, I believe that this is what one would expect. In fact, our teaching community is characterised by Architecture teaching and mainly for the training given by the profession, rather than graphic disciplines or the Area of Knowledge" [Montes 2010, p. 16].
The thematic section *Architecture* appears predominantly within the previously mentioned analyses. Nevertheless, it is established generically, usually without specifying the aspect in which these contributions can be integrated into the teaching of architecture. During the twentieth century, 'drawing' did not appear in articles' titles within the works on architecture. In contrast, it must be highlighted that nowadays 'drawing' (or some synonym) does appear in the vast majority, whether this is the main subject of the study or not. There is a large variety of particular cases. However, the heritage subject had a notable influence among Zaragoza congress' works. Even so, it is still feasible to do a reflection '*Pingui Minerva*' about them since participants have 'patrimonialised' their studies. I will refer to these topics excluding authors' names, as a full collection would both need an endless bibliographic reference and would go further a logical extension for this article.
There is a predominance of building studies and their different considerations among the Spanish and Italian architectural referred articles. It can be observed that many contributions of these studies would not differentiate this congress from another one hypothetically dedicated to the monumental restoration or the conservation of heritage. If this studies' rate follows, the latter consideration applies up to the extent that it might be soon difficult to find examples to be addressed. In general, specific aspects analyses of Renaissance and Baroque classical buildings abound among the articles. As well, there are modest constructions cases inserted in local areas and popular architecture of undoubted interest. A special mention must be made to the many architectural studies of the Modern Movement or later, both from famous architects (such as Le Corbusier, Wright, Scarpa, Kahn, Parent, Virilio, Toyo Ito, Bo Bardi, Foster etc.), as well as other less-known designers. The inclusion of this latter group relies on the historical

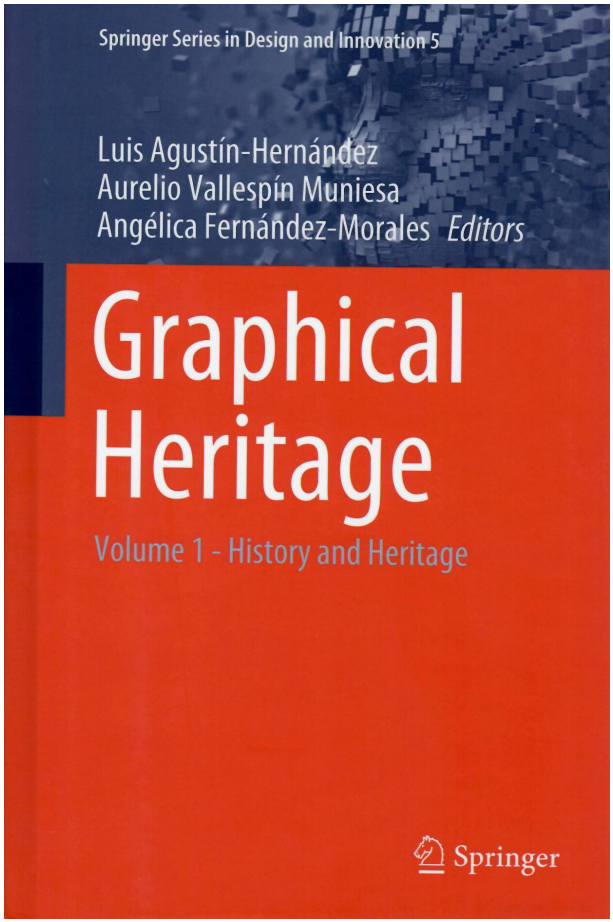


Fig. 1. Agustín Hernández, L., Vallespín Muniesa, A. Fernández Morales, A. (2020). Graphical Heritage: XVIII International Congress of Architectural Graphic Expression. Cham, Switzerland: Springer. [Agustín et al. 2020a]. Cover.

claim for its importance within their particular contexts. Very often, these works result in themselves an important contribution to the History of Architecture, although they were approached through the excuse of drawing. The selected examples have different variants from which we highlight: a first group containing built and existing buildings, a second one bringing together built but disappeared buildings, and a

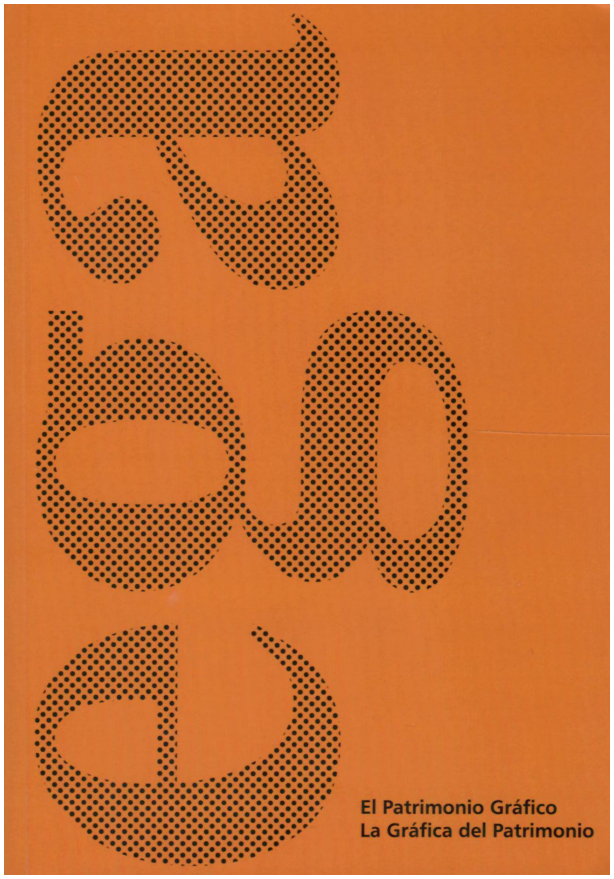


Fig. 2. Agustín Hernández, L., Cerveró Sánchez, N., Sancho Mir, M. (2020b). El patrimonio gráfico. La gráfica del patrimonio: XVIII Congreso Internacional de Expresión Gráfica Arquitectónica. Zaragoza: Universidad de Zaragoza. [Agustín et al. 2020b]. Cover.

third one gathering buildings neither built nor existing. The first group's buildings are normally collected during or after an intervention. These structures are usually surveyed with new technologies, then compared with previously performed analyses made using Graphic Expression techniques so to expose their final version. The second group gathers buildings fully or partially destroyed, that is, structures either not existing anymore or from which just some parts still remain. Since these buildings have disappeared, they are nowadays only visible through drawings and photos. Their historical vindication through graphic reconstruction is not devoid of nostalgia. The third group corresponds to buildings that never existed but that are interpreted and analysed from their existing graphic proposals. Such graphic pieces allow the visualization of what will or what could have been within the urban and historical areas of their time. Note that here Graphic Expression techniques are key for the definition and analysis. The new computer procedures also allow the graphical reconstruction in the form of 3D virtual models, especially in the second and third groups. But actually, these models are nothing more than animated perspectives in the computer in most cases. On some occasions, the 3D model is a previous step before the passage to a physical model with the help of CAM, yet they are much less abundant in the Fab Labs. Likewise, some communications also treat the architectural model as a project process' element. A separate group refers to Archaeology although is somehow connected to the previous ones. In this case, drawing always had a very important presence, equal or superior to photography. This happens since the representation is a partial and interesting interpretation of what we could consider the 'photo-chemistry point cloud' from traditional photographic printing (talking in a photogrammetric language). This latter group addresses several examples of archaeological remains from buildings, fortifications and cities. The examples belong mainly to the Roman period due to the Italian-Spanish character of the congress with the logical interpretation of the congress' celebration place: the Caesaraugusta city of Zaragoza. Nevertheless, there are also discussions about Moroccan, Egyptian and Armenian examples. This section opens up a clear field of activity for the Area of Knowledge thanks to the wide graphical interpretation capacity provided by both the old practices and the new technologies mastered in our academic field.

Moreover, there are studies of sites and places among Zaragoza's works: a great diversity of themes and approaches for analysing urban complexes such as landscapes, gardens and cemeteries. For example, landscape analyses go from visions in painting and historical prints to the reinvention of the Costa del Sol in Malaga. By its side, the gardens include examples from Madrid, Caserta, Tirana examples (among others). There are also articles studying general views and travellers' graphic routes (with the Way of St. James as a classic) up to the planimetric and historical analysis of some particular chosen typologies. Furthermore, some articles deal with the insertion of architecture into the landscape, rural architecture, towers and

isolated military defences and industrial constructions. Even, it is addressed the hospital typology through an example in Seville: the analysed healthcare establishment is still in use, despite being the oldest in the city and possibly in all Europe. Another interesting contribution studies panoramic views of the territory, made by the Italian CTV for gunnery shooting during the Civil War on the Ebro front (although it calls "*Comando*" to the "*Corpo*").
The landscape subject links to works dedicated to Cartography, territorial analysis and Urbanism, with a notable presence of urban complexes' historical maps studies. Among territory analyses, cartographic works of the Army's Geographic Service appear twice and there are also addressed cultural and tourist landscapes management, specific itineraries, agricultural fields of olive grove, the Roman Via Appia, etcetera. On the Urbanism side, there are studies about certain neighbourhoods with the application of the well-known graphic itineraries. Also, there are analyses addressed to the urban growths, citizen collaboration in the design, the Doxiadis' graphic-theoretical proposals and Sert's lessons in Harvard. There are even communications on territorial representations applications aim at the prevention of seismic risk.
Some contributions focus on some particular aspects of the construction and covering a wide catalogue: there are studies on pavements, locksmithery, ceilings, mural painting. An important theme in this section is stone cutting (stereotomy). The stonework trace has been previously treated on numerous occasions and it has been very present historically in Spain and France, yet less common in Italy. The Descriptive Geometry hogs exclusively these studies in Spain, ahead of any other area of knowledge. Effectively, there are three studies collected from three Spaniard groups of Descriptive Geometry researchers from Madrid, Cartagena and Valencia among Zaragoza's articles.
But the thematic set is even broader. It also encompasses purely theoretical and speculative analyses: the dance's immaterial heritage, furniture, color, graphic design, architectural journals, architectural typography, sketches and painting, gnomonic, structural geometry and cinema. In particular, the latter in its dual aspect of productions' ephemeral architecture, and the early films' translucent shadow image and their subsequent influence. There are also more sophisticated subjects, such as hands and pencils' presence in the image of architects. The data of the bibliometric analyses mentioned above gets confirmed: although drawing presence is generalised to a greater or lesser extent, the proportion of topics specifically dedicated to the graphic section is not the majority. Nevertheless, there are some communications on the traditional sketches' practice and *Urban Sketchers*. In particular, there are reflections about three significant draftsmen: José Luis Picardo (an Andalusian who was active in Madrid), Luis Berges from Jaén and the Mexican Jorge Tamés. These illustrators focus on gathering the architectural heritage and their contributions have an undoubtedly homage character both for the authors and for natural drawing.
There is an outstanding presence of new computer techniques applied to architectural representation, geographic and management techniques (e.g., GPR, BIM, GIS). Sometimes these works are specifically dedicated to some of these technologies. If this is the case, in most cases the work focuses on their use for the proposed topics. It is important to note that the architectural drawing's fundamental object in its broadest conception should not be overshadowed by the fascination for these modern tools. Sometimes the computer's results are very valid for being displayed on a screen, but difficult to interpret as a scientific communication's illustration, and above all not very aesthetic.
There is a final reflection to be made based on the provided studies' geographical location. There are themes and authors from Spain, Italy and Portugal. Other European references go to France (Le Corbusier's place), Albania, Montenegro and Finland. We also as European a reference to Russia for being Italian the author of project studied. As well, there is a big interest from the United States, Mexico, Costa Rica, Colombia, Brazil, Argentina, Armenia, Egypt, Morocco and Japan. Curiously, the Anglo-Germanic world is almost non-existent, except for a few theoretical references.

Conclusions "*Pingui Minerva*"

Does the thematic diversity described above imply a dispersion of ideas and motivations of the Spanish Expresión Gráfica? I think not, since the common denominator within the presented papers is almost always a reference to a specific and determined subject, even in the theoretical reflections. And architecture is a practical discipline whether we like it or not, even more in Spain. Indeed, the architecture in Spain also includes building Engineering which has to deal necessarily with specific problems. Other areas of knowledge have often drifted towards speculations that take them away from their essential tasks. These speculations bring them closer to Metaphysics, if not to Theology, hagiographies included. On other occasions they limit their interest merely to technical-legal questions or to philosophical and political ones: that is

to say, they can approach esotericism. It is not uncommon for us to find professors from other subjects outside strict drawing publishing (or trying to) in the EGA journal and participating in our congresses. This happens because when they have topics of interest, we are almost the only ones who pay attention to them.
To end, there is a paper quite indicative of the reached level that deserves a special comment and from which we have taken the Latin expression that heads this text: the one presented under the title *Pinguiore Minerva: una nota al Tratado de la Pintura de Leon Battista Alberti* [Montes 2020]. The subject has little to do with the congress' theme (masters usually write whatever they want), but it is a brilliant and original philological erudition on just a couple of words generally misinterpreted up to the present, which makes us see the incursion of Graphic Expression to other fields of knowledge. We take the meaning of the expression '*Pingui Minerva*' from this article: the sense of the sentence comes from the one used by the Genoese author in *De Pictura*: "Alberti is referring to the fact that he will deal with painting in a broad sense, in broad strokes, without too much depth" [Montes 2020, p. 41]. The sense that the treatise's writer gave to his painting exposition is the one we have wanted to give here to the reflection about the Spanish Expresión Gráfica.

Dedicated to Javier Seguí, who wrote for Zaragoza's Congress and left us while this text was being written.

Acknowledgements and Memories

First of all, I am grateful for the kind and (I believe, mistaken) invitation to speak at the UID's *Giornata di Studi*. I especially thank the UID's president Francesca Fatta, who allowed me to narrow down my talk into a written and more ordered report. I would also like to greet my dear and admired Mario Docci and to congratulate Luis Agustín for the magnificent documentation submitted for EGA's Congress. Last but not least, I express an emotional memory of Vito Cardone, a beloved friend who recently passed.

Author

José María Gentil Baldrich, University of Sevilla, jmgentil@us.es

Reference List

Agustín Hernández, L., Vallespín Muniesa, A. Fernández Morales, A. (2020a). *Graphical Heritage: XVIII International Congress of Architectural Graphic Expression*. Cham, Switzerland: Springer.

Agustín Hernández, L., Cerveró Sánchez, N., Sancho Mir, M. (2020b). *El patrimonio gráfico. La gráfica del patrimonio: XVIII Congreso Internacional de Expresión Gráfica Arquitectónica*. Zaragoza: Universidad de Zaragoza

Gentil Baldrich, J. M. (2003). Sobre el origen de las especies (gráficas). En Gámiz Gordo, A. *Ideas sobre análisis, dibujo y arquitectura*. Sevilla: Universidad de Sevilla, pp. 11-22

Gentil Baldrich, J. M. (2016). Para una crónica de la Expresión Gráfica Arquitectónica: los profesores anteriores a 1986/Towards an Account of Architectural Graphic Expression: professors prior to 1986. En Chias, P., Cardone, V. *Dibujo y Arquitectura - Disegno e Architettura - Drawing and Architecture*. Alcalá de Henares: Servicio de publicaciones de la Universidad de Alcalá, pp. 170-183.

Linares García, F. (2010). La revista EGA: 17 años, 14 números, 266 artículos. En *Actas del XIII Congreso Internacional de Expresión Gráfica Arquitectónica*, Valencia, 27-29 de majo de 2010. Valencia: Universidad Politécnica de Valencia, pp. 247-255.

Linares García, F. (2015). EGA. Revista de Expresión Gráfica Arquitectónica. Un análisis bibliométrico tras veinte años de su edición. En *EGA: Revista de Expresión Gráfica Arquitectónica*, nº 25, pp. 36-47.

Linares García, F. (2016). Los Congresos de Expresión Gráfica Arquitectónica en España: 30 años, 16 ediciones, 1.413 artículos. En *Actas del XVI Congreso Internacional de EGA*, Alcalá, 2-4 de junio de 2016. Alcalá de Henares: Universidad de de Alcalá, pp. 325-334.

Linares García, F. (2018). 25 años de EGA: ultimos indicios. En *EGA: Revista de Expresión Gráfica Arquitectónica*, nº 34, pp. 264-275.

Llorens Corraliza, S., Rincón Millán, M. D., Martín Pastor, A. (2019). *Avances en Expresión Gráfica aplicada a la Edificación*. Valencia: Tirant Humanidades.

Montes Serrano, C. (2010) Investigación, dibujo y conocimiento. En *Actas del XIII Congreso Internacional de Expresión Gráfica Arquitectónica*, Valencia, 27-29 de majo de 2010. Valencia: Universidad Politécnica de Valencia, Vol. I., pp. 15-22.

Montes Serrano, C. (2020). *Pinguiore Minerva*: una nota a Tratado de la Pintura de Leon Battista Alberti. En Agustín Hernández, L. et al. (eds.). *El patrimonio gráfico. La gráfica del patrimonio*. Actas del XVIII Congreso Internacional de Expresión Gráfica Arquitectónica, Zaragoza, 21-25 de septiembre de 2020. Zaragoza: Universidad de Zaragoza, pp. 39-42.

The Sphere between Stereotomy and Cartography. From Stony Traits to the Representation of the Cosmos

Alessio Bortot

Abstract

In the Murcia Cathedral there is an important repertoire of vaulted systems showing very refined structures and decorations which were built with stereotomic technique. The painter and architect Jacopo Torni (1476-1526) and the essayist Alonso de Vandelvira (1544-1626) are some of the personalities who were involved in it. This paper focuses on the drawings published in Vandelvira's treatise and analyses in detail two uncommon case studies in the field of this construction technique: the Capilla de Junteron's vault and the one covering the room of the anti-sacristy. A digital restitution of the case studies will then be offered, with the aim of highlighting the geometric genesis of their stone joint through the intersection between architectural volumes and fundamental geometric entities. The contribution is also intended to investigate the relationship among stereotomy, astrolabes and cartography. We would like hypothesizing how the tools for the observation and calculation of celestial phenomena (astrolabes and planispheres) may have been assumed as inspiring models for the subdivision into blocks of some vaulted surfaces. Celestial and terrestrial maps, assumed as projections on the plane of spatial models, could therefore have indirectly influenced the history of constructions through a logic of subdivision into blocks that would have solved the problem of the development of the sphere on the plane according to cartographic logics, or by approximating meridians and parallels to portions of ruled surfaces.

Keywords: stereotomy, cartography, Murcia Cathedral, vaulted systems, spherical vaults, Alonso de Vandelvira.

The vault in Capilla de Junterón

The Murcia Cathedral (Spain) is the outcome of an unwearying construction activity which started first from the building of Capilla de los Vélez in 1491 and lasted until 1570 [Gutiérrez-Cortines Corral 1987]. Among the main supporters of this project one can find the protonotary apostolic don Gil Rodríguez de Junterón (1480?-1552), a prelate who lived and worked in Rome for a period in the earlier 1500s. After the return to his homeland, Junterón decided to commission the construction of a funeral chapel named after him. Thus far it is considered one of the most impressive structures in the whole building complex in terms of formal complexity and decorative aspects. In general this Murcia religious complex represents the prime model of the Spanish stereotomic school which considers Alonso de Vandelvira (1544-1626) to be as one of the most important essayists. As it happens in the chapels built in the mid-20s of sixteenth century in the same cathedral, this funeral chapel shows a style which recalls Italian Renaissance: in particular it refers to the architectonic production by Filippo Brunelleschi (1377-1446), Bramante (1444-1514) and Michelangelo (1475-1564). This fact has not to surprise since many of these rooms have been created by the painter and architect Jacopo Torni (1476-1526) called Jacopo Fiorentino at the time [1]. In addition to this funeral chapel, Torni was also the author of the belling tower's first order, the sacristy, the antisacristy and the vaulted passage connecting the two en-

Fig. 1. Point cloud of Capilla de Junterón's vault obtained with the laser scanner Faro Cam2 (rendering by A. Bortot).

vironments. This text is going to describe some hypotheses on the potential geometric strategies to be used in order to divide the ashlars of Capilla de Junterón's vault and those in the anti-sacristy.
The Capilla de Junterón (fig. 1) is characterized by a rectangular plan surrounded by two semi circumferences on the shorter sides. This building plan is defined as an 'ovalada' or an imperfect oval by Vandelvira. At the time –in terms of composition considering such a mapping configuration– it was generally common to include a barrel vault covering the rectangular area and two quarters of sphere on the two borders of the remaining curvilinear parts. Torni's solution, instead, appears to be quite original: as a matter of fact it deals with an annular vault comparable to a quarter of torus resulting from the 180 degrees rotation of one of the semi-equator around the transversal axis of the impost (fig. 2a) [2]. This environment is lighted by some small windows which are on the vertical surfaces, but also by a cylindric lantern put at the centre of the vault's upper part. As it was already known in the Roman epoch, it was more common to use a semitorus covering the circular colonnade, but in that case the axis of the surface is oriented vertically like in the Mausoleum of Santa Costanza in Rome (340 ca.). In his treatise Vandelvira [de Vandelvira 1585c; Barbé-Coquelin de Lisle 1977] proposes to divide the surface through the use of two series of coaxial cones: the first series is characterized by a common vertex and a horizontal axis which corresponds to the transversal one of the plan; the second series is characterized by an axis which follows the same direction, even if it has varied vertexes [Calvo López 2005, pp. 123-136] [3]. The Spanish essayist agrees that the most useful method to obtain the stereotomic apparatus is the same used in *capilla*

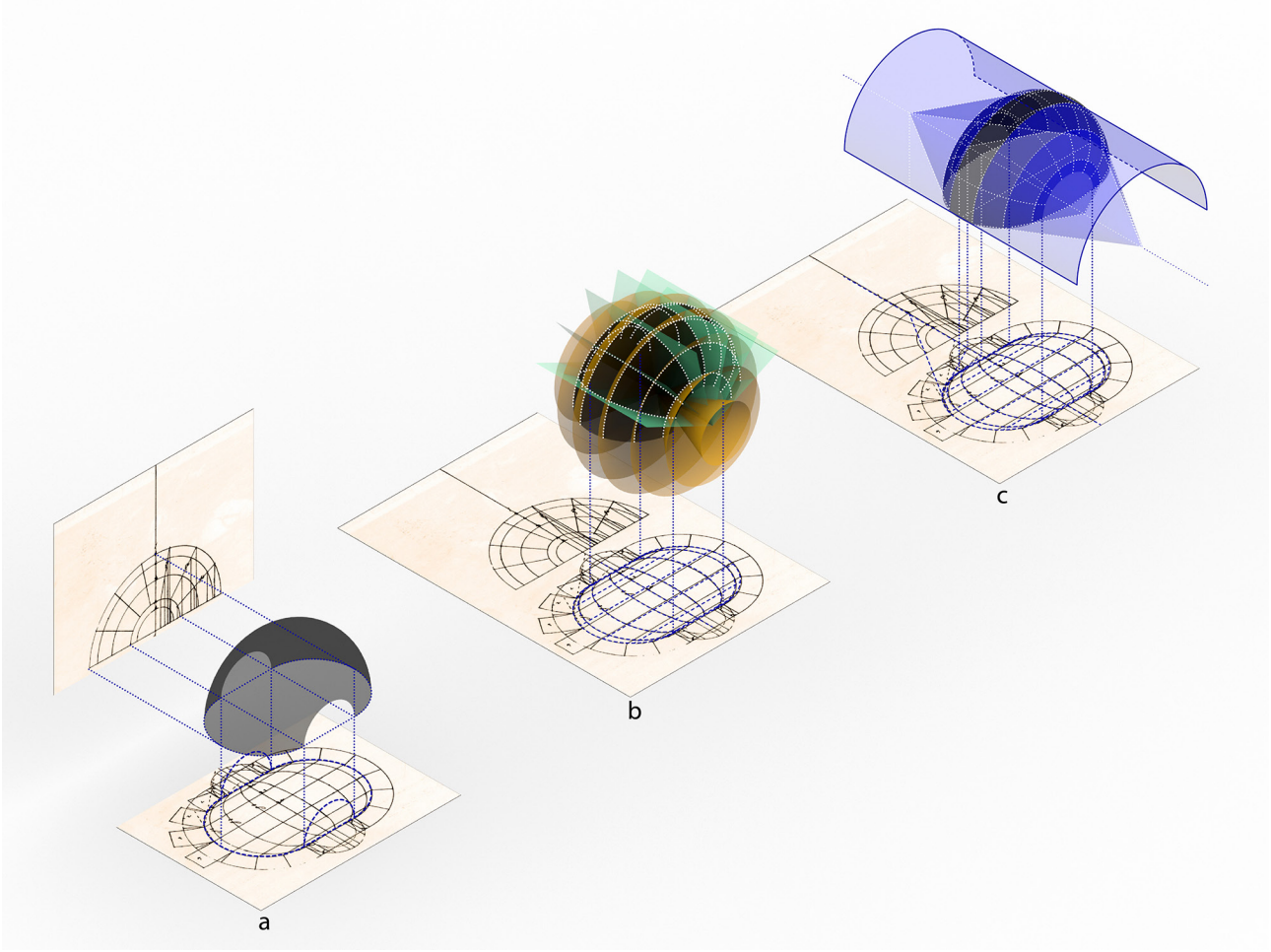


Fig. 2. Geometric reconstruction of the drawing by Alonso de Vandelvira (a), study of the subdivision of stereotomic apparatus into meridians and parallels (b), representation of the approximation of the intrados faces of the ashlars to portions of cones (c) (rendering by A . Bortot).

redonda en vuelta redonda or rather the hemispherical vault. Although both surfaces are considered to be the resulting rotation of the circumference around an axis, the solution –previously explained– causes a certain astonishment which has to be clarified. In the treatises of this period such problem is often repeated and refers specifically to the use of ruled surfaces, in order to make approximate the lower surface of every ashlar. In fact, since they are portions of spheres, are not developable and it's difficult to connect them to the so-called '*panneaux*'. So the examined cones will have a common axis and a variable vertex depending on the inclination of the generatrices that, while approaching the surface's equator, tend to be parallel to the axis of revolution. It emerges the extreme case close to the equator where the cone has an improper vertex, so it reduces the lower surfaces as portions of a cylinder (fig. 2c). In such cases the use of ruled developable surfaces became a common routine, a sort of geometric shortcut which was able to maintain an acceptable margin of approximation as demonstrated by other authors [Rabasa-Díaz 2000, pp. 174,175]. The problem certainly caught the scholars' attention, even if it was necessary to await the first decades of 1700s –in particular Jean-Baptiste de La Rue's work (1697-1743)– in terms of more refined geometrical solutions practically based on a method which could be defined as 'overturning' [Bortot, Calvo López 2020, pp. 21-34]. Anyway, the determination of the intrados surfaces of the stone blocks, approximated thanks to the generatrices of cones tangent to the various parallels that delimited the horizontal beds, was subsequently refined through the use of a tool called '*bevel*': it is a sort of a set square to be oriented towards the center of the dome, to which a further arm was hinged, whose profile was an arc of circumference [Palacios 1987].

The figures of Vandelvira's treatise which are combined with the description of the Junterón's chapel's vault are two. Both show their own surface by means of a couple of orthogonal projections (more in detail: an upper and a frontal view). While the first figure focuses on the projection of the ashlars' grout lines in a sort of mutual coordination, the second one proposes a rib decorative apparatus which can be integrated to the whole structure (fig. 3). The observation of the vault during the survey and the following analysis of the Spanish essayist's projections allowed us to speculate on geometric elements: after they have intersected the portion of annular vault, they can allow to define meridians and parallels. While intersecting a series of cones (in this case with a common vertex –corresponding to the centre of the ovoid– and an horizontal axis –coincident with the transversal one of the ovoid) with the portion of toroid, there is a generation of parallels which are comparable to the ones drawn by Vandelvira. Instead, through the intersection of a horizontal sheaf of planes, it is assured the production of hemicircumferences in the space which, after being projected onto the horizontal plane, show the meridians in the form of ellipse arches (fig. 2b). This latter is the closest solution to Vandelvira's drawing and, among other things –as we'll soon explain– it is the one that can be applied to the division of a hemispherical vault into ashlars. So this solution is able to offer a clear interpretation of the Andalusian essayist's statement concerning the supposed stereotomic analogy between spherical and annular vaults. In addition to the originality of the structure, the described vault surprises for its hyper-decorativism: pagan images, often uncanny, seem to wriggle and arise from the single stony blocks. Moreover they seem to allude more to a cathartic passage and to an ascesis towards eternity than a funeral dimension [Vilella 1998, p. 93]. The sculptural high reliefs show an inclination of the stereotomic technique in Spanish area which marks a meaningful difference if compared to the contemporary cases in French context. In fact,

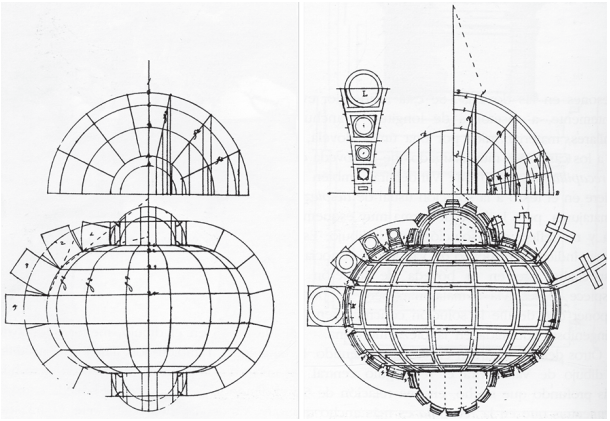
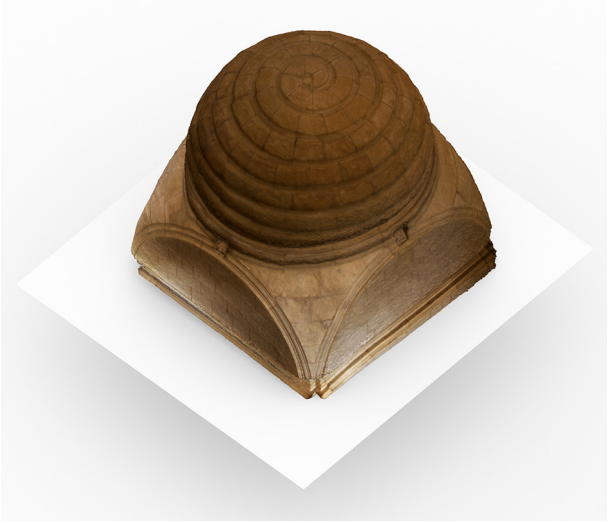


Fig. 3. On the left the drawing of Bóveda de Murcia, on the right the drawing of Bóveda de Murcia por cruceros, both illustrated in the manuscript by Vandelvira.

these ones often show a structural plainness without extra decorative elements. Finally, the complexity of this apparatus suggests that the plastic forms have been excavated when the vault was completed, and that therefore the individual blocks would have been oversized during the construction towards the intrados surface to be then carved in order to bring out the decorations.

The vault in anti-sacristy space

The vault covering Murcia Cathedral's anti-sacristy (fig. 4), built in the early 1600s, is connected to the treatise by Vandelvira, where it is described as "*capilla redonda en vuela capazo*". The hemispherical vault is placed on four spherical pendentives which are leaning against four arches, respectively following the walls which surround the square room. Probably due to the collapse of the first order of the belling tower during the construction, this structure has been subjected to meaningful changes which are currently visible. Although in 2001 the restoration smoothed the dissimilarities among the ashlars of the vault and among those in the pendentive of the north-eastern part. The survey allowed to observe the extrados surface of the dome through a secondary passage which represented the entrance to the room above the anti-sacristy. On the extrados surface the ashlars appear to be rough-hewn in a more precise way, in order to follow the spherical shape of the extrados like in a three-dimensional offset operation. Moreover one can find a binding agent which reinforces the connection of the joints, probably inserted during the restoration we previously mentioned.
It's a quite rare case of subdivision of a spherical cap into ashlars based on a helicoidal path of the blocks. As already observed by José Calvo López [Calvo López 2005], an illustration of this problem arises in Vandelvira's manuscript (fig. 5a) and in Philibert de L'Orme's text (1514-1570) [de L'Orme 1567], who defines it "*en forme d'une coquille de limaçon*" (fig. 5b). When comparing it with de L'Orme's figure, one can immediately notice a certain discrepancy, especially if Murcia vault is taken into consideration. In fact the height of the series is approximately the same: this fact brings to the thought that when projecting the drawing of the helix on the horizontal plane, a logarithmic spiral (the distance among its spires is bigger and bigger) and not an Archimedean one (the distance of the spiraes is constant) arises. As a matter of fact, if we obtained a counterpro-



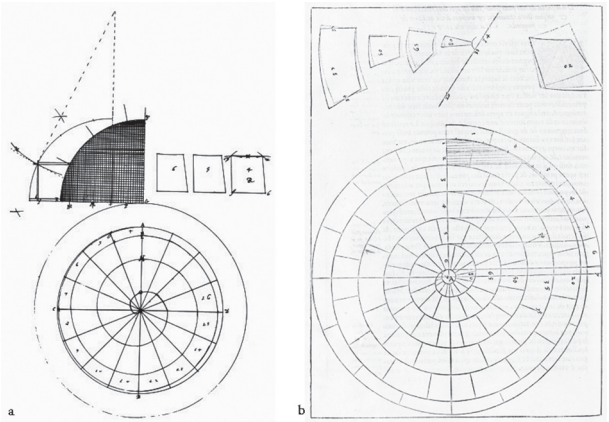
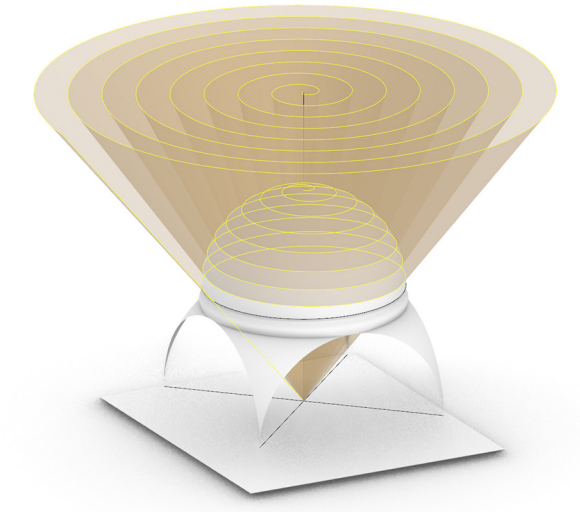


Fig. 4. Axonometric view of the textured model of the antisagresty vault obtained with photogrammetric methodology (rendering by A. Bortot).

Fig. 5. On the left the capilla redonda en vuelta capazo illustrated in the manuscript by Vandelvira, on the right La voute en forme d'une coqulle de limaçon illustrated in Le premier tome de l'Architecture by Philibert de L'Orme.



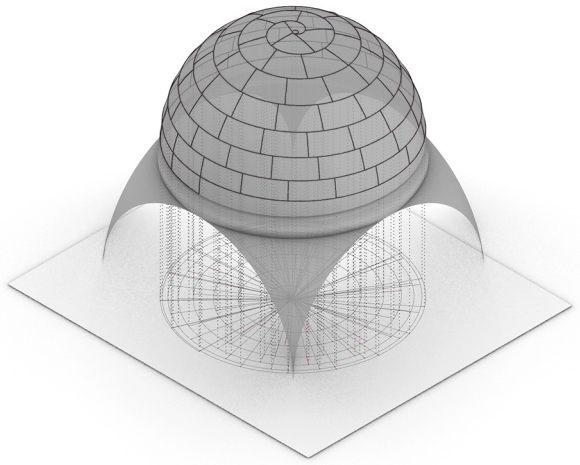


Fig. 6. Digital reconstruction of the spherical helix in order to obtain the bed joints of stone blocks for the antisagresty vault (rendering by A. Bortot).

Fig. 7. Digital reconstruction of the subdivision of vertical joints of the vault surface (rendering by A. Bortot).

jection of de L'Orme's logarithmic spiral from the impost towards the hemispherical surface, we would acquire a spherical helix with a variable height of spires, and so for the series of stone blocks. The graphical incongruity described so far, appears in both manuscripts (Ruiz 1560c) by Hernán Ruiz el Joven (1514-1569) and by Jean Chéreau (Chéreau 1570) –only to mention some of the authors who focused on this issue [4]. The analysis on Vandelvira's drawing carried out by Calvo López, illustrates, instead, how the figure represents the spiral of the planimetric projection starting from the spatial helix to be obtained. The procedure consists first in determining the height of every series of ashlars dividing the vertical section into equal parts, then in dividing the circumference of the plan into the same amount of blocks. From these points some straight lines are drawn towards the center of the vault, so the directions of the meridians –projected on the horizontal plane– are acquired on the spherical surface. Then, while projecting the sectors in section, it will be possible to pinpoint the constant distance among the turns of the spiral (in their first projection) on the straights lines previously identified that is to say, those which define the portions of the meridians. At this point it will be possible to draw the first projection of the spiral and know both the center and the distance among the single turns in a coherent way in respect with the vertical section. A spatial helix will correspond to this kind of spiral which can refer to the bed joints of the various blocks which, as a consequence, will be different from each other. The drawings by de L'Orme and the other authors already quoted, except for Vandelvira, are definitely unrealizable. It's unlikely that a stonecutter had agreed in working on a stereotomic sequential structure with different heights. Maybe it could have happened only for a precise static reason which, anyway, it is difficult identify in this specific case.

The digital reconstruction of Murcia Cathedral's vault is based on the geometrical analysis of this structure and the use of a textured mesh model of the intradox surface obtained from techniques connected to stereo-photogrammetry [5]. Considering the deformations of the vault due to the collapse of the belling tower during the construction, a first survey focused on the identification of the spatial curve which characterizes the bed joints. At the beginning we speculated on a loxodrome –well-known in the field of nautical science to chart the courses– able to join any two points on Earth's surface intersecting all the meridians with the same angle (instead, the complementary curve, called 'orthodromic distance', joins two points in their shorter

arc). Redrawing this element directly on the digital clone, allowed to show that the curve looks like a spherical helix, despite with a certain approximation. So the preliminary analyses allowed the reconstruction of a solid and rectified digital model of the anti-sacristy's vault and of the related subdivision into ashlars. The 'parallels' (as we simply define the joints lying on the spherical helix) have been obtained due to the intersection of the half sphere with a cone whose vertex has been placed at the centre of the square identified by the lower vertexes of the spherical pendentives and whose directrix is an Archimedean spiral with the same number of turns of those really existing (fig. 6). Instead, the 'meridians' have been obtained from the division of the cone's directrix spiral into the same number of existing segments, so drawing some straight lines which can connect every segment's endpoints to the centre of the curve. Then some portions of the straight lines (those included from a turn and the second one) have been projected onto the half sphere (fig. 7). Finally an offset operation of the intradox surface has been carried out in order to obtain the extrados surface, moving from a surface model to a solid, divided into ashlars (fig. 8) where every block has portions of cone as head ashlars and portions of planes as joint faces. The resulting digital model has partly rectified the structure's effective state of conservation except for the deformations due to the collapse of the tower. Instead, this model has followed the amount and shape of every single ashlar. For this reason it is not surprising, in some cases, the lineup among the vertical joints of the consequential series that –although less efficient from the structural point of view– are placed in the antigresty's vault in this way.

This case study highlights the great influence of Spanish stereotomic practice in French context: Jean-Marie Pérouse de Montclos states that "the simple comparison of sixteenth-century stereotomic apparatuses recognizes the eminent role of Spain as catalyst" [Pérouse de Montclos 1982, p. 212]. Yet, the same author affirms that the case of *capilla redonda en vuelta capazo* defined by de L'Orme as "*en forme d'une coquille de limaçon*", is simply a sort of caprice, a virtuoso subdivision of a hemispherical vault into ashlars: too complex to become a repeatable model. In fact there are a few analogous examples, although in Spanish area sometimes one can observe similar joints covering helicoidal stair-cases like the one in the tower of Palacio de los Guzmanes in León (second half of 1600s), or the one in Plasencia Cathedral or the other of Monastery of Santa Catalina in Talavera de la Reina.

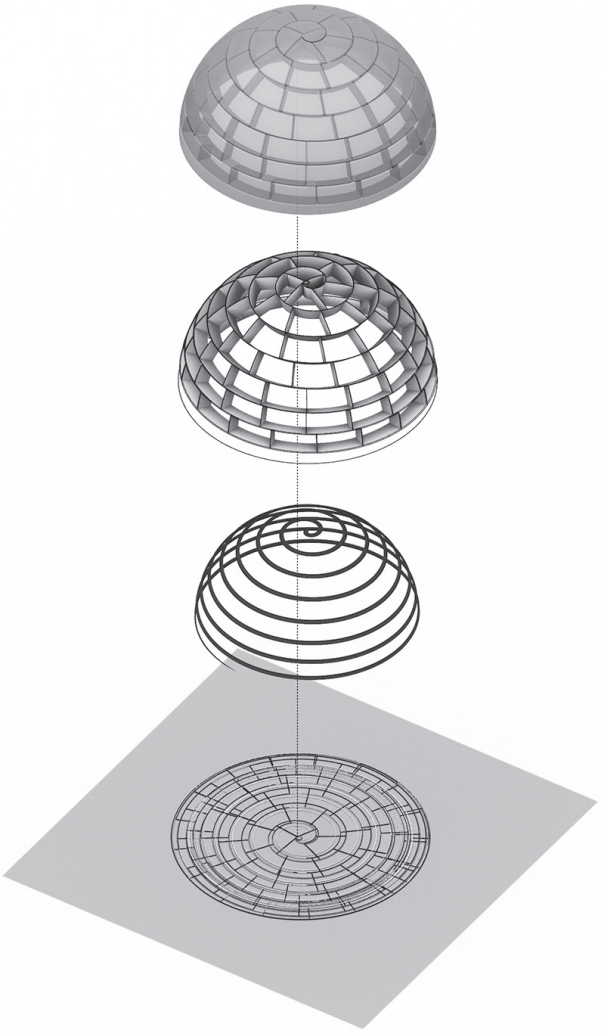


Fig. 8. Exploded axonometry of the anti-sagristy vault with the subdivision in stone blocks (rendering by A. Bortot).

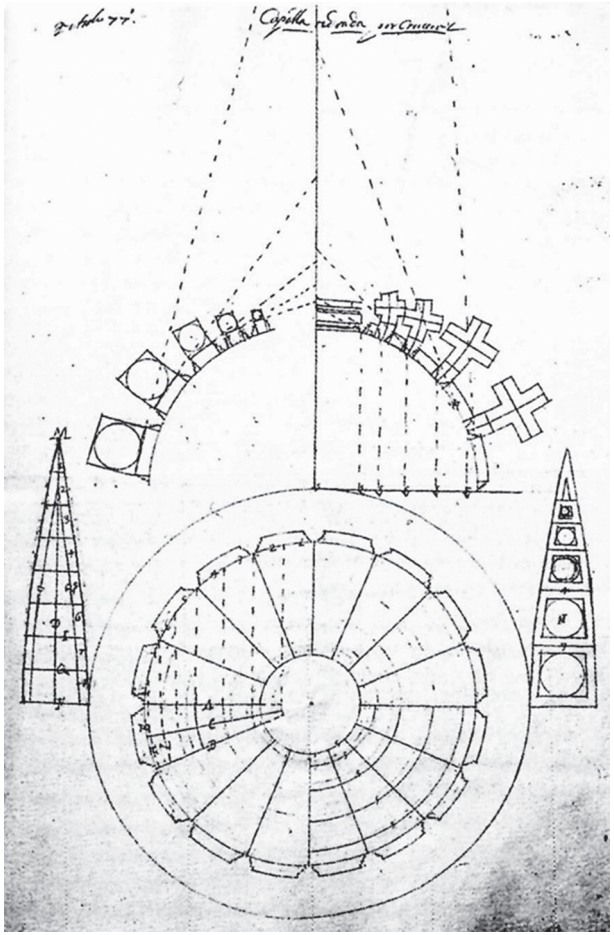


Fig. 9. A. de Vandelvira, Libro de trazas de cortes de piedras, p. 62 v.

Stereotomy and cartography

We know that Alonso de Vandelvira was responsible for the construction of the hemispherical vaults located over the corridors of the Casa Lonja de Mercaderes in Seville (1572) whose overall project was entrusted to Juan de Herrera de Maliaño (1530-1597), famous for his work during the construction of the Escorial (1594). The house, initially conceived as a place of exchange for merchants due to the routes that had opened towards the New World, will also become the headquarters of the General Archive of the Indies. In this place, however, not only economic transactions took place, but also cultural exchanges combined with new geographical representation and, more generally, to a new conception of the world. Vincenzo Minenna highlights in this context the cultural role of Seville city in the European context, declaring that in the Casa de Mercaderes "the theories on the spherical track of Pedro de Apiano's *Tratado de la Esfera*, the methods of cartographic measurement of Martin Cortes and the geographic representation through the use of planispheres were studied" [Minenna 2014, p. 32]. The same scholar points out an implicit relation between the spreading of these new representations of the world and the choice to replace with a series of stony sail vaults the flat wooden roofs of the interior of the Casa, designed for the first project. It is sure that among the leading figures in the Sevillian panorama of those years we can find Alonso de Santa Cruz (1505-1567), cosmographer of Charles V and Philip II, as well as author of the *Islario general de todas las islas del mundo* (1541) and coauthor of the *Padrón Real*, a secret geographical map for sailors, continuously updated according to the discoveries that took place in those years. Broadening the field of investigation to the European context, it is important to remember that in his *Underweysung der Messung* (1525) Albrecht Dürer (1471-1528) had already proposed a method –useful also for the realization of globes– to develop the spherical surface on the plane through its subdivision into slices, a solution which obviously imply a certain degree of approximation. Dürer's illustrations show significant analogies with those proposed by Alonso de Vandelvira for the *Capilla redonda por cruceros* (fig. 9), in which the portions of stone blocks between two meridians are developed on the plane according to a logic that seems near to the method of the slices suggested by the German painter and essayist.
As already observed by Francisco Pinto Puerto [Pinto Puerto 2000], an interesting geometric relationship can be no-

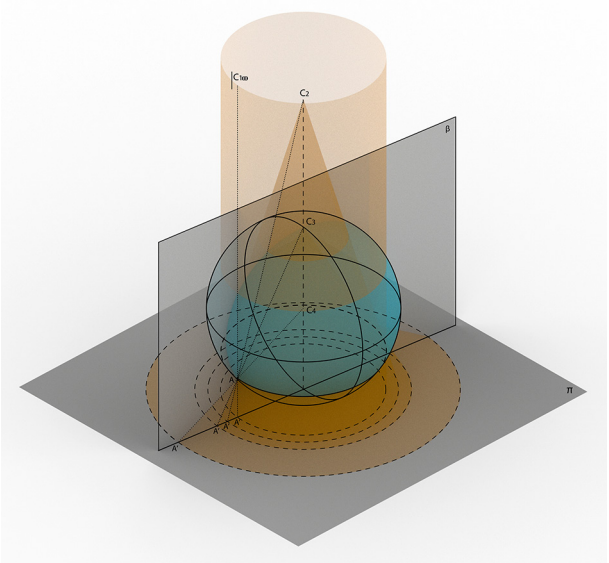


Fig. 10. Diagram in summary of the types of projection employed to obtain geographical maps.

ticed between the stereotomic solutions for the subdivision into ashlars of hemispherical surfaces and the geographical practices connected to the definition of nautical chart and terrestrial globes. In other words, the problem is obviously to transfer to the plane curves and surface portions belonging to the sphere, whether they are indicative of the *trait* for stereotomic cutting planes or the orographic profiles of the landmass. As a proof of this last observation, it will be enough, for example, to recall the previously described analysis relating to the Murcian vaults: the logic of meridians and parallels characterizing the Capilla de Junterón can be considered similar to a terrestrial or celestial globe. We can also suggest a hypothetical relation between the helical logic of the blocks for the vault of the anti-sacristy and the loxodrome curve used for tracing nautical routes.
We highlighted how the approximation of the spherical intrados surface thanks to the use of coaxial cones (with generatrices characterized by variable inclination) has allowed the architects of the past to approximate a non-developable surface to a developable one. In the history of cartography, since the classical era, various positions of the projection center and of the map plane were experimented in order to reduce as much as possible the level of distortion generated by the geometric process [6]. The evolution of cartography is therefore closely connected to the history of the concept of projection. In modern times, a cataloging of the so-called 'flat perspective maps' has been achieved, it is based precisely on the relationships between the position of the projection center [7] and the position of the plane of the map in relation to the sphere [8] (fig. 10). Analogously to what we have just observed in relation to stereotomic practices, also cartographers start to employ cones to approximate spherical surfaces. Instead of projecting directly onto a plane, it was therefore thought to employ quadric surfaces of rotation (cones and enveloping cylinders) which thanks to their geometric properties, can then be unrolled on the plane without tears. Among the most famous navigation charts obtained with the aforementioned method, we find the one by Gerhard Kremer (1512-1594), creator of the Mercator method which involves the use of a cylinder tangent to the equator of the globe and a centre of projection coincident with the centre of the sphere. This kind of projection is also called 'gnomonic'.
The adjective 'gnomonic' refers to another cartographic application, the representation of celestial vault, with explicit connection to the field of astronomy and to the realization of solar clocks (astrolabes): this proto-projective method was used by Thales of Miletus (636?-546? BC) for the tracing of his star maps [Snyder 1987, p. 164]. It could therefore be hypothesized that the main problem faced in this contribution –the representation on the plane of entities belonging to a spherical surface– can be traced back, not only to terrestrial cartography or even to stereotomy, rather than to the representation of celestial phenomena. The geometric cutting entities (cones and planes), used in stereotomic constructions and previously analyzed, could in this context be compared to same entities, made of light and shadow, employed in gnomonics since the Renaissance period to define the lines and curves of time (hour lines, meridians and celestial parallels, curves of the equinoxes and solstices, etc.).
"Any sundial is a precise projection of a sphere and its circles towards some surface or plane" [Maignan 1648, p. 46] states Emmanuel Maignan (1601-1676) in his treatise on gnomonics, referring to a tradition dated back to classical period. It is significant in this context the affirmation in the XV century of a method for tracing sundials defined as 'universal'. This method imposed to position at the centre of an armillary sphere, previously oriented according to the lati-

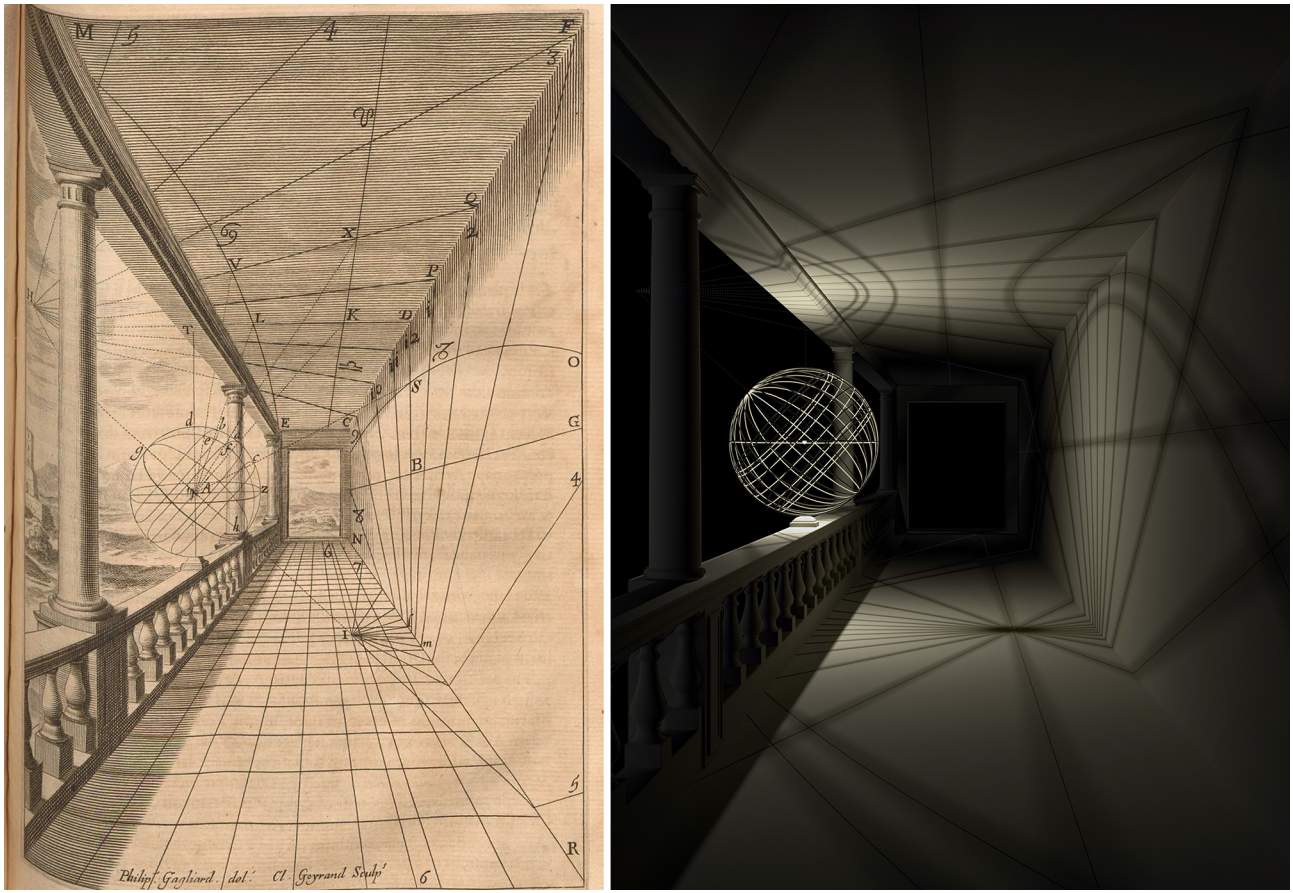


Fig. 11. On the left a drawing of the treatise by E. Maignan, Perspectiva Horaria… (Rome 1648), p. 334; on the right the 3d reconstruction of the same table with the simulation of the shadows cast by a point light source placed in the center of the armillary sphere, as suggested by Daniele Barbaro (rendering by A. Bortot).

tude of the place, a light source able to project the shadows cast by the instrument on the architectural surfaces chosen for the sundial (fig. 11). Among many illustrations of this device we find the one by Daniele Barbaro (1514-1570) illustrated in *La pratica della Prospettiva*… (1568), where in the place where the lamp should be –that is in the center of the sphere– we note the representation of an eye, to denounce the analogy between central and skiagraphic projections generated by a point light source. Finally, it could be observed how the gnomonic projection, probably the first to have been used in history, represents an ideal model of relationship between man and the cosmos: we have to think to the Earth as a point placed in the centre of an ideal celestial sphere, as we can see, for example, in the depictions of middle age treatises (fig. 12). The illustration, extracted from *De Sphaera* (1230 ca.) by Johannes de Sacrobosco (1195-1256 ca.), shows among other things the relationship between two surfaces already observed in this essay, the cone and the sphere, used by the astronomer to describe the phenomenon of the eclipse. In terrestrial cartography instead, man is positioned on the surface of the globe, he occupies the same space occupied by the entities that have to be projected onto the plane: a variation of the 'point of view' that seems even more significant. The stereotomic solutions relating to the *bóveda* proposed by Vandelvira could therefore have found a source of inspiration in a proto-projective geometrical model that shares a central point of view with the astronomical representations, where the geometric cutting entities are placed.
Finally, in Vandelvira's literary work –whose broad spreading as a manuscript is already known– it is possible to clearly perceive a certain inclination towards the practical solution of every single case more than a focus on the research of a general method. This latter will involve, instead, all the French authors of the following century. According to us the drawing of Murcia anti-sacristy's vaut (with some geometrical licences) shows a certain coherence due to the construction practice more than the pure speculation. Since it comes from an imaginative-projective habit which had developed in an epoch where project drawing had to concentrate on the solutions and not on the representation of its rigid execution. Finally, it seems plausible to suppose an underlying relation between the stereotomic solutions, referred to spherical vaults and the cartographic representations of earth and sky that embodied, in addition to geometric solutions, cosmological models able to affect the entire European culture.

Fig. 12. An illustration extracted from De Sphera (1550) by Johannes de Sacrobosco, p. B IIIr.

Notes

[1] On the biographic details referring to this author, there are only a few information. The main source is still Vasari's work, cfr. Vasari, G. (1568). *Vite de' più eccellenti pittori, scultori, e architettori*, Firenze: appresso i Giunti.

[2] A similar stereotomic case is found in the church of Santiago in Orihuela, not far from Murcia. In this case, the toroidal surface is characterized by a system of ceiling coffers that seem to follow the method proposed by Vandelvira for the subdivision into ashlars of this type of vault.

[3] Cfr. Trevisan, E. (2014-2015). *Intreccio strutturale e vertigine dello sguardo: tettonica, decorazione e attualità della stereotomia nella Cattedrale di Murcia*. Ph.D. Thesis (unpublished). IUAV School of Doctorate Studies in Venice, supervisor prof. A. De Rosa, a.y. 2014-2015, pp. 125-143.

[4] Similar drawings also appear in other manuscripts and treatises following the vault's construction in Murcia. For instance, one can refer to: Tosca, V. (1794). *Tratado de arquitectura civil, montea y cantería y reloxes*. Valencia: Hermanos Orga; de Portor y Castro, J. (1708). *Cuaderno de arquitectura*. Madrid: Manuscript, Biblioteca Nacional.

[5] The survey has been carried out through the use of a camera Nikon D800e equipped with 24 mm F1.4 aspheric lens. After setting ISO value to 200, we have taken 88 photographs in Junterón's Capilla and 33 in the antisagresty's vault. The images have been processed with the *Agisoft Metashape* software. The 3D mesh model has been scaled and oriented thanks to the point cloud obtained with the laser scanner Faro Cam2.

[6] The methods for the development of the sphere on the plane necessarily represent a distortion or approximation of it, we have to notice that no terraqueous map is at the same time equivalent (preserve the proportion between the distances), equidistant (maintain the relationships between the areas) and isogonic (preserve the angles, for example between meridians and parallels), compared to what is depicted on the globe's surface. The attempt to reconcile these attributes in the same map has determined over time the spread of different cartographic methods.

[7] We speak about orthographic projection if the centre of projection (a fixed point or a point at infinity) is outside the earth; we speak about stereographic projection if the centre is located on the earth's surface and finally we speak about central projection when the centre of projection correspond with the centre of the earth.

[8] Tangent to a pole, to any point on the sphere or to the equator.

Author

Alessio Bortot, Department of Architecture and Arts, Iuav University of Venice, alessio.bortot@iuav.it

Reference List

Barbé-Coquelin De Lisle, G. (ed.). (1977). *Tratado de Arquitectura de Alonso de Vandelvira*. Albacenete: Confederación Española de Cajas de Ahorros.

Bortot, A., Calvo López, J. (2020). Material construction and abstract geometry in the Traité de la Coupe des Pierres by Jean-Baptiste de la Rue. In J. Calvo López, A. Bortot, G. Piccinin (a cura di). *Geometria e costruzione. Stereotomia e configurazione in architettura*, pp. 19-31. Roma: Aracne editrice.

Calvo López, J. et al. (eds.). (2005). *Cantería renacentista en la catedral de Murcia*. Murcia: Colegio de Arquitectos de Murcia 2005.

de L'Orme, P. (1567). *Le premier tome de l'Architecture*. Paris: Morel.

de Vandelvira, A. (1585 ca.). *Libro de trazas de cortes de piedras*. Manoscritto, Biblioteca de la Escuela de Arquitectura de la Universidad Politécnica de Madrid.

Gutiérrez-Cortines Corral, C. (1987). *Renacimiento y arquitectura religiosa en la antigua Diócesis de Cartagena, Reyno de Murcia, Gobernación de Orihuela y Sierra del Segura*. Murcia: Colegio de Aparejadores y Arquitectos Técnicos.

Maignan, E. (1648). *Perspectiva horaria, sive de orographia gnomonica tum theorethica tum pratica libri quattuor*. Roma: Typis, & Expenfis Philippi Rubei.

Minenna, V. (2014). La mappa del nuovo mondo: dall'Archivio delle Indie agli spazi stereotomici generativi. In G. Fallacara, V. Minenna (a cura di). *Stereotomic Design*, pp. 30-37. Lecce: Edizioni Gioffreda.

Palacios Gonzalo, J.C. (1987). La estereotomía de la esfera. In *Arquitectura*, n. 267, pp. 54-65.

Pérouse de Montclos, J.-M. (1982). *L'architecture à la Française, XVI^e^, XVII^e^, XVIII^e^ siècles*. Paris: Picard.

Pinto Puerto, F. (2000). Transformaciones. De la línea a la superficie. In A. Graciani et al. (eds.). *Actas del Tercer Congreso Nacional de Historia de la Construcción*. Sevilla, 26-28 ottobre 2000, pp. 815-826. Madrid: I. Juan de Herrera, SEdHC, U. Sevilla, Junta Andalucía, COAAT Granada, CEHOPU.

Rabasa-Díaz, E. (2000). *Forma y construccion en piedra: De la canteria medieval a la estereotomia del siglo 19*. Madrid: Akal.

Snyder, J.P. (1987). *Map Projections - A Working Manual*. Washington DC: U.S. Government Printing Office.

Vilella, M. (1998). Jacopo Torni detto l'Indaco (1476-1526) e la cappella funebre "a La Antigua" di Don Gil Rodríguez de Junterón nella cattedrale di Murcia. In *Annali di architettura. Rivista del centro internazionale di Studi di Architettura Andrea Palladio*, n. 10-11, pp. 82-103.

Weaving Ontology. Patterns of Textile Structures from the Knot to the Digital Lace

Giorgio Buratti, Sara Conte, Valentina Marchetti, Michela Rossi

Abstract

One of the main design issues concerns the connection of components in artifacts. The ancient art of weaving presents interesting and relevant aspects, which apply to the field of design and architecture and emphasize the truth of Gottfried Semper's statements about the classification of materials and construction techniques.
The combination of digital technology and textile patterns derived from the development of the connective structure of the knot/button in the weaving and then in the lace, creates textile structures adaptable in many fields, in which the properties of the formal archetypes of weaving are found. In its development, weaving has always benefited from technological innovation, for example the invention of the Jacquard loom in the 17th century introduced the mechanical control of patterns with recursive algorithms.
Starting from the 16th-century tradition of Milanese bobbin lace, passing through the 20th-century interpretations within the schools linked to the Modern Movement up to the most recent interpretations, the research develops the application of structures generated by digital algorithms for the production of innovative artifacts through the revitalization of a heritage of ancient knowledge.
Once basic elements are defined, i.e. the weaving movements and the complete cycle to be repeated, it is possible to recreate the formal structure of the lace through the control of geometric parameters of shape and movement.

Keywords: node, algorithm, linking, weaving, visual modeling.

Introduction. Theoretical premises

Gottfried Semper, who demonstrated the relationship between *artificial forms* and the *specific working techniques* of the four categories into which the natural materials used in the arts are framed [Semper 1860, vol. I, pp. 9-12], argued that architecture learned the rules of style from the forms of used objects. Today we can add that, when industry replaced craftsmanship and the figure of the creator became disjointed from that of the maker, the same principles passed from Architecture to Design. The two arts were then reunited with the industrialization of architecture, until the digitalization led to the nullification of the differences of scale between different design categories, focusing again on the founding principles of basic Design [1].

The primary concepts of symmetry, proportion and movement, which reinterpret in construction the elementary laws of balance, are reflected in the three essential forms (knot, weave, fabric) that characterize the formal archetypes of weaving. This, considered as the first fundamental technique for the definition of the formal principles of style, regulates the artifacts' articulation according to a strict functional and performance reference. Unlike objects of use and manufactured products, architecture has always tended to develop hybrid models between the four constructive principles formulated by Semper: weaving, modeling, tectonics and carpentry. As underlined by the common root of the Germanic words '*Wand*' and '*Gewand*' ('wall' and 'garment' respectively), the

principle of re-wearing unites textile art with construction. Both are associated with the constructive principle of creating spatial structures by linking pieces of small dimensions. The connection of pieces or parts, in fact, is among the main problems of the project, which must balance technology and functionality, conditioning the aesthetics according to the terms of the Vitruvian triad of *firmitas*, *utilitas*, *venustas*.
Today, digital technologies offer control tools applicable in the design and construction phase, capable of renewing interest in the adoption of hybrid technological solutions. Starting from the fundamental construction archetypes, they allow the improvement of mechanical and hygrothermal performance of evolved products and construction components.
In particular, generative modeling methodologies allow the development of algorithms capable of transforming textile processes into advanced construction systems, applicable at different scales in multiple product sectors. The need to rigorously define the pattern parameters that govern textile algorithms in order to adapt them to the final form, renews interest in the principles expressed by Semper over a century ago. Digitization has reunified the process of design/representation/construction, but the possibility/need to optimize it requires its preliminary setting according to pre-established procedures, especially when these can be traced back to recursive operations. From this point of view, the weaving technique is particularly interesting both for the peculiarity of its structures and for their replicability in the fields of architecture and manufacturing industry. The reason can be traced back to some crucial factors articulated by the art of weaving since its archaic beginnings:
- the generalized importance of the connection of pieces in all construction processes;
- the structural characters of the fabric and its mechanical prerogatives;
- the aesthetic aspect and visual quality produced by the repetitiveness of textile structures;
- the great adaptability to different materials and systems.
Therefore, it becomes natural to start from textile structures for the definition of an operative methodology based on recursive algorithms applied to variable parameters. The first experimentation concerns the digital reconstruction of the structure acting on the metric dimensional parameters to simulate the adaptation to different formal situations. This matches with the design contents of the Drawing in its design nature, but the prerogatives of the parametric modeling allow today the simulated representation of other properties that allow to verify also performances independent of the geometry.
The primitive elements of weaving, the knot and the weave, which allow two or more filaments to be connected together, create elongated linear structures [Semper 1860, vol. I, pp. 18-87] from which arise respectively:
- the button and the sewing, the two anchoring structures that lock the relative position of two independent elements by making them integral;
- knitting, a fabric created from a single thread, and weaving, which extends the process in the two dimensions of the surface to a warping of yarns in multiple directions;
- embroidery and lace, in which the decorative vocation derives from the same constructive aspects of the weaving of the net.
The weaving and lace rework the three-dimensional binding of the knot [Semper 1860, vol. I, pp. 177-201], born from a movement of the rope in space to make two stumps solid with windings or overlapping, which is presented as the primitive structure that allowed the development of others. It is no coincidence that the art of knots, which is not only of interest to seafarers, includes a series of structures that can be classified according to the number of loops and their use (fastening, lengthening or attaching). Moreover, it is the mathematical study of a branch of topology that has generated the Theory of Knots, which studies closed curves intertwined in space, which finds application in biology, subatomic physics and molecular chemistry.
The knot fixes the beginning of elongated structures (braids) which in turn can generate mats and fabrics in which recursive regularity constitutes the main element of order and resistance, allowing the creation of characteristic patterns. The articulation of the signs of the interlacing/knotting of refoli in different directions determines on the surface a design that springs from the material and becomes form, combining the principles of construction and ornamentation (fig. 1).
From the 16th-century tradition of Milanese lace, of which traces remain in Cantù's lace and in Gio Ponti's publications, begins research that intends to experiment the applicability of structures generated by digital algorithms in the realization of innovative and sustainable materials and artifacts, reinterpreting an ancient art through digital tools and technologies.

Tradition and 20th-century reinterpretation

According to a Venetian legend, the first lace was made of sea foam and donated by sirens to a fisherman from the Burano island as a reward for his loyalty to his fiancée. The story reveals the origin of the lace, which evolves from fishing nets to become a decorative object: women in fact refine the plot by studying figures and refined geometries. Between the end of the Fifteenth and the beginning of the 16th century the needle lace of Burano spread in stately homes. Moreover, in the documents of property division between the sisters Angela and Ippolita Sforza Visconti (1493), the term '*tarnete*' is used to indicate braids, lace and trimmings, testifying their presence also in the Milanese area and since 1584 lace is among the teachings of the University of Embroiderers of Milan. In the second half of the 17th century the lace technique found wide diffusion thanks to the establishment, in the monastery of Santa Maria in Cantù, of teaching the use of bobbin lace to girls' groups. Then, this practice and the canturina technique spread to various schools including La Regia scuola d'arte applicata all'industria locale, founded in 1882. A few years earlier, in 1872, the School of Burano was opened in the lagoon area under the patronage of Queen Margherita, and in 1898 the Aemilia Ars was founded in Bologna, called the 'Society for the Protection of Decorative Arts and Industries of the Emilia Region', reflecting a growing interest in lace and needlework.

After the setback caused by the First World War and in opposition to the spread of machine-made lace, craft and industrial activities were relaunched by ENAPI (Ente Nazionale per l'Artigianato e la Piccola Industria, a National Organization for Crafts and Small Industry) and soon textile works became part of the Biennale di Monza and then of the Triennale, attracting the attention of various architects including Gio Ponti. Moreover, columns of a practical nature were born, alternating with writings about the art of embroidery and photographs of artifacts, demonstrating a growing interest in the phenomenon and an attempt to link it to the concrete needs of a less abstract public. *Domus*, *Stile* and *Fili*, a magazine founded in 1934 by Emilia Kuster Rosselli, contributed significantly to the diffusion and modernization of lace. *Domus* provided accurate reviews of the section dedicated to lace and embroidery at the Triennale of 1933, promoting the preparation of the Triennale of 1940, born "with the precise aim of realizing […] the most exhaustive and highest modern exhibition of embroidery

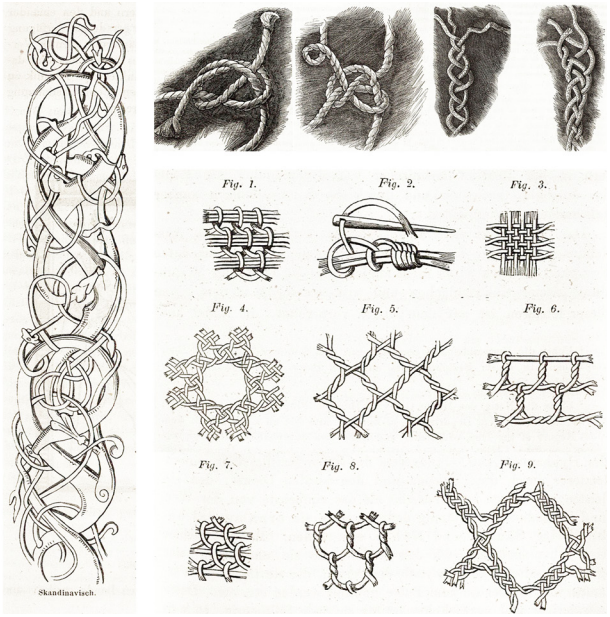


Fig. 1. Ornamental pattern. Textile structures. Abacus of knots, braids and nets. Images from Semper 1860, pp. 83, 180, 181, 184, 186, 187]

ever seen in Italy" [Ponti 1939, pp. 65, 66]. Starting from 1928, various examples of 'modern' lace were published, including those designed by the architect Giorgio Wenter Marini, who in 1931 took over the direction of the Scuola Canturina del mobile e del merletto (School of furniture and lace) with the intention of relaunching it. According to Ponti, the VII Triennale was an opportunity "to make the sense of a tradition shine again among us, a tradition that is not a limitation –that is, copy and imitation– but the living continuity of that prodigious Italian inventive spirit that has always amazed the world" [Ponti 1939, pp. 65, 66].

The researches of the 1930s focused on the abstraction and the geometrization of the drawing, without significant modifications in terms of materials; only from the end of the 1950s, after the new setback of the war, we witness on one hand the diffusion of lace and doilies made of plastic, where the innovation consists only in the application of the new material, and on the other hand diversified experiments that reinterpret the traditional practical technique moving away from it (fig. 2).

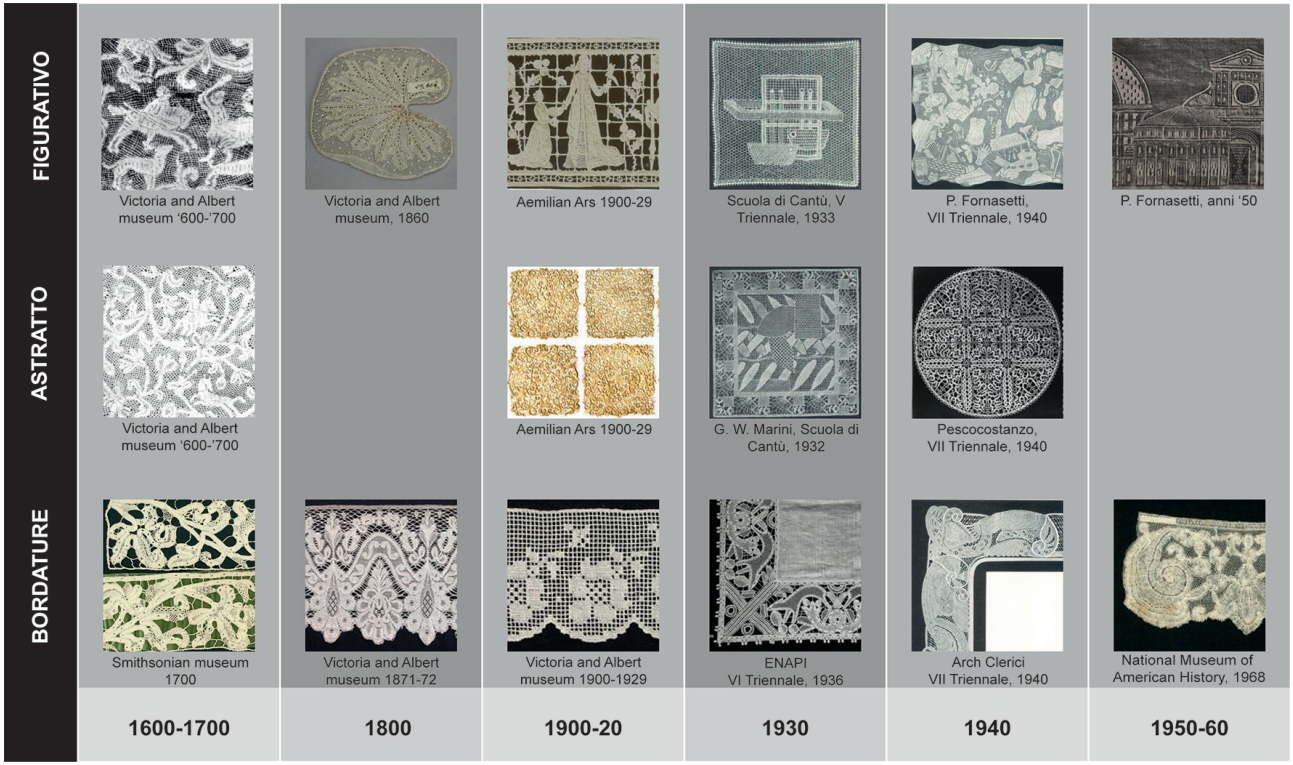


Fig. 2. Scheme of bobbin lace types (edited by V. Marchetti).

Carla Accardi's Tenda, in 1965, overcomes the two-dimensional limit of the canvas by creating a 3D environment in 'sicofoil', enriched by a dense weave of graphic signs. This refers to the traditional weaving technique reinterpreted through graphics and color. Other interesting works are developed by Franca Sonnino starting from the second half of the '70s. Here the weaves of iron wire and cotton thread recreate three-dimensional books, construction elements such as bricks, mosaics or abstract three-dimensional representations of architecture, countries or landscapes.
Since the early 90s, initiatives for the preservation of the lace tradition have proliferated, such as the Internazionale del merletto di Cantù and the related Merletti e Design. These initiatives see the collaboration between artists, architects, designers and lace makers to create innovative projects that enhance the craftsmanship, inserting it in the research of contemporary design [Guglielmetti 2015], culminating with the candidacy of the same for inclusion in the list of Intangible Cultural Heritage of UNESCO. In the last 10 years, the revival of traditional techniques and of the aesthetics of lace combines with new technologies. Serena Confalonieri presents in 2014 two lamps that exploit 3D technologies
reinterpreting the typical weaves of traditional Italian lace and goldsmith in sintered polyamide. The tradition, the universal language of geometry and the preordained and repeated patterns typical of lace are also the basis of the architectural elements of The Flying Mosque macro-installation in 2018 by Choi+Shine Architects. Finally, lace be-

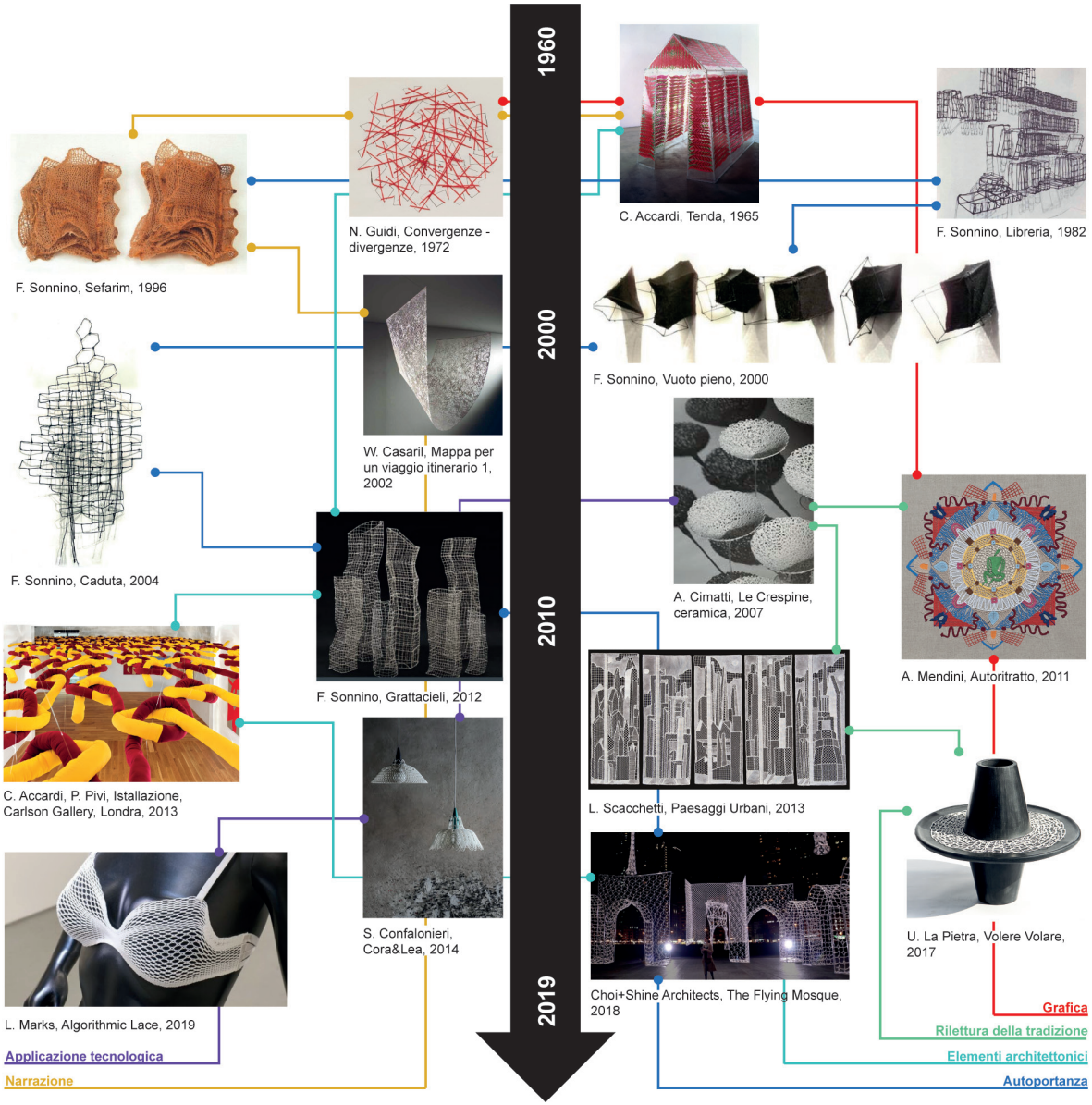
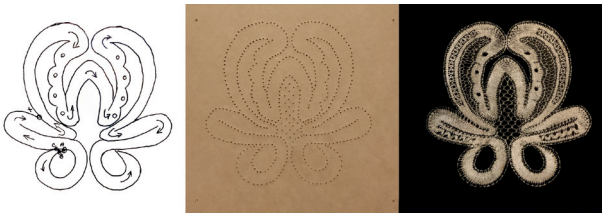


Fig. 3. Timeline of development and application: selection of case studies (edited by V. Marchetti).

comes a technical structure in Lisa Marks' project for a bra for mastectomies' women, in which algorithmic modeling generates a true three-dimensional lace, able to adapt to any anatomical shape: lace becomes structure (fig. 3).

The bobbing lace and the Lombard technique of Cantù lace

The bobbing lace is a hand-made textile artwork, realized weaving a pair of few single threads partially wound on bobbins at the ends, commonly called '*fuselli*'.
The weaving is worked on a cylindrical pillow padded with horsehair from which it takes its Italian name, '*tombolo*', and to which it is fixed with pins. The pins also block the several passages during the work progress. The threads traditionally used are linen, silk, cotton, or more particular metallic threads, while in modern creations materials of all kinds are used.
The bobbing lace can be subdivided according to the technique used to make it into straight laces, continuous braid laces and part braid laces or discontinuous laces. In the first case, the fabric is entirely executed simultaneously in both full and empty parts, called 'fillings', starting from a constant and sometimes very large number of bobbins. The continuous braid bobbing laces is executed with a limited and constant number of bobbins where the braid, following the drawing of a series of more or less elaborate patterns, constitutes the full part of the work; when different parts approach each other they are joined by thread passages with the crochet hook or bobbins, called 'seewings' or 'bars' and with more complex filling patterns. Lastly, the part braid bobbing laces or discontinuous bobbing laces used a variable number of bobbins, increasing or decreasing during the work following the drawing; the full parts, called 'braids', can be made by more than one single person, and then they are joined with crochet hook and filled in the empty parts by fillings, bars or nets.
Since its origins in the 15th century, the main feature of the bobbing laces in the Lombard area, the Milanese lace or Milano stitch, was the continuous braid lace or '*bisetta continua*' technique. This last tchnique is an antique one, which can be defined as the lace of the origins, illustrated by numerous drawings already in *Le Pompe*, one of the first and most popular books concerning lace patterns printed in Venice in 1557. The



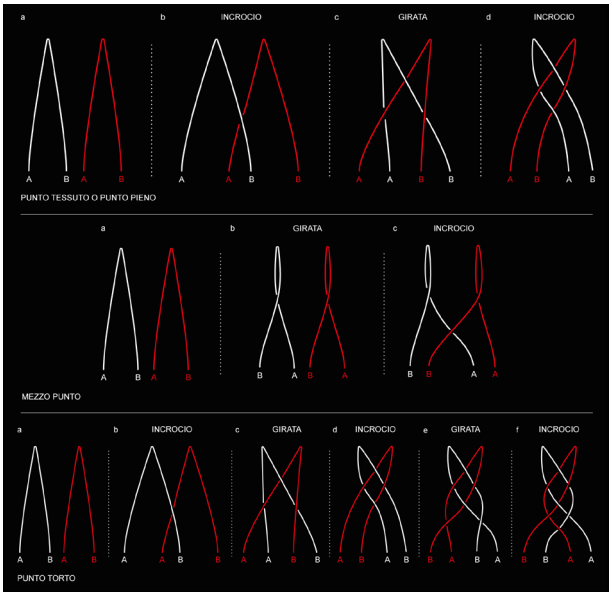
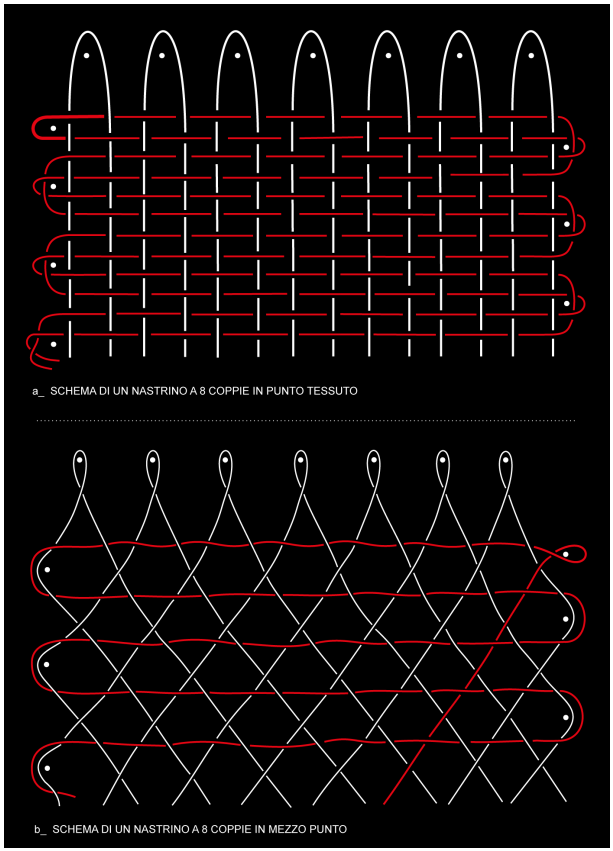


Fig. 4. Schematic drawing, trimmed cardboard, the realized motif (edited by S. Conte).

Fig. 5. Sequence of movements for the execution of basic stitches: cloth stitch or whole stitch, half stitch and turning stitch (edited by S. Conte).

weaving was compact and solid, fairly fast to execute, a characteristic determining, together with "the miracle of lightness" [Il girovago 1943, p. 3], its success over time. In the oldest Cantù laces that have come down to us, unlike Flemish needlace of that time, the braid was continuous and worked with cloth stitch, drew flowers and foliage with traditional ornamental patterns. Unlike needle lace, the Milanese did not require a bottom net to support the work and the different parts were joined together by bars during the work [Jourdain 1905, pp. 384, 385].
From the middle of the 17th century, the bottom net appeared in the processing and not applied afterwards, with the same base points to fill the spaces with cobwebs, fish, jealousy or Valenciennes patterns.
This specific type of lace is made following a graphic design on medium-weight cardboard by a designer using a defined code, in which the cross bars indicate the number of turns of the thread, the dots indicate the pins that hold the work in place and the circles indicate a specific basic stitch, the turning stitch. Then the trimmer perforates the cardboard, organizing the course and direction of the weaving, which will serve as a path for the lacemaker to create the weave (fig. 4).
At the beginning of the drawing some pairs of bobbins, usually in odd numbers and called passives, are hanged in line with pins, while the weavers pair, also called workers or leaders positioned lower than the vertical ones, will be worked alternately from side to side creating the braid [Read, Kindcaid 1988].
All the basic stitches originate from the use of two pairs of bobbins, a worker and a passive, working with *turn movement*, exchanging position of the threads in the same pair, and *cross movement*, exchanging position between the side by side threads of two different pairs.
The lacemaker thanks to the combination of these movement gives life to a weave that can be:
- compact with *cloth stitch* (or *whole stitch*), obtained by reproducing the sequence of *cross*, *turn* and *cross* movements;
- more sparse with *half stitch*, thanks to the scheme of *turn* and *cross* movements;
- open-worked with *turning stitch*, which is formed by a sequence of five movements between the bobbin threads (*cross*, *turn*, *cross*, *turn*, *cross*). This stitch is also used where the project requires the endorsement of work or the division of a braid (figs. 5, 6).



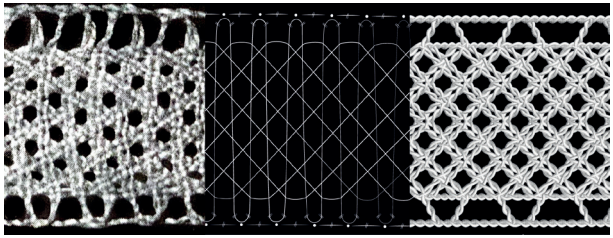


Fig. 6. Schemes of whole and half stitch braid. In red the workers and in white the passives; at the end of the row a double or single twist of the workers and the placing of the pin allows to start again with the work (edited by S. Conte).

Fig. 7. A traditional basketweave braid, drawn diagram and the digital algorithmic construction (edited by S. Conte).

In traditional Cantù lace, the succession of these simple codified sequences alternating with empty spaces has given rise to a great variety of braids, about 80 in number, which, combined according to consolidated ornamental patterns or new designs created by the creativity of the lace-makers, generate a practically infinite series of decorative motifs or patterns. Over time, the designs of the bezels have become much simpler, even abandoning their absolute continuity, but keeping the basic idea of decorative structure unchanged. This idea is reborn today in the re-elaboration of new languages, the result of design collaboration between ancient knowledge and contemporary design, capable of infusing the technology of mechanized production with the uniqueness of the workmanship.
Among the traditional geometric type of workmanship, the basketweave pattern [Read, Kindcaid 1994] presents some prerogatives, such as the self-supporting characteristics, the fabric robustness and its permeability, of great interest for application in various fields of design. The variety of stitches used in the construction also favored its choice to experiment with the automated generation of a braid through algorithmic modeling (fig. 7).

Digital Laces

The binomial combination of computational processes and textile production has attracted the interest of the industrial and academic world since the invention (17th century) of the Jacquard loom, which allowed the automatic handling of single warp threads starting from perforated cartons to set more complex weaves than those that could be obtained by hand. The technology has given a considerable boost to the textile sector: computational textile [Yi et al. 2007] has allowed solutions capable of improving the properties of washability and elasticity by promoting new functions. The result is the current variety of advanced textiles whose properties derive from the synergy between innovative materials and the study of the geometries that characterize the weave.
Representing textile morphologies through algorithms means understanding the combinations and sequences of characteristic knots, to translate the constituent and constructive elements into entities that computer can recognize and manage. The process involves the parameterization of the basic elements that determine the final result, making the digital modification of shape and size possible and facilitating the study of properties, functionality and manufacturability of the object. Through *Grasshopper*, visual algorithm editor associated with *Rhinoceros* (McNeel), the parameters that control elements, movements and recursiveness of simple lace, then assembled into articulated elements, have been defined:
- the basic braiding of 2 or more wires is obtained by dividing an *L* series of circumferences into 6 known points. These become the control points of an interpolation spline curve, defined by a 3rd degree polynomial function capable of maintaining, for each pair of points, the position and tangent continuity that characterizes the physical behavior of the textile fiber, simulating the helical trend of the braided yarns and controlling the parameters that determine the different types of braiding: thickness, turns and pitch of the helix (fig. 8);
- logical Boolean denial operators, linked to points *A*, *B*, *C*, *D*, *E*, *F* guarantee the non interpenetration of the surfaces and limit the variation of the thread thickness up to the tangent point, regardless of the number of threads. By modifying in cartesian space the curve on which the generating circles lie perpendicularly, it is therefore possible to obtain any type of geometry while maintaining and controlling the characteristics of the weave;
- the weft thus obtained defines the basic components of Cantù lace: by overlapping three or more threads it is possible to create finished products, but it is also possible to create load-bearing lattice structures, where ornamental finishes characterized by different geometry complete the composition.
The algorithm describing this interweaving exploits the previously told properties of the interpolation spline curve, bound at the extremes of the curve *AB* and at point *V*, projection of point *M* in the *xz* plane, which lies on segment *AB* belonging to *xy*. By making *M* a variable between the values of the length *AB* and *MV* a variable in a range between 0 and infinite it is possible to modify the morphological characteristics of the curve. By modifying the curve on which the generating circumferences lie, it is possible to obtain the desired geometries. The rototranslation with respect to point A creates a sinusoid whose waves are bound to the variable points *M* and *V* and to the symmetry itself. With two other translations by symmetry, it is possible

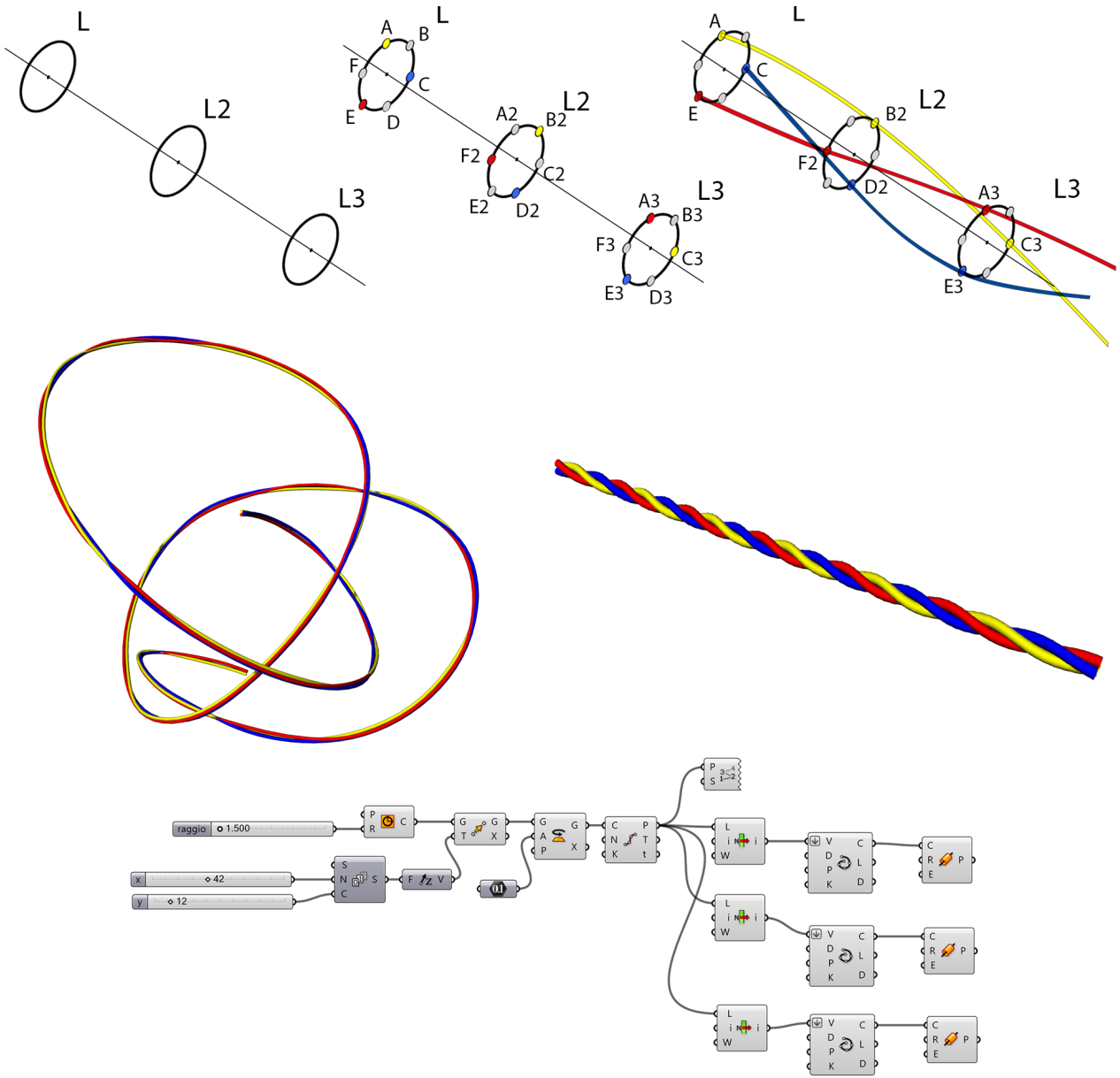


Fig. 8. Algorithmic construction of the braid (edited by G. Buratti).

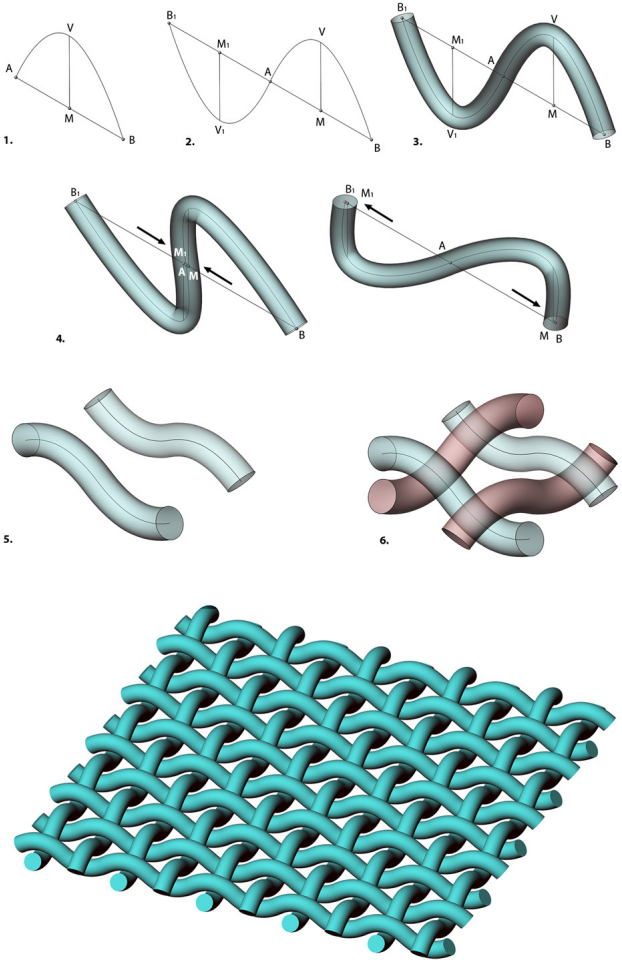


Fig. 9. Armor definition algorithm. Algorithm for defining the weave. The parameterization of M and M1 allows the modification of the morphology by simulating the textile reaction (edited by G. Buratti).

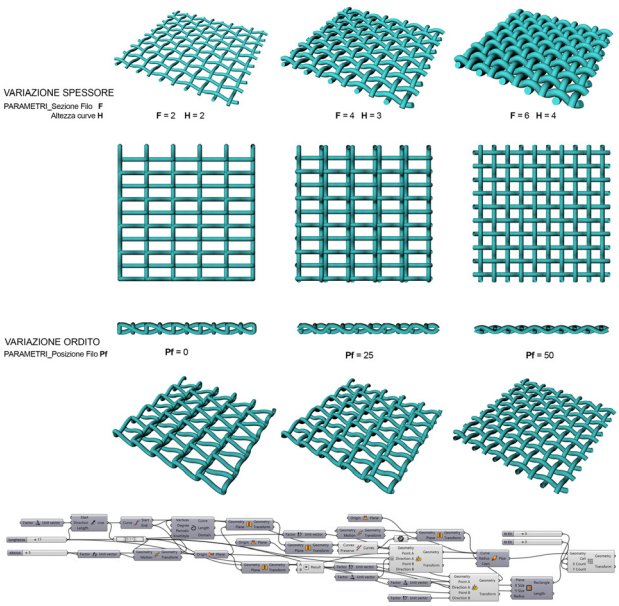


Fig. 10. By modifying the different parameters, it is possible to obtain morphological variations and texture density (edited by G. Buratti)

to obtain the basic unit of the armature, i.e. the sinusoidal braiding between the weft (fig. 9) and the warp of the Cantù lace.
By changing the parameters and extending the common characters, the algorithmic writing generalizes the totality of possible cases. It is possible to create weft, chain (fig. 10) or three-dimensional structures and the latter, so far little investigated for the productive and morphological complexity, present interesting structural properties also for sectors other than textiles (fig. 11). The structural elasticity of the weaves, which does not depend only on the material, allows them to act as springs and for this reason the stresses are absorbed at a structural level affecting the material to a lesser extent.
The possibility to control with the computational design the yarn configuration, in synergy with highly automated production processes that can give materials new performances of lightness and resistance, offers interesting application perspectives for architecture and design, but also in aerospace or medical field.

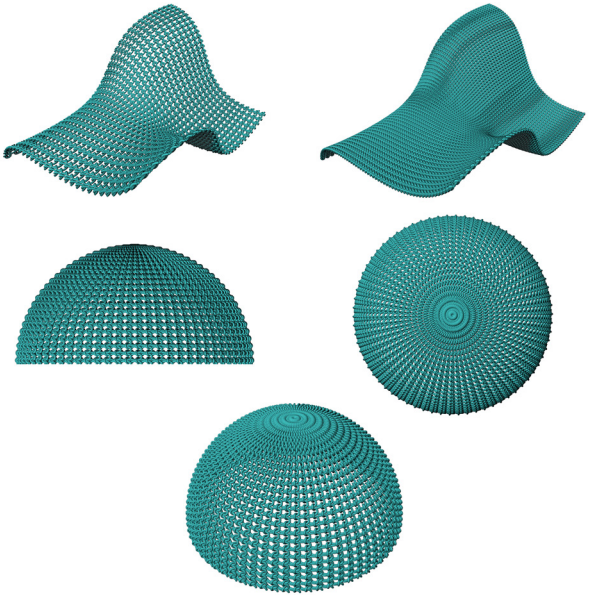


Fig. 11. Three-dimensional studies for the geometric adaptation of the weft for a strange surface and a spherical cap (edited by G. Buratti).

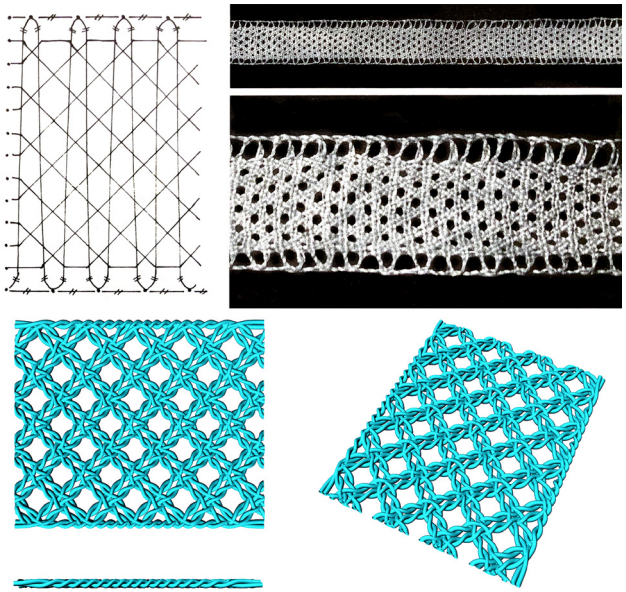


Fig. 12. Partial reconstruction of a basketweave braid (edited by G. Buratti).

Conclusions. Old lace and new materials

The work here presented is the first result of a research in progress that aims to introduce parametric tools for industrial innovation starting from the valorization of ancient arts and manufacturing. This is intended not only as a preservation of past models, but as a contemporary reinterpretation of patterns that are still current. In order to overcome the crisis triggered by the exhaustion of economic mechanisms based on increased consumption and the delocalization of production, it is necessary to enhance the value of tradition aimed at the application of processes capable of providing more effective solutions in terms of performance, use of materials and ecological and economic sustainability.
The knot, the interlacing and the weaving develop the modular approach and the geometric rules of the surface and, together with the symmetries of space, constitute a theme of theoretical (mathematical) and project (design) research. The geometric structures used in the laces refer to the investigations of Maurits Cornelis Escher, Richard Buckminster Fuller e Roger Penrose on modular grids, on the symmetries of the lattices at the basis of spatial constructions and on the rules of plane and three-dimensional tessellation.
This also allows to underline the close link between weaving, architecture and applied arts, considering the importance of the textile principle applied to the project. The various scales of application of the formal principles of knot, weave and fabric and their reworking for application in multiple fields represent a valuable source of references for the transposition of traditional lace techniques to different scales. The contemporary diffusion of digital tools don't deny but does reaffirm the importance of the primary constructive principles, and it underlines the value of the introduction of new digital applications to the basic elements of weaving.
The deepening of the constructive processes of the Milanese lace and the investigation of the properties of lightness and complexity of the structures realized

according to this tradition constitute the cultural substrate of departure for the application of computational processes. The digital control of geometry favors the diffusion of a past cultural heritage both as a model for the creation of new materials, structures or products, and for the valorization of traditional techniques and intangible cultural heritage.
Ancient techniques together with modern tools allow to reinterpret the lace through applications not only aesthetic but also structural, since –as Semper teaches– there is an indissoluble link between material and processing technique. The characteristics of lightness, permeability and resistance, typical of the Milanese lace, can be translated under new guises in the study of moldable, flexible, elastic and responsive materials. The manipulation through the new tools of design and production of formal parameters, such as the variation of the section of the 'thread' or of the size of the 'binding', allows the realization of innovative structures on a small or large scale previously impossible. Architecture can take advantage of this by imagining flexible elements, mass-producible and endowed with peculiar characteristics that are not only formal and aesthetic, but also structural and economic.

Note

[1] Although the contribution was conceived jointly, Michela Rossi is the author of the paragraph *The theoretical premises*; Valentina Marchetti is the author the paragraph *Tradition and twentieth-century reinterpretation and the related images*; Sara Conte is the author of the paragraph *The bobbing lace and the Lombard technique of Milanese lace* and the related images; Giorgio Buratti is the author of the paragraph *Digital Lace* and the related images. The conclusions were drawn jointly.

Authors

Giorgio Buratti, Department of Design, School of Design, Politecnico di Milano, giorgio.buratti@polimi.it
Sara Conte, Department of Design, School of Design, Politecnico di Milano, sara.conte@polimi.it
Valentina Marchetti, Department of Design, School of Design, Politecnico di Milano, valentina.marchetti@polimi.it
Michela Rossi, Department of Design, School of Design, Politecnico di Milano, michela.rossi@polimi.it

Reference List

Guglielmetti, I. (2015). Cultural Design: un tentativo interdisciplinare sperimentato nel progetto. Design al tombolo. In *Antropologia*, vol. 2, N° 2, pp. 141-156.

Il girovago (1943). La scuola di Cantù. In *Fili*, n. 113, maggio 1943, pp. 2-7.

Jourdain, M. (1905). The Lace Collection of Mr. Arthur Blackborne. Part IV - Milanese Laces. In *The Burlington Magazine for Connoisseurs*, vol. 6, No. 23, February 1905, pp. 384, 385, 388-391, 393.

Ponti, G. (1939). Per l'affermazione delle industrie femminili italiane. In *Domus*, n° 139, luglio 1939, pp. 65, 66.

Read P., Kindcaid L. (1988). *Milanese Lace. An introduction*. London: Batsford.

Read P., Kindcaid L. (1994). *New Braids and Designs in Milanese Lace*. London: Batsford.

Semper, G. (1860). *Der Stil in der technischen und tektonischen Künsten oder, Praktische Ästhetik. Ein Handbuch für Techniker, Künstler und Kunstfreunde*. Band 1: Die textile Kunst für sich betrachtet und in Beziehung zur Baukunst. Frankfurt a.M: Verlag fur Kunst und Wissenschaft [Trad it. parziale in *Lo stile nelle arti tecniche e tettoniche o estetica pratica*. Bari: Laterza, 1992].

Yi, L. (2007), Computational Textile Bioengineering. In Xianyi Zeng et al. (eds.) *Computational Textile*. Berlino: Springer, pp. 203-221.

Algorithmic Approach for the Application of Graphic Standards in the BIM Environment

Matteo Del Giudice, Emmanuele Iacono

Abstract

In the era of digital connection, the construction industry is crossing a transition that involves numerous aspects, related, among others, to the representation of the building artifact. Information and Communication Technologies (ICTs) in the construction process stimulate the adoption of innovative methods and tools aimed at communicating the design idea, shifting the focus from the digital drafting machine to the information model. The adoption of Building Information Modeling (BIM) is triggering a radical inversion of perspective, such that the development of a parametric 3D model allows the generation of a series of coordinated drawings, avoiding information redundancy and consequent inconsistencies. Traditionally, the production of design content takes advantage of standards and graphic conventions, inherited from information modeling tools. The contribution aims to develop a critical approach on the current capabilities of collaborative BIM models to produce such documents, as part of the construction process. This study is part of a broad field of research focused on optimizing the building process by improving the connection between tradition and innovation in the science of representation.

Keywords: Building Information Modeling, Visual Programming Language, graphic standards, connected BIM, algorithms.

Introduction

The digitization of the construction industry has seen a significant acceleration in recent years, largely due to the influence of the development of the so-called Information and Communication Technologies. It is an innovation process that does not only affect the construction industry, but involves the whole of contemporary society, which is therefore moving towards more and more articulated and complex systems of connection and optimization of data management, with a view to proceed towards the development of cities, and therefore of increasingly intelligent societies. All this is a consequence of the fourth industrial revolution, which necessarily implies a radical change in production processes, through sensor networks, smart manufacturing, cloud manufacturing, and a general paradigm shift in design and production methods [Qi, Tao 2018, p. 3585].

Among the numerous examples that could be proposed, one of the most eloquent can certainly be the introduction of sensors inside buildings, which allows the development of innovative building models that are not only able to replicate the properties and appearance of their constructive components, but also their behavior over time, in a dynamic way. However, these models require the presence of special graphic interfaces that make it possible to view data and information in order to satisfy the needs of the users concerned.

For these reasons, the architectural representation of design intentions is increasingly orienting towards the

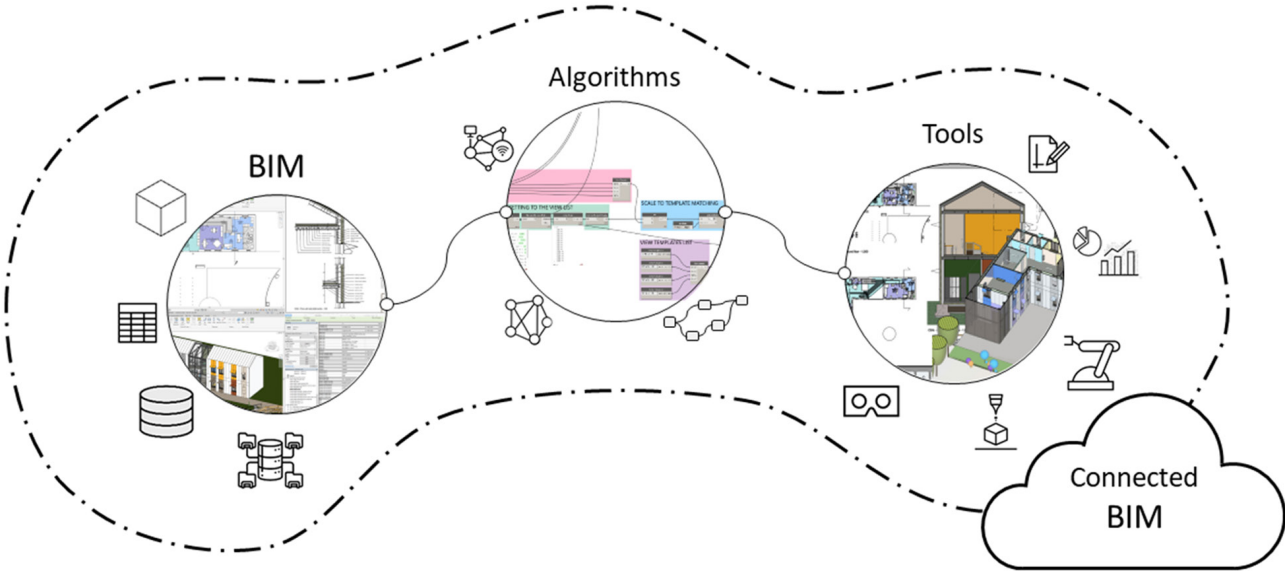


Fig. 1. Conceptualization underlying the Connected BIM hypothesis (image of the authors).

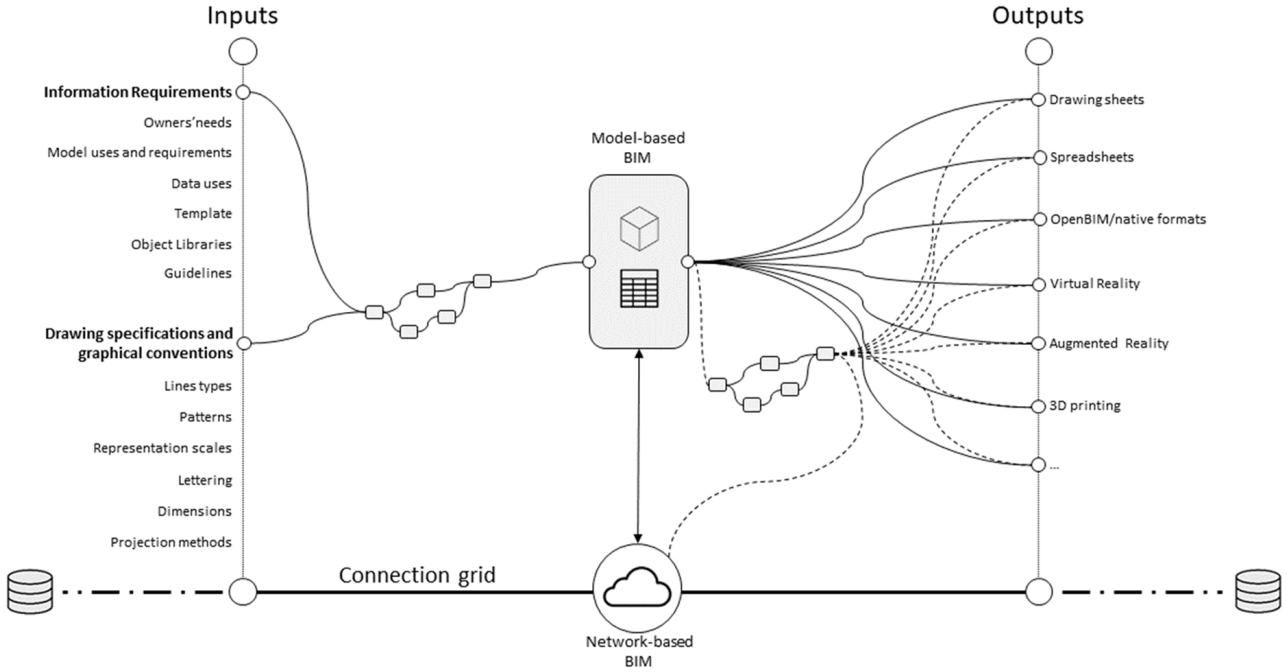
so-called BIM (Building Information Modeling) methodology. This is based on the creation of a three-dimensional parametric model, whose constituent elements host properties, data, and numerical and graphical information, in order to be able to optimize the information management of the building process [Osello 2012, pp. 29-33].
Therefore, the organization of the information models mentioned above must be aimed at representation not only through regulatory standards and graphic conventions, but also through new viewing methods, for example with virtual reality and augmented reality (VAR) technologies. From this it follows that it is possible to greatly optimize the potential of representation through the development of information models representing buildings and their behavior detected through connected sensors, consequently generating what is identified as a "digital twin" [Maatev 2020].
Given these premises, it is possible to say that the current times could be considered as what is called the "era of connection" [Autodesk 2020, pp. 6-12], in which the development of BIM models must be based on some fundamental concepts, such as data sets, algorithms and smart interfaces. The first ones can describe the characteristics and behavior of the building, both statically and dynamically. The second ones are capable of receiving, processing and producing large quantities of information and data, so as to be able to formulate considerations on the current state of buildings and predict their future behavior, optimizing their management. The last ones are able to ensure easy man-machine interaction (fig. 1). All the above should be made possible through constant sharing between users [Ratti, Claudel 2017; Garzino 2011, pp. 135-176].
At the moment, a similar conception of a connected information model is often associated with the development of a Common Data Environment (CDE), i.e. a shared data platform, which, however, does not automatically involve the preparation of algorithms capable of optimizing the graphical representation based on the planning requirements outlined by the design regulations. It follows that the adoption of a CDE is not sufficient to achieve a level of BIM maturity such as to allow an adequate Integrated Project Delivery (IPD) [Succar 2009, pp. 6-8, 31-34].

At best, the connection methods described above make it possible to use systems equipped with cloud-based platforms which, however, allow only viewing. On the other hand, it would instead be desirable that these systems can be further developed in such a way to allow directly interested users not only to view, but also to interact directly with the model by modifying, creating, deleting, integrating, updating the elements and data on them. This would ensure the possibility of an agile advancement and evolution of the model that goes hand in hand with the evolution of its building process.
The modeling and management process through BIM allows to generate significantly better project documents through the integration of models, analytical tools, collaborative platforms, and Big Data in general. Despite this, at the moment the gap between the production of these methods of visualization, and the graphic representations referring instead to conventions and standards codified within the discipline of drawing and graphic representation, is still significant.
This article presents a possible analytical approach based on the creation of algorithms, with the aim of testing their effectiveness in terms of optimizing the graphic representation in a BIM environment. This approach involves the application in an automated manner as much as possible of the coded representation rules, applied to specific views created by the information model on the basis of the graphic scale adopted, in an attempt to bring the contents provided by the BIM platforms closer to those regulated by the design standards. This analysis starts from the studies carried on as part of the drawing course held at the Polytechnic of Turin, by Professor Giuseppa Novello.

Methodology

In the realization of a BIM model the main logical steps basically are: 1) definition of the inputs; 2) creation of three-dimensional parametric models; 3) production of the outputs required by each specific phase. In addition, the bases for the development of an information model remain in any case requirements and specifications of the design and graphic conventions, which constitute the set of modeling inputs. After that, in order to improve the communication of the project, it is a usual procedure to manipulate the specificities of the model to obtain the appropriate graphical and alphanumerical outputs.

Currently, the processing of information content is often based on *ad-hoc* algorithms to carry out specific conversion operations, according to the characteristics and specificity of the project outputs and related requirements. Through this type of operations, the project representations are therefore conformed to the regulatory standards adopted without the need for further manipulations, with consequent benefits on the graphic level.
The further step in order to obtain a connected BIM model (fig. 2) currently involves its upload to a platform set up on the network to allow the sharing of its content and data. Such a connection, between the model uploaded on the network and the file-based model, it would be desirable to be adjustable through specific algorithms. With the aim of unifying the different ways of representing and displaying projects, it is first of all necessary to consider both those relating to the construction process and those more related to the BIM methodology (fig. 3). With regard to the former, the Public Procurement Code (Legislative Decree 18 April 2016, No. 50) indicates a series of macro-phases of the building process, also specifically stating those relating more specifically to the design phases. In addition to these, the preceding and subsequent phases are also included, in order to consider the process in its entirety. On the other hand, as regards the BIM methodology, the so-called Levels of Development (LOD) must be taken into consideration. In the Italian regulatory framework they are divided into seven ranges. Each one is identified by a letter, with increasing graphic and information contents starting from LOD A up to LOD G [De Gregorio 2018, pp. 20-21; Novello, Lo Turco 2014, p. 3]. At the international level, ISO 19650 updates the concept of LOD by introducing the Levels of Information Need (LOIN) including criteria of quantity, quality and granularity of the information requested [UNI EN ISO 19650-1 2019, p. 27]. In addition to what is stated for the Italian legislation, it was considered appropriate to try and take into consideration also the concept of Graphic Detail (GraDe) proposed, in the British context, by the AEC (UK) *BIM Protocol V2.0*. However, it is worth observing that this concept actually takes into account only the graphic content of the models, thus not expressing an evaluation on the information content [Caffi et al. 2017, p. 70]. However, by proceeding to identify correspondences between the three different expressions of the evolution of the building process, through a transversal



LOD	Project phases								GRADE
	Survey	Feasibility study	Preliminary project	Definitive project	Executive project	Accounting	Technical testing	Life-cycle	
A		1: ≥ 500	1: ≥ 500	1:500	1:500				0
B	1: ≥ 200		1:200						1
C				1:100					2
D					1:50				
E					1:20	1:20			3
F					1:5	1:5	1:5		
G					1:1	1:1	1:1	1:1	

Fig. 2. Schematic of the transition between File-based and Network-based BIM methodology (image of the authors).

Fig. 3. Hypothetical matrix of correlation between project phases, LOD and GraDe through the representation scales (image of the authors).

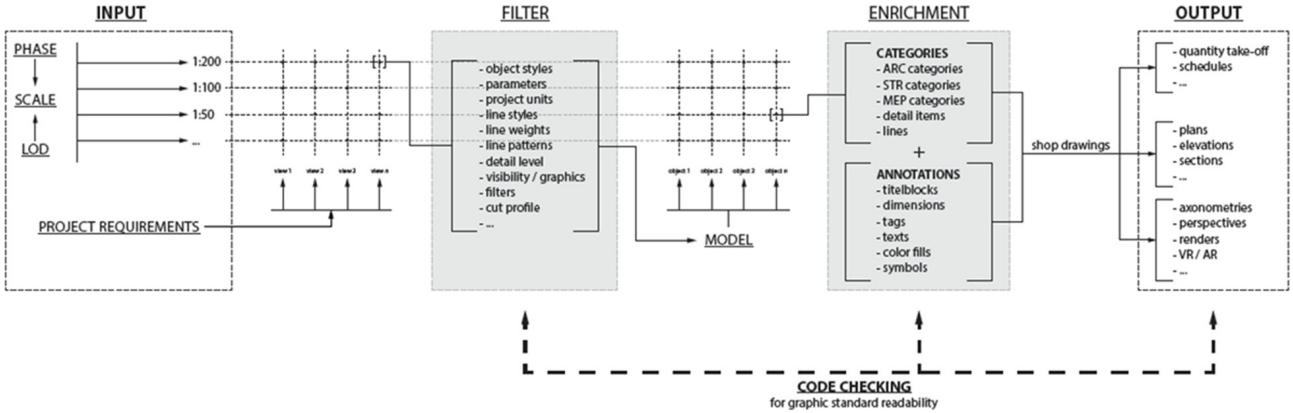


Fig. 4. Workflow diagram of the ideal automatic process for the improvement of representation outputs (image of the authors).

element such as the representation scales, it is possible to trace a logical path that leads to the setting, in an automatic way, of the necessary representations and the correct contents of a given current phase of the process, starting from the requirements and design needs.
The workflow illustrated in this document starts from the elaboration of an algorithm (fig. 4) consisting of a series of matrices capable of setting and regulating the representation of the project views starting from the definition of phase, design requirements, LOD and graphic scale. Hypothetically, the procedure is as follows: depending on the project phase in which the user is, the corresponding phase of the building process is identified, be it the project phase of technical and economic feasibility, the final design phase or finally the executive. These correspondences constitute a first input in the illustrated logical scheme. A further input consists of the LOD, in turn based on the level of detail that must be guaranteed in the design documents required by the phase, and on the respective information content. Once these first two inputs have been defined, the intersection between them, i.e. the intersection between the project phase and the corresponding LOD, especially as regards the graphic component, consequently identifies the most correct representation scales (1:500, 1:200, 1:100 etc.) to fulfill the starting requirements. Subsequently, the correlation between the appropriate graphic scale and the related graphic products to be processed, in order to correctly communicate the design idea, constitutes the third and final input of the algorithm. A first matrix of the documents necessary for the completion of the current project phase is generated by the intersection of the required representations, into which the project is divided, and the scales defined by the first two inputs. In particular, each element of this matrix must pass through an element, in the scheme called Filter, which is identified for each type of view (whether they are, for example, 1:200 plans, 1:100 sections, 1:50 executive drawings, 1:20 details etc.). This filter is a series of predefined system requirements, to which one or more specific functions or settings provided within the software used by the user can be associated (thicknesses and types of lines, fills, hatches, profiles, etc.). This operation has obviously the aim of improving the display of the different views of the model on the basis of the graphic design regulations and standards. The next step concerns the Enrichment section, which is a specific implementation of views and contents of the information model. Here, each element would be subjected to an analysis through operations that possibly add specific elements through categories and detail lines, as well as through further operations that act on the views by entering elements of annotation categories (e.g. dimensions, symbols, tags, texts or title blocks). Once the Enrichment phase has been completed, the production of the drawings will effec-

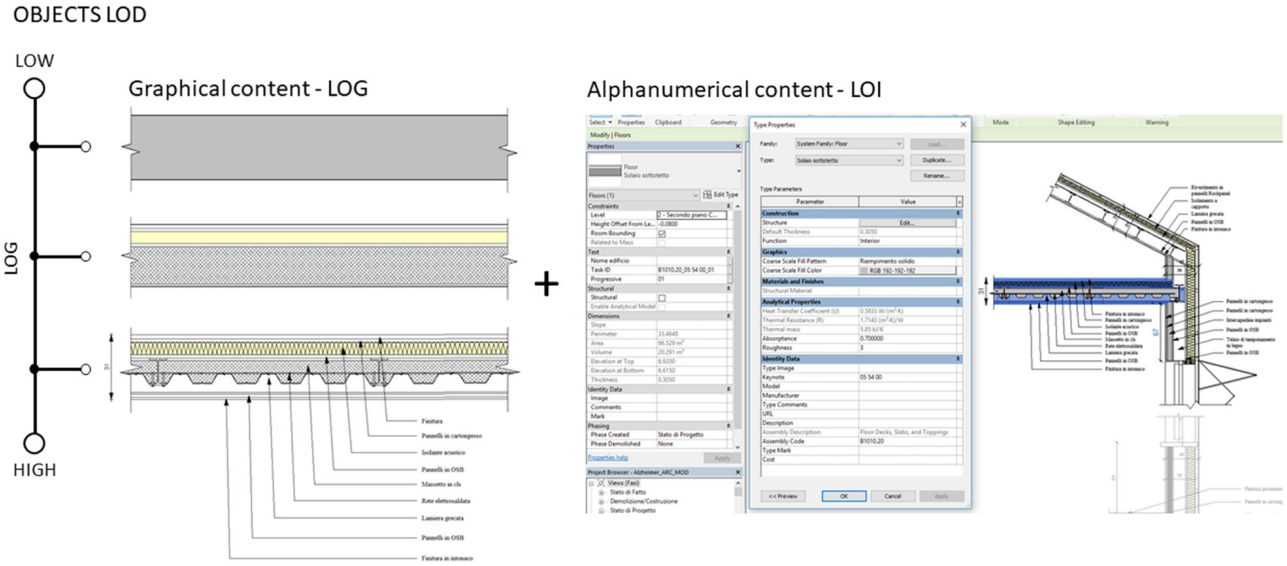


Fig. 5. Example of graphic and alphanumerical contents of the LOD (image of the authors).

tively be able to meet the regulatory requirements, whether they are two-dimensional (plans, elevations, sections, abacuses, etc.) or three-dimensional representations (axonometries, perspectives, renderings, VR/AR etc.). The set of these exported drawings forms the final output of the logical process, on which it is finally possible to start a validation operation, which consequently provides a response on the correctness of the filters set within the software.

This articulated series of operations would make it possible to obtain, as a product, the improvement of the so-called Level of Geometry (LOG) as well as the addition of various elements of detail that would help to understand the more advanced project phases, as well as the improvement of the Level of Information (LOI) [Pavan, Mirarchi, Giani 2017] (fig. 5). Depending on the BIM authoring application used to perform these operations, different subsets of representation settings may be required, whether they are based either on certain graphic filters, or on the addition of components and annotations, or on automatic or manual compilation of various properties of the elements. The study carried out in this document was based on the choice of Autodesk Revit software as BIM authoring platform to evaluate the strengths and weaknesses of the information model and the method applied to it. The degree of automation in the process is a crucial point, since depending on its incidence, it can become more or less burdensome.

The flow chart (fig. 6) proposes a hypothetical sequence of actions performed by the algorithm responsible for the validation. For each view in the model, the representation scale is assigned as the initial input and immediately associated with its view. Element by element, the compliance with the design regulations is checked. If this correspondence is correct, the algorithm proceeds with the next element; otherwise, the verification and enrichment process is initiated. This process evaluates, for each element, its specific requests and regulatory requirements. For each of them, in cases when these do not comply with the standards, the next step is the implementation of the object with the missing necessary elements. Once this is done, the algorithm continues with the following requirement, until compliance with each of them has been verified. Upon completion of the procedure, the element is considered compliant with the standard, and the program proceeds cascading to the subsequent objects.

The logical diagram hypothesized here, depicting the sequence of steps that the machine must follow, has been

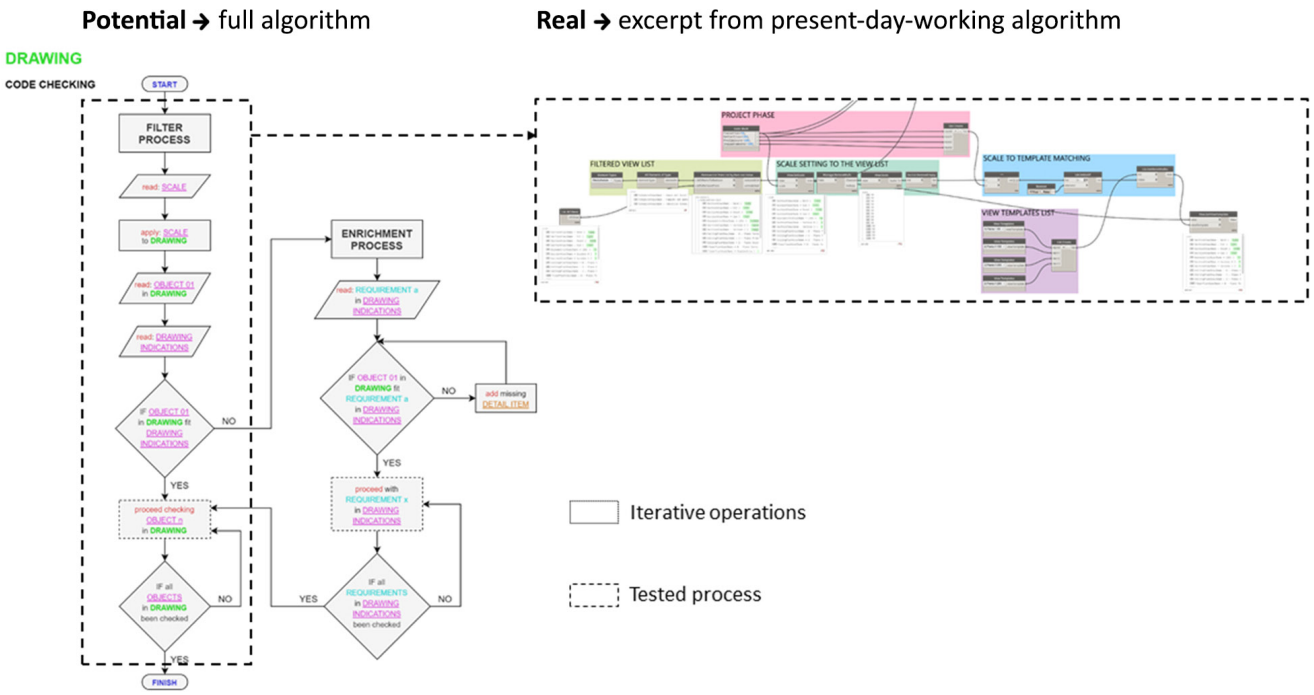


Fig. 6. On the left, logical flowchart of the proposed algorithm; on the right, a part of the tested script (image of the authors).

translated as Visual Programming Language (VPL) executable by the BIM authoring tool used (fig. 6), through the interface of the Dynamo graphic programming. The resulting script, visible on the right of the image, is the prototype of one of the tested sections of the complete algorithm, which is still under development and would must necessarily be made fully functional.
It should be noted that the currently working script has been developed starting from the assumption of first testing its ability to interact with the Views, thus using a preliminary simplification on the side of the inputs, which here have therefore been reduced to a simple reading of the set representation scale by the user. Furthermore, since some functions used in Dynamo do not provide for the possibility of an auto-refresh when the input is changed except by manually restarting the algorithm, a group of nodes capable of timing the automatic updating of data has been implemented inside of the script. Thus, the algorithm created (fig. 7) is structured in such a way as to update itself automatically, according to either a predetermined timing if keeping Dynamo running, or starting it whenever necessary through the Revit Dynamo Player.

Results

At the moment, the creation of connected information models that are able to correctly represent the design information is a process that can still be improved (fig. 8) and can be optimized, in the perspective of obtaining more efficient procedures, both as regards the visualization of information and data and for an integrated process. In particular, it is still necessary to evaluate as input to the process both the information requirements and the graphic settings, in order to proceed with the develop-

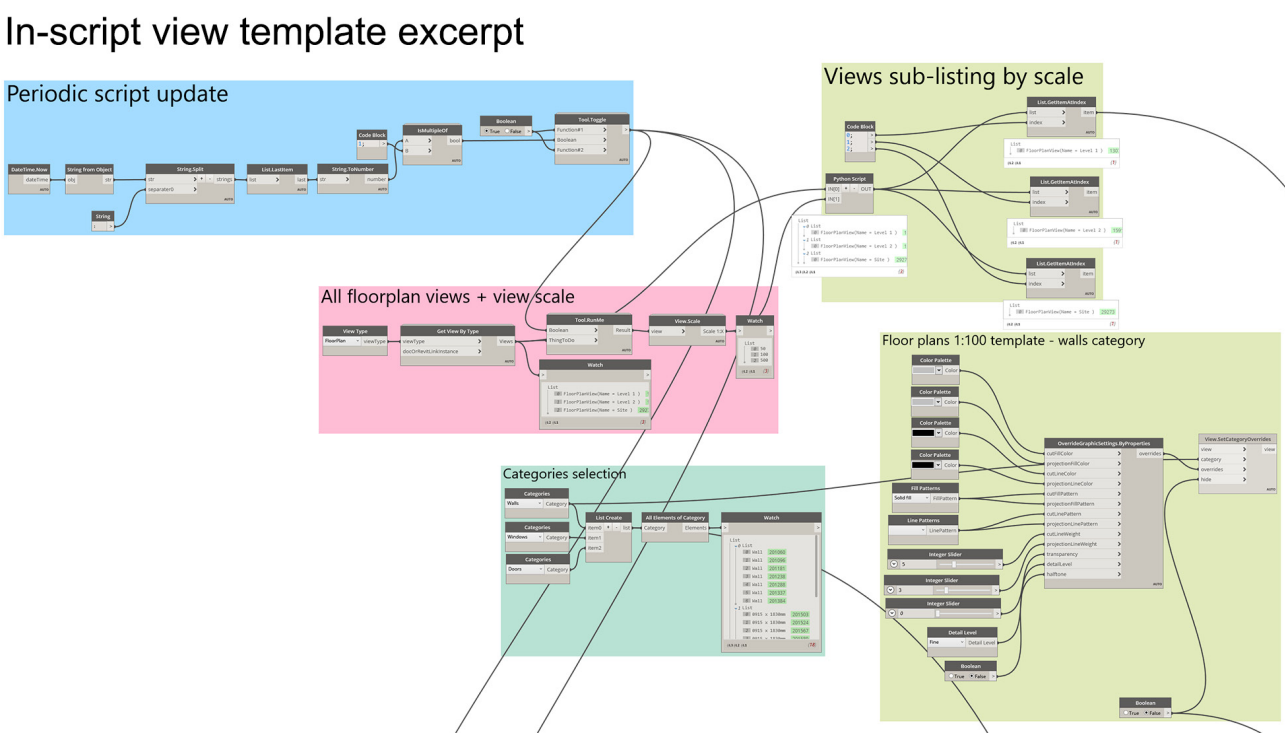


Fig. 7. Excerpt of the developed algorithm, as a focus on the management of in-script templates (image of the authors).

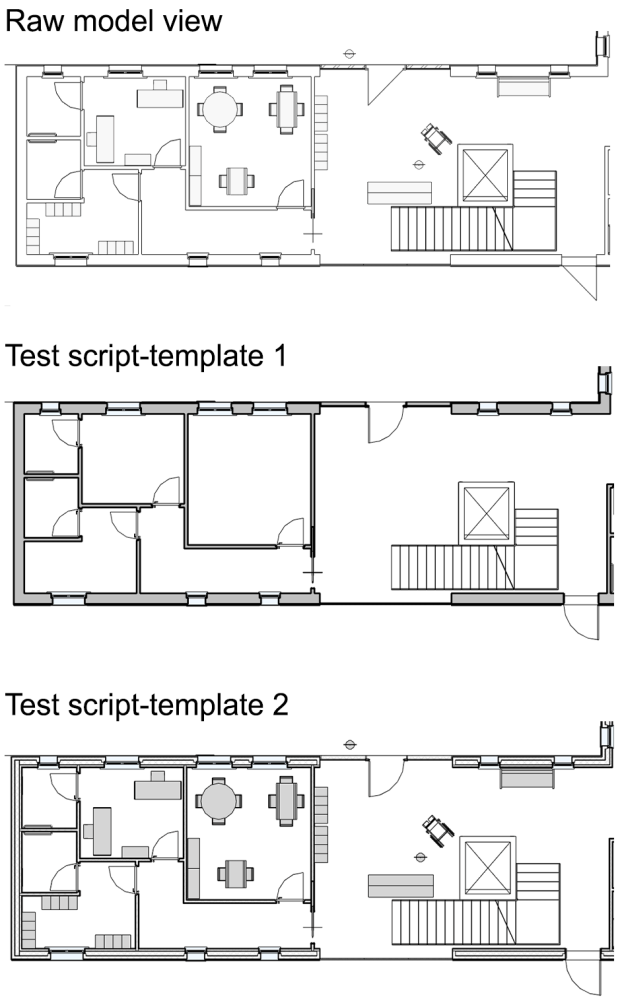
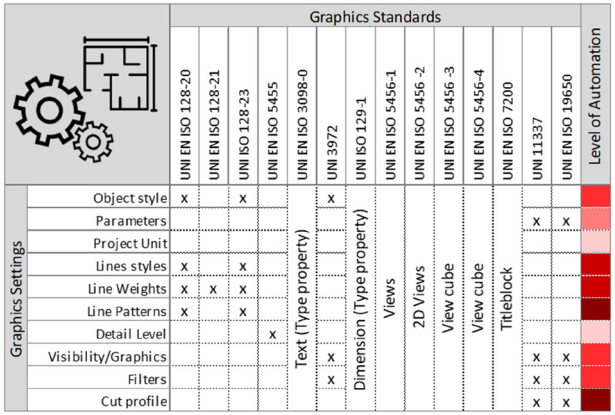


Fig. 8. Test examples of simple pre-set script executions starting from an untreated model view (image of the authors).

ment of a potential digital archive that is optimized to be able to collect and put together graphic and alphanumeric information.
This contribution underlines the validity of the introduction of automated steps within the building process, in order to facilitate the production of design documents, through a connection between the project inputs and the outputs required by the process itself through the use of graphic standards. Therefore, the level of automation necessary for the production of correctly set graphical drawings was evaluated through a schematic representation of the effort required for it (fig. 9), systematizing the correspondences between graphic standards and software-side settings. For example, the setting called Detail Level allows you to adjust the visibility of the different elements of the model in a simpler way than a setting like the one called Cut profile, which requires a greater work effort, as it requires to be individually applied for each desired view.
Therefore, the automatic procedure described above still presents certain criticalities, which are to be identified both in the objective current technological limits, and in the peculiarities and uniqueness, for technical and constructive choices, of each individual project.
Concretely, it is possible to operate on the filtering process, through a series of settings, which can be incorporated into the project templates, modifiable through scripts (e.g. with the use of plugins such as Dynamo), on the basis of the representation set on certain views. However, it is still entirely possible to refine the enrichment phase with the possibility of making it further automatable, since many elements present in this phase still need to be entered individually. In fact, the production of graphic drawings starting from BIM models also implies the need, sometimes, to insert additional objects, such as the so-called Detail Items or certain Annotations, which can determine a clearer and more understandable communication of the project.
Furthermore, as regards the integration between project templates and scripts, through the experimentation tested here it was possible to manage the large amount of graphic settings aimed at project documentation through scripting operations via Dynamo.
Moreover, the previously described ability of the algorithm to constantly self-update itself based on the simple adjustment of the scale of representation in the view, potentially makes it possible to set a series of predefined



		Graphics Standards														Level of Automation
		UNI EN ISO 128-20	UNI EN ISO 128-21	UNI ISO 128-23	UNI EN ISO 5455	UNI EN ISO 3098-0	UNI 3972	UNI ISO 129-1	UNI EN ISO 5456-1	UNI EN ISO 5456 -2	UNI EN ISO 5456 -3	UNI EN ISO 5456-4	UNI EN ISO 7200	UNI 11337	UNI EN ISO 19650	
Graphics Settings	Object style	x		x		Text (Type property)	x	Dimension (Type property)	Views	2D Views	View cube	View cube	Titleblock			
	Parameters													x	x	
	Project Unit															
	Lines styles	x		x												
	Line Weights	x	x	x												
	Line Patterns	x		x												
	Detail Level				x											
	Visibility/Graphics						x							x	x	
	Filters						x							x	x	
	Cut profile													x	x	

Fig. 9. Evaluation of the level of automation regarding the graphic settings and respective graphic standards (image of the authors).

pseudo-templates for different views within a single algorithm, maintained in action in the background.
The innovation proposed in this contribution favors the optimization of the production of graphic designs without which the time for adjusting most of the graphic settings within the application would be prolonged also with a view to transferring shared standards, with a simple exchange of a file of a few kiloBytes.
Surely, the article highlights the current differences between Project Views (specific to the BIM authoring platform) and the design drawings that are the real expected product of the current building process.
The illustrated study highlights how the effort required to complete the different tasks that are naturally part of the complex representation process is considerably different, and how this difference is essentially due to the specific functionality selected, activated or used in a given view or set of views.
This document has also investigated the relationship between the LOD scales with respect to the design phases, trying to establish a correspondence with the related representation scales. Therefore, the information level obtained in the project sheets must be considered to all intents and purposes one of the requirements for the definition of the so-called Levels of Information Need, defined within the ISO 19650 standard and the UNI EN 17412-1:2021 transposition.

To date, the choice of a scale of graphic representation is fundamental to achieve the project objectives in the context of the production of graphic drawings. Through the information modeling it is desirable that the graphic product be oriented to the contents of the BIM uses that integrate the requests for representation to the objectives and related uses of the information model.

Conclusions

The ability to communicate a design idea has always been a prerogative of the human being who, over time, has developed a series of skills to optimize communication between his peers. Within the construction industry, this ability has found an application on the production of graphic designs capable of facilitating the understanding of design intentions. This procedure has therefore always characterized the *modus operandi* of the engineer and the architect, who finalized their intentions in a variety of documents to describe the design idea. With the adoption of CAD, this ability has been refined, improving the quality and graphic precision of the documentary apparatus, which however continues to be uneven and uncoordinated, highlighting some limits on the consistency between the documents.
With the advent of BIM we are witnessing a reversal paradigm in which the uniqueness of the design idea is guaranteed by the development of a parametric 3D model from which various graphic representations are generated. This way the difficulties highlighted by the traditional methodology are overcome thanks to technology. In the era of digital connection, the purpose is to raise the level of BIM maturity by reaching a degree of collaboration and integration, orienting the construction industry towards implementation in processes, based on the development of a collaborative model. Certain activities, such as the development of project documents and the updating of data along the entire life cycle of the building, should be based on the creation of a model connected to heterogeneous databases, with a view to the development of smart cities.
This contribution analyzed the level of automation of the documentation production process aligned with regula-

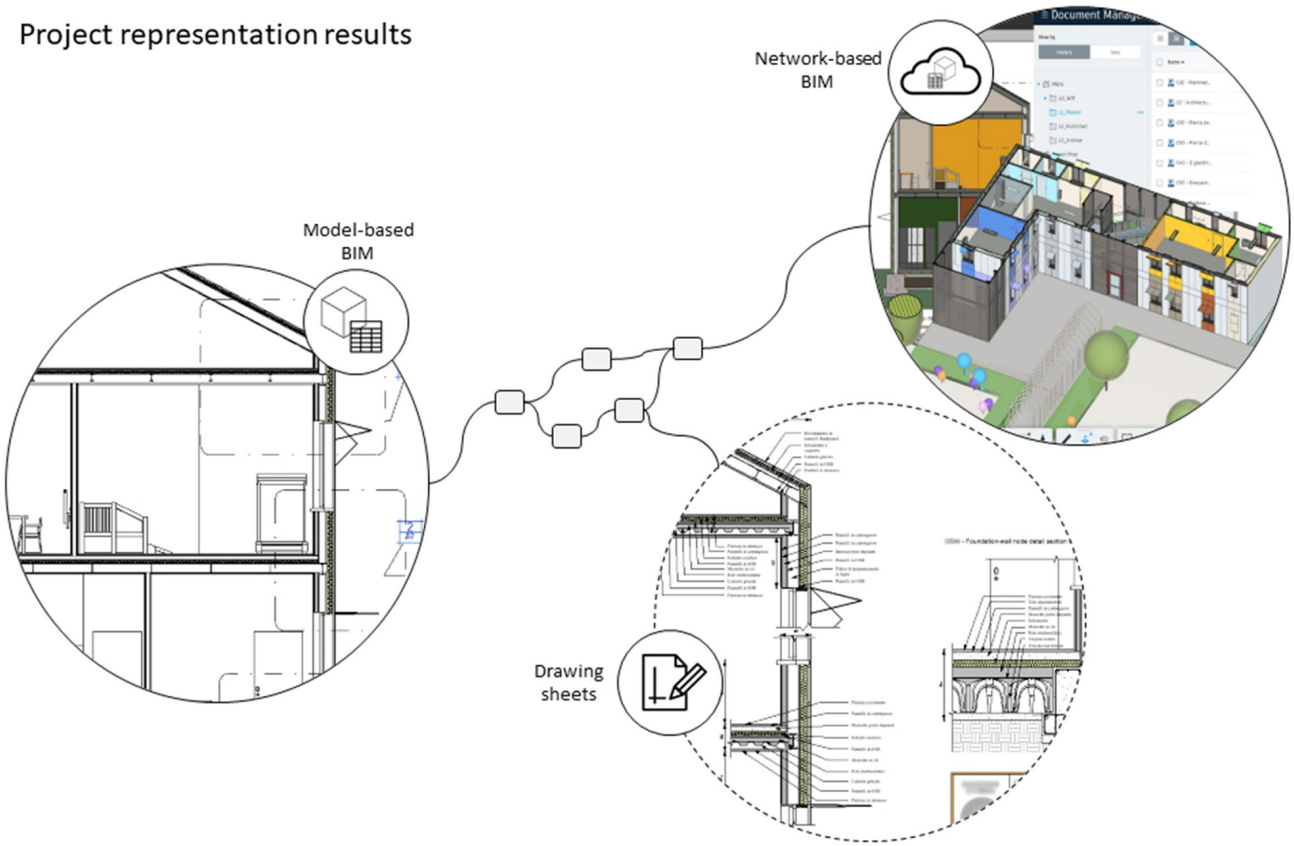


Fig. 10. Theoretical interaction between the connected BIM model and its representations (image of the authors).

tory requirements, taking up the BIM challenge of overcoming the current gap between simple visualization and correct representation (fig. 10). A further optimization could be the self-regulation of the proposed algorithms on the basis of certain entered data. It is hoped that in the near future the definition of the graphic and information requirements of the project documents will be further codified through the use of systems capable of correctly reprocessing the data set in the system within the various databases, and then transfer them to certain specific representations of reality.
Due to the complexity associated with the world of collaboration and interoperability between technologies on the construction market, it is desirable that current technological limits will be overcome in the near future. In conclusion, technological innovation will have the task of providing new methods and tools for the creation of connected information models, to be used with different interfaces for the multiple specificities of contemporary society.

Acknowledgements

The authors agree on the contents, the methodological approach and on the final considerations presented in this research. In particular, Matteo Del Giudice introduced the contribution in the introduction paragraph. The methodology was addressed by both Matteo Del Giudice and Emmanuele Iacono. The latter focused on the obtained results, while the conclusions are meant to be a synthesis of the two authors.
The authors would like to thank the student Isabella Dusi for giving us the permission of diffusing a part of the content of her thesis.

Authors

Matteo Del Giudice, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, matteo.delgiudice@polito.it
Emmanuele Iacono, Department of Economics and Business Studies, University in Eastern Piedmont, emmanuele.iacono@uniupo.it

Reference List

Autodesk. *BIM and the cloud for building design. Improved project insight with connected BIM*. Autodesk.com. <https://www.autodesk.com/solutions/bim/discover-building-design/bim-for-building-design> (accessed 2020, February 19).

Caffi, V. et al. (2017). *Il processo edilizio supportato dal BIM: l'approccio INNOVance*. Roma: Edilstampa.

De Gregorio, M. (2018). BIM: la normazione nel futuro dell'edilizia. In *U&C Dossier UNI*, 8, pp. 19-34.

Legislative Decree 18 April 2016, No. 50, Codice dei contratti pubblici.

Garzino, G. (2011). *Disegno (e) in_formazione. Disegno politecnico*. Segrate (MI): Politecnica, Maggioli Editore.

Mateev, M. (2020). Industry 4.0 and the digital twin for building industry. In *International Scientific Journals of Scientific Technical Union of Mechanical Engineering "Industry 4.0"*, Issue 1, vol. 5, pp. 29-32.

Novello, G., Lo Turco, M. (2014). *Linee guida per la modellazione dei componenti in ambiente BIM*. Torino: Politecnico di Torino.

Osello, A. (2012). *Il futuro del disegno con il BIM per Ingegneri e Architetti*. Roma: Gangemi Editore.

Pavan, A., Mirarchi, C., Giani, M. (2017). *BIM: metodi e strumenti. Progettare, costruire e gestire nell'era digitale*. Milano: Tecniche Nuove.

Qi, Q., Tao, F. (2018). Digital Twin and Big Data Towards Smart Manufacturing and Industry 4.0: 360 Degree Comparison. In *IEEE Access*, vol. 6, pp. 3585-3593. <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8258937> (accessed 2021, February 12).

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

Succar, B. (2009). Building Information Modelling Maturity Matrix. In J. Underwood, U. Isikdag, (eds.), *Handbook of Research on Building Information Modelling and Construction Informatics: Concepts and Technologies*, pp. 65-103. Information Science Reference, IGI Publishing.

UNI EN ISO 19650-1:2019, Organizzazione e digitalizzazione delle informazioni relative all'edilizia e alle opere di ingegneria civile, incluso il Building Information Modelling (BIM) - Gestione informativa mediante il Building Information Modelling - Parte 1: Concetti e principi.

Metis. The Mutation of Form

Configuration, Design, Transformation

Connecting. Notes and Exercises for a Theory of the Practice of *Disegno* of the Visual Form

Francesco Cervellini

Premise

First, I would like to express my contentment that the theme chosen for the conference consists of a verb related to the action of *Disegno*. For me, *Disegno*, in any of its forms, is an action, a practice consubstantial with a thought whose end, as an instrument of its expression, is (etymologically) always entirely involved. Indeed, I maintain that any authentic reflection on *Disegno* cannot overlook considerations specifically reserved for the modes of action; it therefore cannot but help to contribute to building a theory of its practice.
I have claimed elsewhere that "a theory of the practice of *Disegno* can be none other than a thought for thinking about the means of acting in *Disegno* itself" [Cervellini 2016]. In my opinion, this statement, within the entirely particular relationship between theory and practice, basically expresses the way of operating and the expressive phenomenology of *Disegno* throughout its history. In fact, it is also (and especially) the fruit of multiple practices that are built and dismantled through the exercise of *Disegno* over time, of which said practices are simultaneously the products and conditions necessary for their realization. In this sense, I have personally developed the conviction that such practices can be created specifically within themselves, without diverging from the order of their actions.
This is why it is important to discuss *Connecting*, which I consider an excellent way of operating in *Disegno*, as I will aim to argue and support with some illustrative images taken from classes I taught some years ago.

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editorial director's responsability.

Reflections on Connecting and Similar Activities

I use the word 'connection' in the linguistic sense of 'syntactic nexus'. This use is based on a personal conviction regarding the possibility of having knowledge about the genesis and development of the visual form through *Disegno* via a method that I would describe as 'grammatical and syntactic' [Cervellini 2016]. Indeed, I consider 'connecting' –beyond its new digital stamp– as one of the actions that has always operated synonymously, in succession, and/or in parallel with 'creation' of the visual form.
For brevity, I will limit myself to listing some of these actions, aiming to attribute some characteristics to them. These are, in particular, 'inventing/imitating', 'recalling/classifying, associating/connecting', 'composing/constructing', and finally 'extracting' and 'algorithmically searching the Internet to find correlations' (that is, digital actions similar to the so-called web scraping for data mining, but in an absolutely different sense [1]). In describing each, I have intentionally and expediently considered them as operating in binary interrelated pairs as I believe that they are frequently performed (albeit not always or exclusively).

Inventing/imitating
The first action is, in the real sense of the word, the initial action, but precisely because of this original strength it often goes on to acquire the character considered to distinguish the entire creative operation. I would like to clarify, however, that I prefer 'inventing' over 'ideating', both for its pragmatic character, that is, it can "give life and concreteness to the contents of fantasy and imagination", and because it also suggestively enunciates the "eventuality of a happy, unexpected realization" (Devoto, Oli 1995). These specifications are the prerogative of *Disegno* as a creative form of imaginative thought, from which, however, is does not entirely derive. I instead consider the term 'ideation' to be compromised by a semantic distortion due to the idealistic interpretation of creative processes; a distortion in that the etymon of 'idea' is '*eidos*', that is, 'form', a concept referring to the content of perceptible experience.
In my opinion, instead, the *inventing/imitating* nexus lies in the fact that 'invention' is rarely creation from nothing and the cases in which it is are not often those with the best results. However, history always shows that 'invention' in many cases follows 'imitation' by assuming suggestive material –logical, iconic, poetic etc., perhaps found on a different level, even problematically lower– that, through a series of transformations and developments, can move to another conceptual level. In addition, as suggested by the theme, 'something' (perhaps even only an evanescent 'formal blob') is nevertheless always present in the designer's technical memory that, through either ability or causality, glimpsing or imagining amid the surroundings, leads to an unexpected discovery, (that is, etymologically, 'inventing'). With regard to the rest, in the inventive phase of any visual project, *Disegno* does not proceed from a blank slate, but rather works along the boundaries of contact between the various positions of thought. These can be summarized in three dual polarities, that is, between function and standard, between conflict and rule, and one, more properly linguistic, between signifier (the sign and/or its specific action of signifying) and the system of meanings (that is, the linguistic system in its entirety). It is precisely in the moment of development that *Disegno* proceeds and induces in its creator a conscious explanation with respect to those same polarities.

Recalling/classifying
The structuring of heuristic syntactic nexus peculiar to 'connecting' very often begins with 'recollection' and nearly always implies the concurrent sudden appearance of a classification, both initially in the search for epiphanic similarities with the memory, and during progress in the continuous comparison of object-based operations to be progressively implemented. However, 'recalling' (together with 'seeing directly' and 'feeling', or 'experiencing' a sensation) is, according to the basic theses by Emilio Garroni, one of the three certain and not insolubly cyclic/tautological modes of forming a mental image [Garroni 2005].
I believe, however, that on the exquisitely subjective plane of *Disegno*, memory acts not just to reintegrate content related to missed or forgotten experiences, but especially to restore meaning to those in the present, building a network of associations that allow experiences to be reinterpreted in the present. This, for example, is a common experience in traditional *Disegno*, where it is the hand itself, requested by the unveiling of the sense of the image being formed, that

recalls meaningful icons from one's personal 'museum' as it is being composed. Paradoxically, with respect to that unavoidable cognitive experience, computers may reveal all their ambivalence: even if they contain an enormous basin of data and information, they do not always help to reorganize the references. Today, very subtly, automatic associations are often suggested by such mechanisms to promote consumption, contributing to impoverishing the true function of memory intended as a capacity for subjective reinterpretation, i.e. the 'reconstruction' of a new network of meanings in relation to the events themselves.

Inventive classification
'Inventive classification' is tied to recalling as a taxonomy for something known or still partly unknown, but of which the graphical links may represent a trace, almost a sort of deep underlying structure. Classifying entails the simultaneous mental formation of identities, similarities, and differences among different schemes, almost like dramatic writing.

Connecting/associating
I mentioned connecting as the creation of syntactic nexus at the beginning, and the programme of the conference itself with its keywords is also rich with starting points. Here I am interested in noting the similarity and difference with 'associating', an expression that implies a sort of uniformity among the components to be combined, which is instead not required by connection. Association is therefore the typical morphological operation of an active linguistic/spatial society, for example the iteration of equal iconic individuals (points, lines, etc.) as in punctuated rhythmic series.
Association gives rise to the suggestion to work with more elements, trying to institute among them relationships of hierarchy, symmetry, balance, or even asymmetry and tension, which may give rise to order or conflicts, friction, or deformation of one part with respect to an adjacent or interfering part.

Composing/constructing
In teaching, I have always considered compositions to be experimentation 'according to a plan' rather than free digression and in this sense I have always recommended the formation of drawings to be situated on the plane of a structure, that is, a "set of elements organized according to constructed internal dependencies" [Hjelmslev 1998].
These are meaningful structures in *self-described* figures, that is, figures that first express as meaning their process of formation, through operations that are progressively implemented to create their figure. The principal aim of 'composing' should be to cause architecture and design students to concretely reflect on design as a constructive activity, the foundation of a spatial model and a cohesive edifice of signs with their specific attributes (geometry, dimensions, colors, textures). Exemplifying at least the first of the preceding terms with operations such as 'translating', 'rotating', 'extruding', 'folding', 'cutting', everything', 'softening', 'reflecting', etc., can and should be concrete acts in both the traditional and digital realms of a 'configurative form/thought' and not just applications of graphical tools.

Extracting and algorithmically searching the Internet to find correlations
In my interpretation, this is a binary operation of interaction using the Internet and various programmes. It permits the exploration of familiar and unfamiliar places, proceeding through continuous identifications, sampling and possibly manipulating iconic texts according to the itinerary, which is at times also vague, and guided by the mental connections occasionally generated when searching for a form that is more or less distinctly desired. This dual digital action, in my opinion, corresponds in part to the traditional manual 'assembly drawing' of a graphical device, which has become a complex textual construction in that it is frequently multimedia and multicode based. This personalized construction was defined by Sherry Turkle, which is in my opinion also effectively the work of DIY [2]: the new architects, creators of the techniques of 'random' design are at the heart of the new DIYers.

Connection Exercises

In the present contribution, the word 'connection' is used in the linguistic sense as a syntactic nexus in the conviction that it is possible to have knowledge about the genesis and development of the visual form through *Disegno* according to a 'grammatical and syntactic' method.

In this sense, the treatment of the actions is integrated with some exercises –of connection, in fact– and example images of varying complexity developed 'according to a plan' as educational activities for future architects and designers specifically dedicated to experimenting with modes of structuring visual forms.
The meaning of these syntactic exercises –which aim to supply the text with example images– lies first in experimenting with a code to order the writing with which compactness and intensity are regulated on the page, moving easily from continuity to discontinuity, from consonance to dissonance, etc. Many exercises aimed to solicit 'hybrids' from the experimentation, although with the recommendation to predefine a strategy to organize the various rules. The scope was to constitute a body of figures with their rules of formation, a repertoire of themed experiments and developmental variations –for whose realization *Disegno* lies at the base, centre, and summit of every action.
These 'planned' exercises aimed at a specific objective: developing analytical and operational knowledge about the form and its generating procedures. *Disegno* can therefore be defined as 'morphogenetic' and its exercises as 'training exercises', i.e. experiments on defined topics to "extract the form from that 'untranslatable' intuitive sphere wherein lies its truest and deepest meaning" [Neri 1996, p. 72].
In *Disegno*, the first reference for the compositional analysis of the initial elements of figurative composition lies not only in the so-called 'elementalist grammar', which is an ancient tradition, but above all in its Bauhaus redefinition, while the second reference is found in Chomsky's generative grammar.
This is a 'constructive and procedural' concept of *Disegno* and 'formation' whose product represents a building that is integral in its parts through logical and concrete techniques and which, conversely, affirms that any figure or formal composition can be constructed and/or deconstructed according to principles that can be formulated as rules of art.
In this setup, morphological problems immediately become syntagmatic, syntactic, while some syntagmatic relationships, even among simple elements, may become, so to speak, morphological characterizations of elements composed of entire works.
The syntagmatic nexus is not an object; it does not regard any element in itself or its place separately, but rather, it is the relationship between them, the way in which they are manifested, and it is easy to see that by simultaneously increasing the complexity, that is, the number and the attributes and variability of the elements, this system of nexus is structured as a very intertwined chain. The syntagmatic nexus therefore allows a concrete relationship between primary formal elements to be analysed precisely because they are the rules used to generate recurring situations, each with its own peculiarity.
This suggests considering 'adjustability' as an axiom for testing 'according to a plan' in the repetition/evolution of some figures that, while always different, maintain a structural link with the basic one and subsequent ones. That is, to generate a series of transformations "concluded within [a] grammatical system, the value of each experience consists of modifications introduced in the code of the system, which are, however, understood by the code and established as a range of possibilities" [Menna 1983, p. 75].
This is the procedure tested in the various exercises briefly illustrated below, constructing and investigating linear rhythms and combining them using simple figures/diagrams such as the comb, cross, and grid. These are typical syntagmatic structures chosen methodically to assess their teaching efficacy; not only that, they entail the capacity to manipulate mechanisms with a decent complexity.

Linear Series and Systems

Interfering associations/connections among a series of bands (fig. 1)
In clear reference to Josef Albers, the *disegni* constituting the panel investigate the effects generated on the surface through juxtaposition, alternation, and chromatic and dimensional contrast of linear bands, that is, segments with a sufficient thickness to create a combination of surfaces and insert rhythmic successions in the series through the qualitative weighted presence of color.
The empirical surface of the background becomes a plane of metric/proportional precision used to test the shape-generating capacity of primary colors –for example, opposing the 'negative' spatiality of blue or black with the 'positive' spatiality of yellow or red– and of the various components in a play of interweaving, toothing, and overlapping.

While giving rise to the formation of simple morphemes, this 'game' at times also produces the perceptual effect of cavities –with each color suggesting a different depth, even if they lie on the same plane– and dematerializing the borders, the result of an instantaneous visual deviation between the physical reality of the image and the illusion it creates.
More in general, the experimentation on linear bands accentuates the repetitive cadence of the elements, 'measuring' it, and therefore providing the basis on which the sequence can be calculated. The general principle is thus tested, which is valid for each rigorous formal construction according to which a quantity, and particularly a quantity produced through repetition, may be figuratively 'measured' only by another heterogeneous entity (*B* measures *A*).

Associations/connections of linear systems (figs. 2-4)
The three panels are characterized by a particular uniformity and together create a system. They therefore constitute a unique experiment in which the syntactic exercises are extended to entire repetitive systems, composing them in a combinatorial way. The main problem of these *disegni* was to tightly insert each graphical motive and its variations in an overall structure, i.e. imagining and representing some small parts of its possible growth according to a single direction.
Each column presents three combinatorial variations with the same or very similar constituent elements, where the general structure of the various images is formed based on rules such as series and rhythmic alternation, modular collimation, regulation of the sustainable repetitive limits of each axis of support, etc. In contrast, the variations are obtained either by translating the position of preformed groups or by moving some 'strategic' elements in the overall structure. In these images, in fact, the connections intensify, tightening the various 'threads' with purposefully different degrees of compactness (in this sense it is apt to refer to the *disegni* of Anni Albers for the *Bauhaus weaving workshop*).
In particular, the first two panels (figs. 2, 3) show aggregations with a hierarchically pre-formed pattern, that is, aggregations in which some larger elements measure and order of the related sub-multiples. The *disegni* in the last panel (fig. 4) are instead in 'low relief', that is, they have a slight three dimensionality. While in an essentially planar layout, the sculptural/tectonic accentuation is thereby highlighted. This is especially clear in the overlapping of systems of uniform volumetric elements that stand out above each other; or where the elements that act as 'support' three-dimensionally distinguish the support from what is supported, etc.

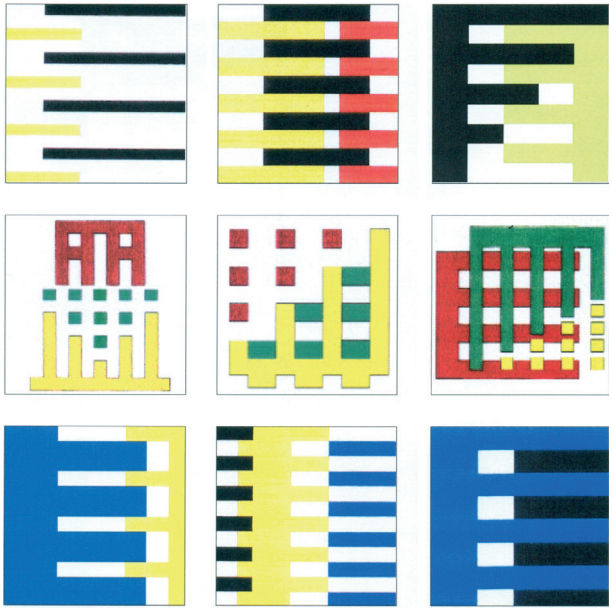


Fig. 1. Interfering associations/connections among a series of bands [Cervellini 2012, pp. 160, 161].

The Comb as a Figure and Formal Structure

The comb figure/scheme serves to contain a series of linear elements, the so-called 'teeth' or 'sticks', on a 'predominant line' of distribution and measure their development, establishing the maximum threshold of repetition and simultaneously conferring and distributing a regulated layout and various spatial qualities in the interstitial voids.
These configuring functions explain the reason for the frequent use of this figure/scheme in architectural composition. On this scale, the variable alternation between the filled areas of the 'teeth' and the voids of the inter-

vals generate different figural and spatial specifics, such as 'semi-cuts', '*ambulacra*', 'perspective stage wings', etc. The distribution line also requires a detailed design for the nodes where the 'sticks' meet it –most commonly composed of support or interlocking– and the related angle of incidence, which in the canonical diagram is a right angle, but it may vary to follow, for example, the particular geometry of the urban system.
This figure was often the object of teaching experimentation. The related figures are therefore considered as both descriptive classifications and heuristic variations on models used to develop formal compositions.

Comb connections between linear elements (fig. 5)
By closing the series in one direction, the support axis of the comb defines the limit and the 'right' proportion of growth in the other. At the same time, it is the metronome of the rhythm, therefore marking the rate of repetitive scanning: it is both the root of the teeth and the metre stick that marks their sequence, with a beginning, development, and end.
In the lower figures, the diagram shows some interesting variations obtained by sectioning the teeth along the diagonal of the real or virtual rectangle (or square) according to which the comb occupies the surface. This permits different configurations: from one with a variable 'backbone' formation; to one with a positive/negative inversion of the size of the sticks; to one created from a series of 'empty spaces' or crossing at the rungs of the sticks, or with trapezoidal courts always with a different size.

Double-comb connections of linear series (fig. 6)
In the largest *disegni*, the compositions consist of a montage of two comb series with the support axes situated outside and the respective series interfering according to various alternation devices. The set of sticks therefore produces a variably oscillating rhythmic effect from the centre towards the edges.
At the same time, the interstitial spaces follow each other in a labyrinth that places compressed and dilated regions in cross-cutting correspondence. In the last drawing at the bottom, the figure of the backbone reappears (with the sticks repeated on both sides of the axis), which recomposes a symmetric system. The smaller squares focus on the details of further variations in applying the scheme which derive from the interchangeability of an

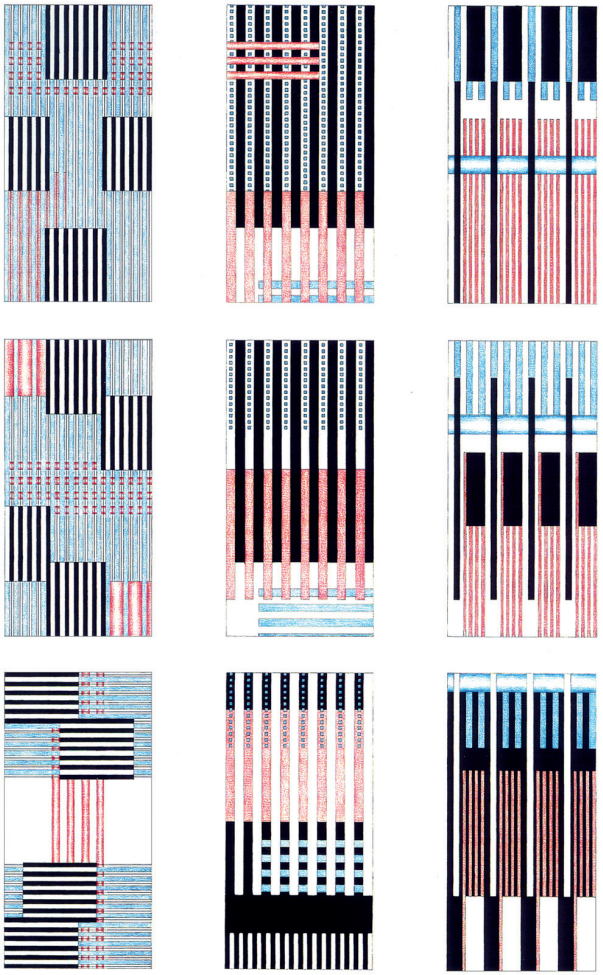
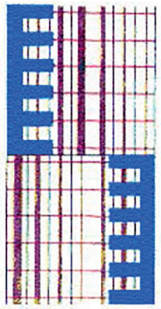
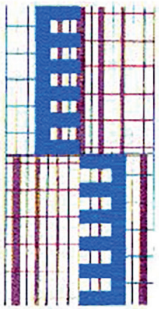
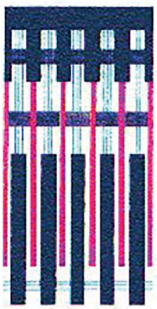
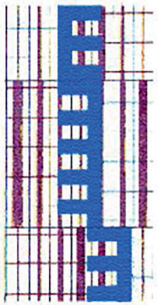


Fig. 2. Associations/connections of linear systems [Cervellini 2012, p. 162].



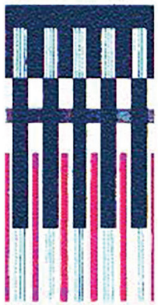


Fig. 3. Associations/connections of linear systems [Cervellini 2012, p. 163].

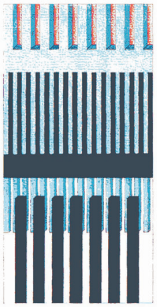
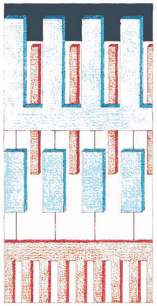
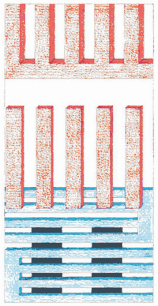
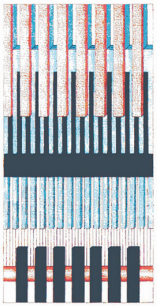
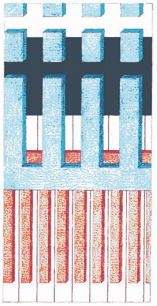
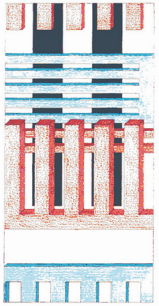
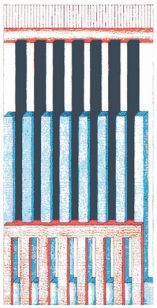
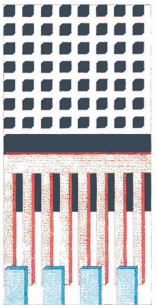
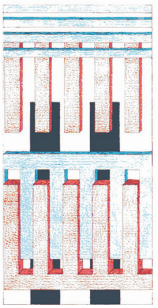










Fig. 4. Associations/connections of linear systems [Cervellini 2012, p. 164].

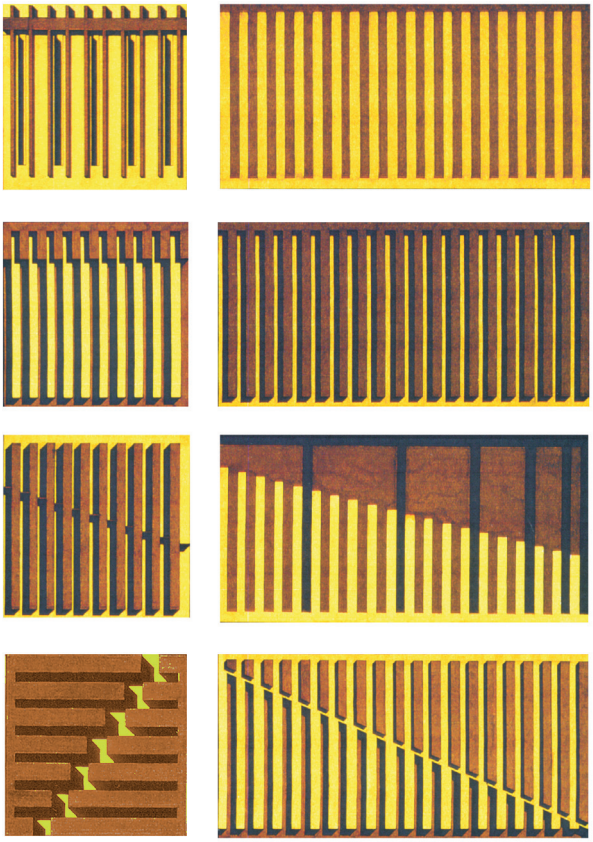


Fig. 5. Comb connections between linear elements [Cervellini 2012, p. 158)].

entire element in a series with a 'prefabricated' sum of submultiples, that is, grouped around a distribution device (like a 'racquet', 'trident', etc.).

The Cross as a Figure and Formal Structure

As Vasilij Kandinskij said, two lines, one horizontal and one vertical, centred on a square surface, "know no repetition. They thus develop a powerful sound, which can never entirely be drowned" [Kandinskij 1982, p. 68]. The right angle is the irreducible opposition of two movements; four right angles combined form a cross, that is, the perfect balance of different movements that cancel each other reciprocally. The cross is therefore a strong sign that denotes the 'fixed' centre and greatest resistance of a system, but it is also simultaneously the foundation for dynamically discerning size at large distances, extended to the city and the entire territory.
And yet, despite the unique power of its configuration, having become a symbol par excellence, a cross can also be formed through a random adventure, rolling dice on a chessboard, as Paul Klee said [Klee 1959, pp. 223 & ff.] and as Sol LeWitt demonstrated by classifying the possible combinations of 5 cubes on a 5 x 5 chessboard [LeWitt 1977].

The cross as a figure and organizational method (fig. 7)
Strong with its symbolic meaning and history, the cross is set above all as an 'absolute figure' –an archetypical sign– thus attracting perception to itself, nearly to placing in the background its exceptional capacity to structure not only each concluded geometry, but also an indefinite, still unlimited surface. The cross, however, is also an organizational scheme, as when tracing two orthogonal axes on the territory; it is therefore a foundational act, the mark of borders, a symbol of power and legislation, and also a principle of orientation, in the physical space as well as on the map.

Compositions of cross figures with point-like, linear, and volumetric elements (fig. 8)
The panel shows an array of small compositions in which many of the basic grammatical issues are reworked according to an essentially uniform interpretation. By alternating plane sections with box-like volumes, the formative strength of one or more schemes

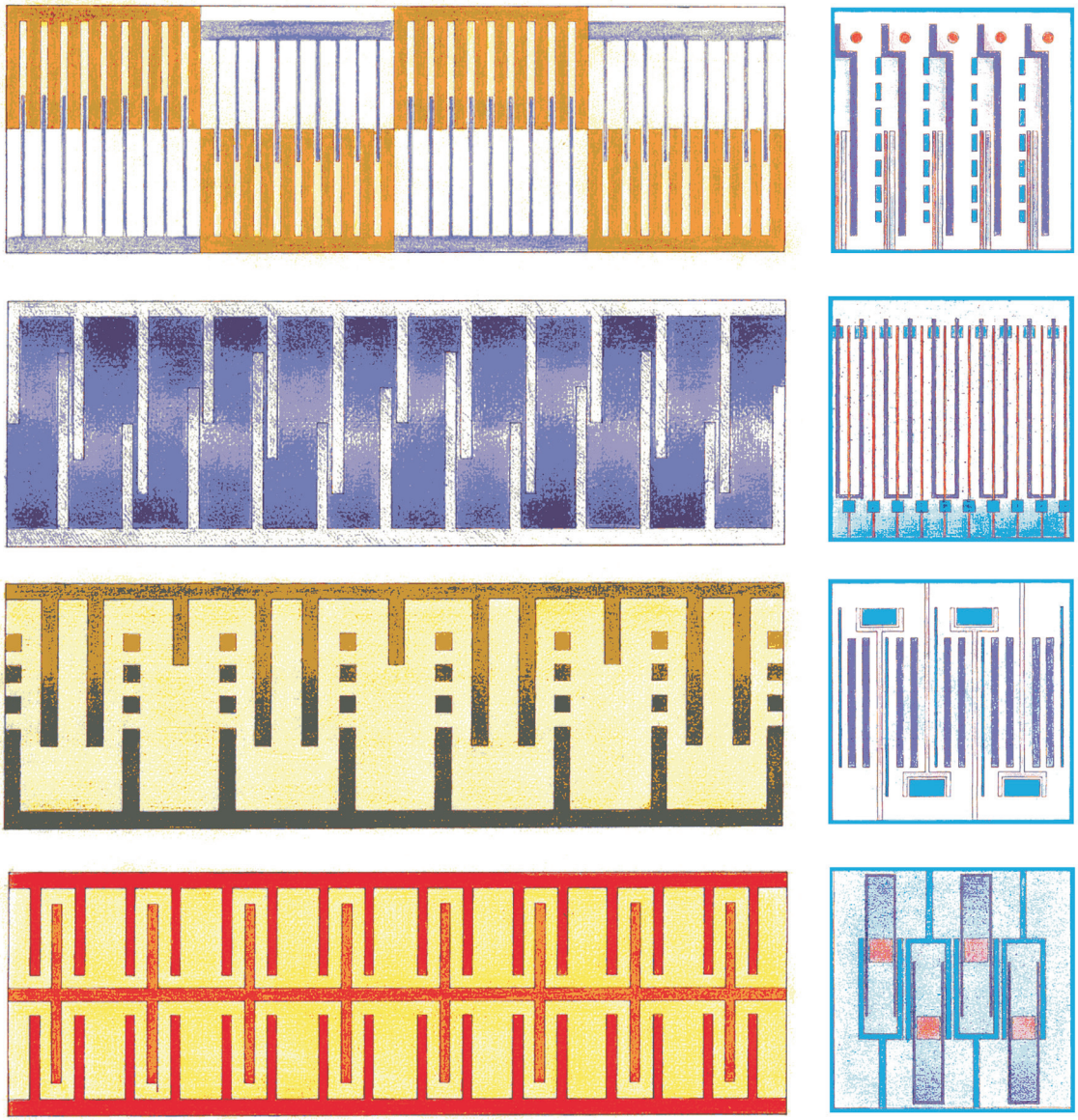


Fig. 6. Double-comb connections of linear series [Cervellini 2012, p. 159].

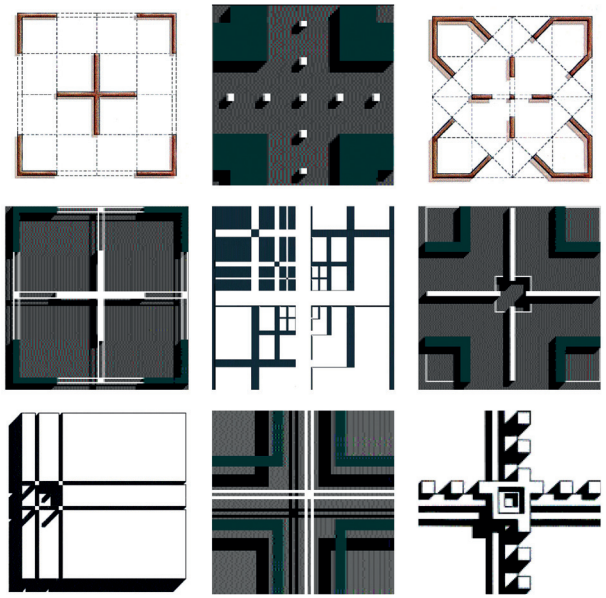


Fig. 7. The cross as a figure and organizational method [Cervellini 2012, p. 166].

is investigated, both intensifying the structural characteristics and attempting to soften its rigidity. This is particularly evident in this panel, where the particular interest focuses on the node of the cross –the 'transept'– either exalting it as the fulcrum of the entire composition –emptying it, carving it out, or concentrating the intersection of the elements there– or reducing its value, overloading the continuity of one of its two axes. More in general, the panel expresses an idea of the composition circulated in a recent era: as the study of nodes, that is, a technique to formally and also technologically accentuate some points to hold everything together.

The Grid as a Figure and Formal Structure

The figure of the grid is an expression of the morphological connection composed of the repetition and intersection on a surface (or in a three-dimensional space) of two or more series of parallel lines (or three-dimensional linear elements), either perpendicular or incident at other angles. In current nomenclature, the elements of a grid are the 'reticle', i.e. the set of lines and their points of intersection, and the 'mesh', i.e. the set of surface units delimited by the reticles, also called 'quad reticle' in the case in which the grid is binary, i.e. composed of only two ensembles.

When, in the most common case of a binary grid, the sequence of linear series has a constant, equal rhythm in the two directions, the grid is modular; if the series are also orthogonal, the most widespread grid is produced, the square grid. As Klee said, a grid may be formed through the dynamic intersection of two "basic structural rhythms", a linear one from top to bottom, and an analogous one from left to right. Since it is the "sum of equal units" repeated in two directions, it rhythmically controls the plane via its measured occupancy. The structural characteristics of the grid are its ability to be 'multiplied' and 'divided', thereby allowing for increases or partial fractioning without altering the rhythmic principle. The grid therefore represents the 'possession' of a plane surface by a system of lines. In fact, it may unfold on the whole of the plane according to the infinite underlying pattern of its coordinates, selecting its tracks from it each time. Through the reticle, the logical/formal procedure of repetition, which the grid possesses genetically, becomes a syntactic/compositional rule that simply makes a metaphor of the plane with a radical figurative elementalism.

There are basically two primary syntactic nodes of connection in grids. The first originates either in the common 'direction' of the series of linear elements (or those similar to linear three-dimensional elements), or in a uniform 'orientation', whenever the components of the grid itself are the bands (these also linear segments but with a two-dimensional thickness).

Since the direction is identical for each series, like the orientation of the bands (which may, however, also pertain to translated or overlapping planes), the peculiar, rhythmic phenomenology of parallelism dominates in the figure, only apparently expressing a grammatical presence of 'time' [4], which, in the grid, as in all 'fixed' visual forms, does not constitute an intrinsic attribute of the final layout. The rhythm of a grid denotes its static paratactic construction through the juxtaposition of its series of linear elements. The spatial measure of the interval between the parallel lines gives it a specific re-

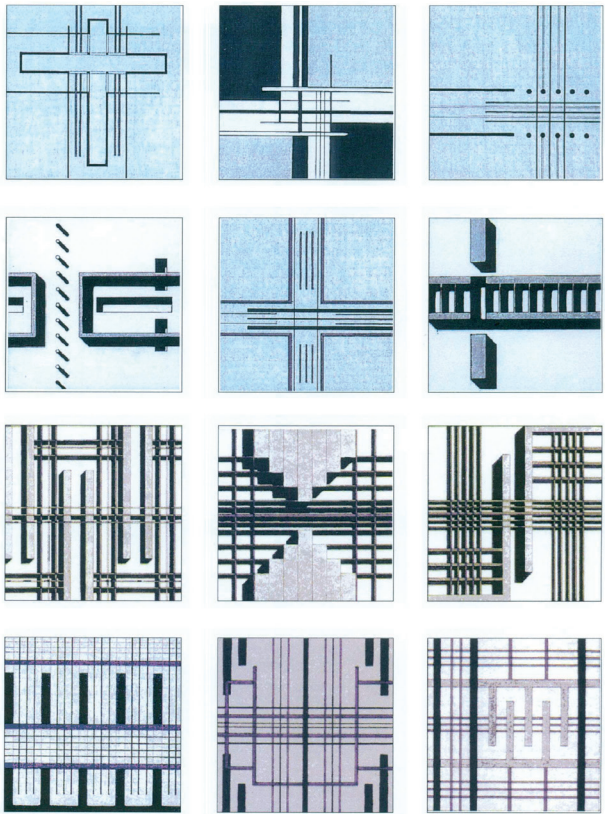


Fig. 8. Compositions of cross figures with point-like, linear, and volumetric elements [Cervellini 2012, p. 176].

petitive cadence, which, with its variability, determines more or less compact or rarefied figures.

Variations of treatment of grids on predefined schemes (fig. 9)
A grid, already in its simplest graphical version –a wireframe– may be considered a 'scheme', that is, a model of associative development between linear systems. In this layout, however, as with every drawing, it already constitutes a complete figure in itself which may make the rigidity of its system evolve into multiple variations. Examples include an outlined organization of the reti-

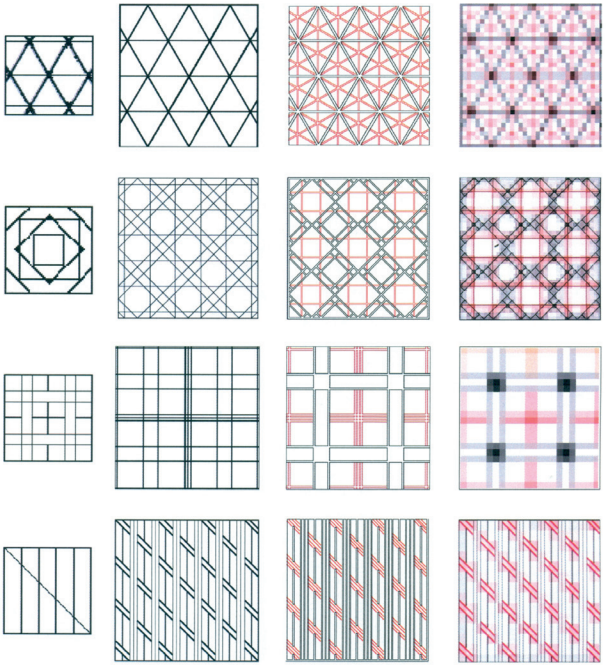


Fig. 9. Variations of treatment of grids on predefined schemes [Cervellini 2012, p. 170].

cle, or development of the weave with colored surface units. In this case, the initial scheme may be assumed as a profound invariant structure used to obtain innumerable 'themed' surface structures. In essence, it may be used in analogy with music, like a 'canon', that is, a melodic tune that can be coupled with 'imitations' and either be added to or superimposed progressively.

Nine square grid (fig. 10)
Applied to a square, an orthogonal reticle of 4 × 4 linear segments, morphologically equal and equidistant, divides the square into nine smaller ones and creates a chessboard [3] of 3 × 3 squares, one of which is the centre of the figure. This chessboard may be considered the prototype for the numerically regulated division of a square. The nine square is a paradigmatic figure for understanding relationships between pros-

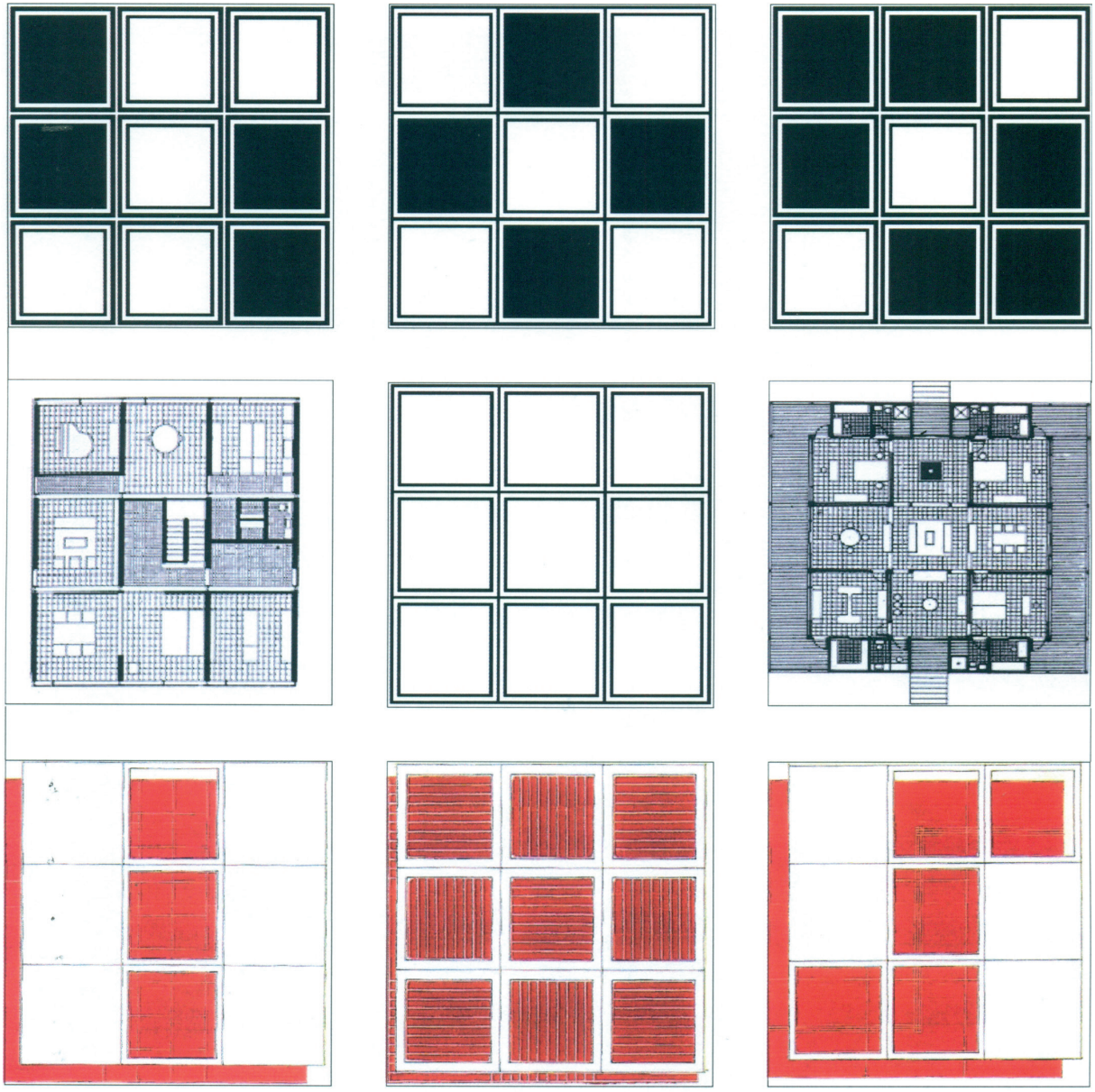


Fig. 10. Nine square grid. On the sides of the central figure, two plans by John Hejduk for the Seven Houses project, Texas, 1980 [Cervellini 2020, p. 21].

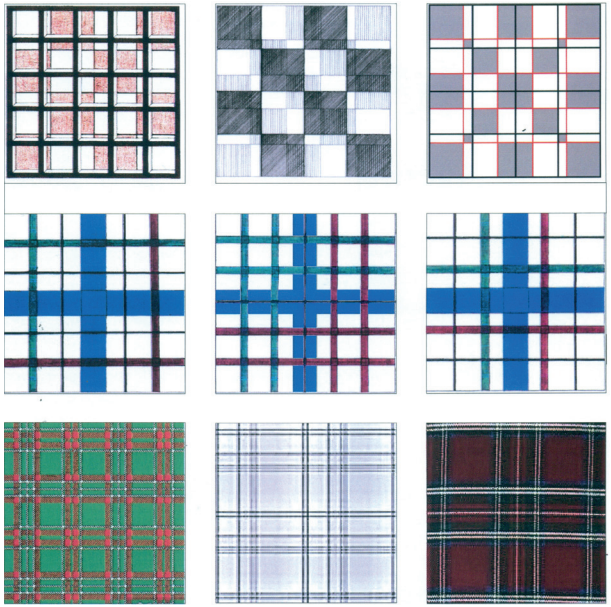


Fig. 11. Even and odd grids: Scottish meshes [Cervellini 2020, p. 21].

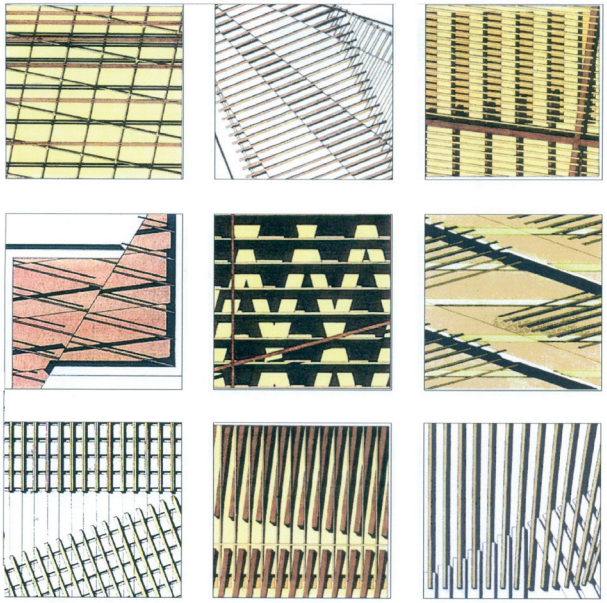


Fig. 12. The formation of complex grids from the deformation and superposition of simple grids [Cervellini 2012, p. 178].

ody and the concept of the form through quantitative, congruent, and commensurable organization of the constituent elements. This is also why the figure frequently recurs in the typological schemes of historical architecture, from Byzantine religious buildings to those with a Greek cross plan in the Renaissance, to planimetric models of Palladian villas. In the contemporary era, the nine square grid [Moneo 1980, p. 70] was a specific design problem, often proposed by John Hejduk in the late 1970s while teaching at Cooper Union in New York.

Even and odd grids: Scottish meshes (fig. 11)
A square grid is substantially different if its meshes are even or odd: in one case, a surface module lies at the centre (e.g. the nine square) while in the other case there is a point, the intersection of the axes. What is more, the two modulations are incommensurable. The solution to integrate them through superposition is to divide the grid with the largest step, creating bands to compensate for the difference in measurement. With these or similar divisions, the devices of the so-called 'Scottish mesh' can be formed, in which the reticle consists of the interweaving of lines –and especially bands– of different color and thickness. The grid therefore becomes a woven pattern, with which the multiple 'figural cover' of each square or rectangular surface is made possible. Grids, therefore, are figures that may shape many of our visual experiences if their conformation is the product of a studied 'pattern' of concept and execution.

The formation of complex grids from the deformation and superposition of simple grids (fig. 12)
Complex rhythmic entities can also be obtained not only by crossing the grids with other schemes, but also through deformation or the superposition of other grids. These operations are analogous to 'intensifying' simple rhythmic individuals, with the difference that to be effective, operations with struc-

tures of elements should generally also intervene on their elementary grammatical character.
In detail, the operations tested here are: the sectioning/translation of part of the grid to produce controlled friction in the alignment; the progressive rotation of the elements of one series with respect to another, which is equivalent to transforming a 'grid' into 'spokes' or solidly rotating one part after it has been sectioned from the whole; and finally, the overlapping of different reticles on different planes (particularly striking are those with acute/obtuse angles).

Notes

[1] According to Wikipedia, Web scraping "is data scraping used for extracting data from websites [it] typically refers to automated processes implemented using a bot or web crawler". Given the essentially speculative and predatory nature of the use of this technique, various methods are used by page authors to prevent automatic visualization.

[2] DIY: Do It Yourself; DIYer: *bricoleur*.

[3] 'Time' is the primary grammatical characteristic of music, poetry, dance, but not of 'fixed' visual forms (it is obviously fully present in 'dynamic' visual forms such as design or cinema). In fixed visual forms, 'time', as in the case of the grid, and movement are agents of the concept –very important throughout the evolution of the project, but leaving no trace in the final product.

[4] Square grids may generate 'nets' and 'chessboards'. In the former, the reticle is valid on the plane of the figure and the units of the mesh are neutral (empty or transparent), while in the latter, figuratively speaking, the opposite is true. Because each grid can be divided or multiplied to infinity, the 'net' not only extends more easily than the others, but also with a specifically tectonic rather than visual characterization. In contrast to nets, the lines on a 'chessboard' exist as the edges of the areas they delimit. Especially when the colors of the squares alternate, this is one of the more 'coldly expressive' figures in the spatiality of a rhythmically marked plane surface.

Author

Francesco Cervellini, School of Architecture and Design "Eduardo Vittoria", University of Camerino, francesco.cervellini@fastwebnet.it

Reference List

Cervellini, F. (2012). *Il disegno officina della forma*. Roma: Aracne editrice.

Cervellini, F. (2016). *Il disegno come luogo del progetto. Note per una teoria della pratica del disegno di architettura*. Ariccia: Aracne editrice.

Cervellini, F. (2020). La griglia/The grid. In *XY Rassegna critica di studi sulla rappresentazione dell'architettura e sull'uso dell'immagine nella scienza e nell'arte*, n. 8, pp. 8-23.

Devoto, G., Oli, G. (1995). Inventare. In *Il dizionario della lingua italiana*. Firenze: Le Monnier.

Garroni, E. (2005). *Immagine linguaggio figura. Osservazioni e ipotesi*. Roma-Bari: GLF editori Laterza.

Hjelmslev, L. (1998). *Principi di grammatica generale*. R. Galassi, M. Picciarelli (a cura di). Bari: Levante.

Kandinskij, V. V. (1982). *Punto, linea, superficie. Contributo all'analisi degli elementi pittorici*. Milano: Adelphi.

Klee, P. (1959). *Teoria della forma e della figurazione*. Milano: Feltrinelli.

LeWitt, S. (1977). *Five cubes placed on twenty-five squares with either corners or sides touching*. Bari: Bonomo Gallery.

Menna, F. (1983). *La linea analitica dell'arte moderna. Le figure e le icone*. Torino: Einaudi.

Moneo, R. (1980). L'opera di John Hejduk ovvero la passione di insegnare. L'architettura alla Cooper Union. In *Lotus international*, n. 27, pp. 65-81.

Neri, G. (1996). Il segno, la linea, la superficie, la forma, il morfema spaziale. In R. Partenope (a cura di). *Il disegno come idea. Materiali di un corso di disegno e rilievo della facoltà di Architettura "La Sapienza" di Roma, anni accademici 1990-1994*. Roma: Gangemi editore, pp. 62-84.

Reversible Ideas, Irreversible Drawings. Time as a Connector in Architectural Drawing

Pablo J. Juan-Gutiérrez

Abstract

Architectural drawing, as part of a means of communication [Sainz 1990, p. 26] can be understood as the signifier that contains or refers to a series of images and ideas that serve as a referent and that have been, in any case, organized by the author of the drawing. This relationship will not be by definition univocal but, although following different degrees of ambiguity, it will have to be constructed, again and again, for each reader. The interpretation of this graphic signifier, its use in language [Wittgenstein 1958, p. 61], will be an essential mental exercise during the analysis of the graphic and will be directly related to the process of drawing that has been carried out and which, in any case, always requires temporality.
This research work is based on the hypothesis that the reader must carry out an exercise that is almost as important as the author during a process that, as such, involves time and, furthermore, requires reversibility for its achievement. Based on this idea, the relationship (and therefore the distance) between the eye that reads and the hand that draws is analysed. The theoretical approach is accompanied by practical examples to help understand the method developed, based on reversibility as a tool for constructing the graphic image. It is this journey "backwards" [Klee 1976, p. 60] by means of which we are able to end up analysing, valuing and, in short, constructing the graphic criterion with which to evaluate architectural drawing.

Palabras clave: conector, crítica, Expresión Gráfica, reversibilidad, anacronía.

Introduction

We start from the assumption that the connector between both extremes of the drawing process (symbolised by the hand and the eye) is of a temporal nature... that is to say, it will be time, understood as a context, but also as a working mechanism, which will help to define the meaning of drawing, on the one hand, and its way of being constructed in society, on the other. The theoretical approach is accompanied by practical examples to help understand the method explained: although the process of drawing is, *a priori*, linear and irreversible, the process of reading the drawing summons and is based on reversibility as a tool for constructing the graphic image. The reader must perform an exercise that is almost as important as the author. Primarily, irreversibility requires that each graphic is understood as an independent effort to encode a series of ideas and prepare them for a temporal journey that, on most occasions, survives us or is alien to us; equally important, reversibility during reading is the main characteristic that allows one's own [re]considerations about the graphic to be synchronized with those proposed by the great philosophers and critics. The conclusions of this investigation serve to argue the indispensable role that temporal vision plays in the graphic context by serving as a link between the author and the reader and, at the same time, announcing one of the most important (and unnoticed) characteristics that images bring about: the anachronism [Didi-Huberman 2000].

The concepts that are developed correspond, fundamentally, to the two interpretations of the same intent; that which has to do with architectural drawing itself, understood as a process, and that which, for its part, delves into the concept of time applied to the reading of the drawing. The starting hypotheses of the research are the following:
- the distance that exists between the eye that reads the graphic and the hand that creates it has a temporal character. Or to put it another way: time is the main connector between the eye that reads and the hand that draws;
- the process of drawing is, *a priori*, linear and irreversible. On the other hand, the process of reading the drawing invokes reversibility as part of its nature and, inevitably, introduces anachronism into the resulting image.

The aim of this article is to develop a personal research methodology based on the ideas set out above, which, taking into account the temporal factor, will allow us to explain the mechanisms of evaluation of drawing from the asymmetry that, as we shall explain, derives from its process of creation-contemplation. The checking of the hypothesis will be accompanied, as we have said, by the inauguration of our personal way of understanding the reading of the graphic which, based on a critique founded on the importance of the inevitable anachronism, will allow us to outline the conclusions which, as always, will also and in part, represent the beginning of new research.

The hand that thinks (irreversibly)

Thinking about the drawing from the point of view of the end of a creative process brings us back, intrinsically, to the intentions of the artist. It will be the artist who will hold the key to its evaluation since, after the tracing of each line or the incorporation of each color application, the author will carry out the exercise of synchronization between the idea or ideas that are the intention to transmit, and the graphic signifiers with which the author proposes to identify them. During these actions, it seems right to identify the skill of the artist as one of the main tools in an exercise that ends with a specific graphic design. But, following the thread of our discourse, we must underline the condition of action and process that a drawing has in general. The words of Paul Klee (1879-1940) remind us of this when, in his book *Theory-Modern Art*, he writes: "Is a painting ever born suddenly? Never! It is assembled piece by piece, no differently, by the way, than a house" [Klee 1976, p. 58].

Fig. 1. M. de Caravaggio, Fragment of David vanquishing Goliath (1596). Available at: Wik-ipedia <https://es.wikipedia.org/wiki/David_vencedor_de_Goliat_(Caravaggio)> (accessed 2021, May 10).

We have, it follows, together with the certainty that the drawing 'appears' –little by little and consecutively, line by line, impression by impression, layer by layer– the condition of being created chronologically, that is to say, following the temporal order imposed by the becoming of our being-in-the-world [Heidegger 1975]. This apparently innocent fact leads us to consider that a drawing is, as the temporal condition was defined after Newton [Prigogine 1979], an irreversible condition… that is, its conformation has no way back, since even the eraser or the superimposed paint will leave an invisible trace on the chosen medium, and, more importantly, will occupy a space of time in the duration of its creation. In Figure 1, for example, we see on the left an original fragment of one of Michelangelo Merisi da Caravaggio's (1571-1610) masterpieces, as it can be read today, and on the right, we reproduce the same fragment x-rayed by Mina Gregori, in which we can see a first version of Goliath's head, more expressive or, in the historian's words, evidencing "the expression of horror" [Gregori 1991, p. 12]. In the centre, superimposing both drawings, the differences between the visible and the invisible can be seen in sequence.

The (redrawing) eye

It seems reasonable to think that the existence of the drawing makes no sense without the viewer who contemplates it. We can even understand the author of the drawing as the reader, since, while the author's intentions end up in private analysis, in a way, the artist has by defini-

Fig. 2. Henry Peach Robinson, Fading Away (1858). Available at: Wikipedia <https://es.wikipedia.org/wiki/File:Henry_Peach_Robinson,_Fading_Away,_1858.jpg> (accessed 2021, May 10).

tion a shared role (author-viewer). In this way, and focusing on the analysis of the work when it has been completed, we can synthesize that the sense of sight –the title of the exquisite collection of essays by the thinker John Berger [Berger 2006]– is the main means of accessing the analysis of paintings in general, and architectural drawings in particular. It is through the eye that we explore the chosen media and begin to traverse it as one who constructs its history and, although through the eye, other senses will be brought into play. As William John Thomas Mitchell argues, "All media are […] mixed media" [Mitchell 2005, p. 17] or, as Juhani Pallasmaa reminded us a few years later, "I believe that the sensations of touch, temperature, weight, humidity, smell and movement in visual images are as real as visual perception itself" [Pallasmaa 2011, p. 236].
The role of the spectator, thinker or critic of the drawing manifests, on most occasions, in the face of a concrete and specific, particular result. In this way, and following in Paul Klee's footsteps, we must learn to construct a reverse route: "The main disadvantage of the contemplator or reproducer is that he is suddenly placed in front of a result and that only in reverse can he retrace the genesis of the work" [Klee 1976, p. 60]. But, although many critics agree on this point, "Survey is like the reverse elaboration of a project and that performing a survey is like reading the history of a building backwards" [Cundari 2016, p. 94], what we are interested in emphasising now is the active role of the observer, and the importance of the particular narrative that the viewer ends up composing, since it will be, this said 'construction-narrative', different for each of the spectators. The final whole, therefore, will be revealed as a consequence of a particular way of understanding, composing and relating the parts, since "also in the spectator the main activity is temporal" [Klee 1976, p. 60]. In figure 2 we reproduce the photographic composition by Henry Peach Robinson (1830-1901). The Pre-Raphaelite painter produced the first photomontage in history, that is, the first photographic proposal in which different times can be read (depending on the reader) as occurring simultaneously.

Anachronism (or temporal distance)

"Always, before an image, we are before time. […] how can we keep up with all the times that this image, before us, conjugates on so many levels?" [Didi-Huberman 2000, p. 32]. The words of the thinker Didi-Huberman are particularly relevant to us at this point in our consideration, where we are somehow engaged in establishing the relationship and the kind of connection between the hand one uses to draws, and the eye through which one sees. Both are part of a process in which every drawing is inscribed, and which also involves a temporal positioning: irreversible, categorical and general, when it is a question of the act of creation, and reversible and particular, but conclusive, when it is a question of the reasoning employed to analyze and evaluate.
In the case of the drawing of a city it is not different: as we discussed above, the readings of a drawing are, always and without exception, multiple. And the possibilities of recognition and identification are wide-ranging. See, for example, the beautiful drawing of the city in figure 3 in which the observer can, accompanied by (and thanks to) the great artist, compose an individual (personal and original) image of the urban fact. The anachronism (that ambiguity in a temporal key) is present during the reading and study, the analysis, of the graphics of the territory. Not only because the urban fact itself escapes from a closed or autistic definition of complexity, identifying itself more with a set of parameters, actions and facts, but also because "there is no graphic tool that can give a real perception of this interaction of factors" [Carazo 2016, p. 34].
The disconnection between what is represented (architecture and/or city) and its representation (drawing) will be inevitable: hermeneutics –interpretation– therefore plays an important role in the temporal distance between the hand that draws and the eye that reads. And at this point anachronism becomes the protagonist. Certain issues, at the heart of the debate of what architecture means, will escape representation and therefore the only way to relate them will be through a graphic development that suggests (rather than represents), or that points (rather than identifies). When Robert Smithson speaks of the impossibility of describing or recording part of architectural reality (understood as capacity) he is, precisely, delving into the limits of drawing, of representation and, therefore, into the territory of its interpretation: "We are thinking of architecture's capacity […] a capacity we can feel and act upon, but cannot necessarily describe or record" [Smithson 1992, p. 5].

Fig. 3. Paul Klee, Revolving house (1921). Available at: Museo Thyssen-Bornemisza <https://www.museothyssen.org/en/collection/artists/klee-paul/revolving-house-1921-183> (accessed 2021, May 10).

Rereadings

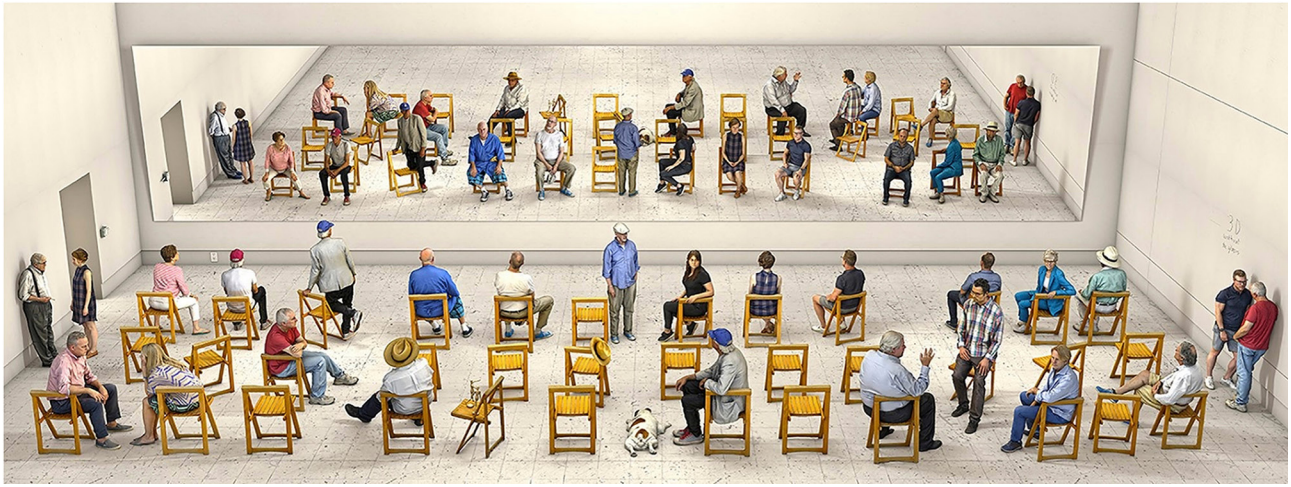
"The work of art is born of movement, it is itself fixed movement and is perceived in movement" [Klee 1976, p. 60]. With this (seemingly) innocent sentence Paul Klee introduces the problematic of the temporal as an inseparable part of the two elements on which we have drawn the connecting line. It is "born of movement" (the hand) and "perceived in movement" (the eye). The connection, moreover, is made on the basis of the drawing, which is "fixed movement", that is to say, graphic time. Even the first and most synthetic element of the graphic is understood by the great philosophers as something more than material space: "The point is the minimum temporal form" [Kandinsky 1952, p. 33]. The asymmetry we mentioned at the beginning of our analysis is based on the fact that the hand that creates the drawing is, in a way, irreversibly proposing a drawing, while the eye that reads and constructs the image from it has a less conclusive role and does not leave per se a material trace as the hand does. We call it reversible because it must try to understand and unravel, decode, the ideas behind the drawing starting from the end and, moreover, it can move around the media at will, starting again with each line, each expression, each color.

The results of the rereading are presented as a methodology for understanding and evaluating architectural drawings in which the awareness of anachronism (in the wake of Didi-Huberman) must occupy a central place. Not only in a teaching context (which is also the case) but also in an environment of reflection on the meaning that the authors propose to us with their works, in general. In the same way that the division of the second with the work of Eadweard Muybridge can be related to the importance and scope of the division of the atom [Solnit 2004, p. 7], Didi-Huberman's importance of assuming anachronism as an inherent part of images can be the most evident argument that the pertinence of a study of the hand-eye connection in a temporal key can have for the analysis of the graphic in an architectural environment in which, *a priori* and as we have developed, we could leave to one side.

This tool of analysis, applied during the study of the drawings, helps us to understand and be able to relate more of the ideas proposed by the authors in their works and also to be aware of the omnipresent ambiguity and, therefore, the relativity of our assumptions. David Hockney, a paradigmatic example, is currently immersed in the relationship between traditional painting and the study of photography together with digital drawing techniques. Observing his paintings means carrying out reversible exercises through which to make relevant the torrent of ideas that the painter proposes to us. In the words of Oscar Tusquets "these works are not intended to represent an instant but permanence" [Tusquets 2019, p. 75]. Our eye, moving across the canvas (for example, in fig. 4), constructs the meanings that, thanks to the artist, make up the discourse. A room, inside what appears to be a museum, drawn from an elevated position. Three rows of chairs, inhabited by a series of people, are arranged in front of a large horizontal mirror which, faithful to the laws of reflection, reproduces what is in front of it. Our eye, as we have said, travels across the work. The mirror can be read, in reality, as a painting within the painting we are contemplating, in which we cannot help but think what would happen if it could reflect us. But there is, above all, at first sight something very strange: there are people who are repeated, in different places and performing different actions. This makes us understand the whole as a double anachronism (that of the image itself and that created by the artist). Our gaze seems to float, to rise, after understanding the temporal game proposed by the author and the implicit reflection: art as an extension of a territory capable of signifying reality and, at the same time, introducing the temporal (and therefore reversible) freedom that is absent in the world of becoming which we inhabit.

As an example of the application of the theory, three series of images are reproduced below in which we observe the results of the work in a graphic medium after the assumption of the main hypotheses developed, specifically the one that shows the eye as a transforming (and re-transforming, insofar as it is reversible) element of the image that is observed. In this manner, the students of the Master's Degree in Architecture at the University of Alicante generate their own graphic signifiers that have to do with the city, and that consciously position themselves in the face of the multiplicity of gazes and interpretations that they receive.

The first of the series (fig. 5) reproduces diagrams of the city understood as a visual organization of databases. The authors, after fieldwork and the collection of information *in situ*, use computers to create drawings anchored to the present time. The graphics, in this case, are under-



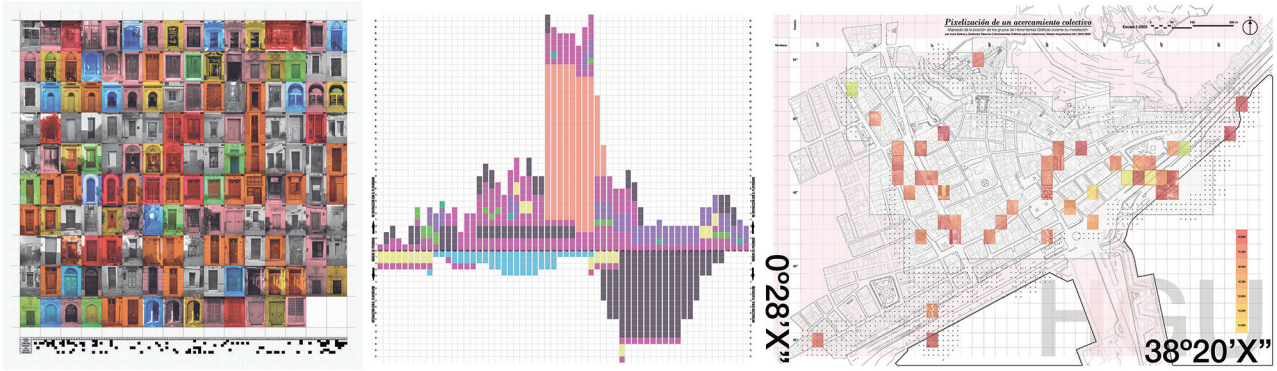
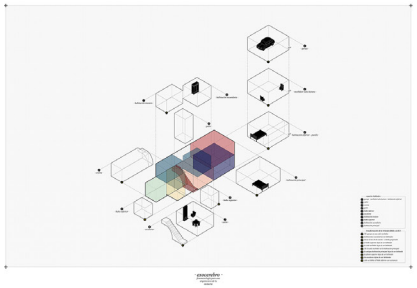
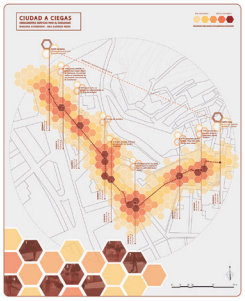


Fig. 4. David Hockney, Pictured Gathering with Mirror (2018). Origin: Ollman 2019.

Fig. 5. From left to right: A. Overlapping of coded doors in the center of Alicante, students: R. Díaz Valera and I. López Aniorte; B. Timeline as a tool to organize territorial information, students: P. López Leiva and D. López Yañez; C. Mapping of a scheduled tour, students: G. Taverner Llácer and I. Esteve Díez.





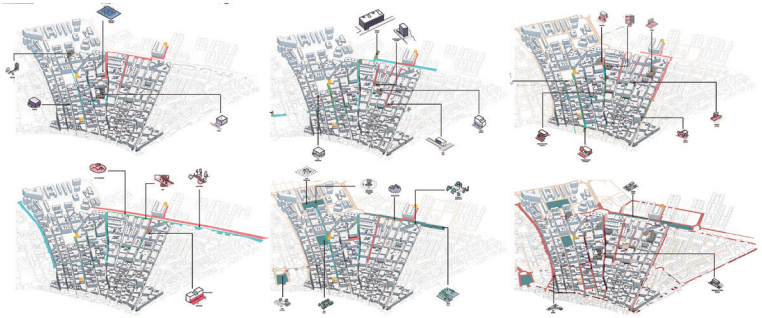


Fig. 6. From left to right: A. Drawing the stories inside a house, student: R. Díaz Valera; B. Overlapping of actions, students: J. Gómez Martínez and K. Marco Pacheco; C. Drawing as a tool to represent actions, student: J. M. Nolasco Vidal.

Fig. 7. From left to right: A. The drawing of the city perceived through different senses of sight, students: A. Garrido Riera and M. Huskinson; B. Sequencing of actions in a neigh-borhood of Alicante, student: J. Sanchis Pérez.

Fig. 8. Tribute to painting Olson's by Andrew Wyeth (1917-2009). Author.

stood as the result of a prior and necessary interaction with the digital information, since in the three examples we are dealing with here the reader is able to select the chosen information intentionally through the computer. Thus, following Mario Carpo's idea that "computers can search faster than humans can sort" [Carpo 2017, p. 48], the visual is understood as a tool that accompanies a thought (that of the reader) still undefined at the moment of creation of the drawing (by the author, in this case the student). It will be the student who ends up drawing, literally, the graphic, according to the student's needs or concerns, but always, of course, within the rules of the game defined at the outset of the exercise.
In the second of the series (fig. 6), the drawing itself is understood as a storehouse of narratives that allow us to transform "what we see into what we read" [Moxey 2013, p. 1]. In this way, anachronism is understood as another possibility: all the information is present simultaneously and it will be the reader, as we have described, who will end up deciding the beginning and the end of a reflection that has yet to be completed, but which is understood to be possible from the very beginning. Thus the drawings present, often based on axonometric or conical perspectives, actions plotted in relation to the architecture and the place where they take place. If the previous diagrams can be understood as more aseptic databases, we can call this type of graphic design of inhabiting that of 'action' (or of the 'happening').
The third of the series (fig. 7) works on the capacity of the image to present itself to us in response "to our desire to last" [Brea 2010, p. 9] as the protagonists of the inhabiting of our cities but, unlike the previous drawings, to house the specific experience of it. The graphic narrative, in this case, is not consciously multiple but apparently linear: it tells the story of a single, concrete experience. In the first example, after having walked through the city depriving ourselves of the sense of the visual and, in the second, after having done so guided by the citizens themselves, in this case Alicante's citizens. The results are also very interesting because, in the same way that a book or a cinematographic experience contains an organized, patterned and directed sequence, the drawings we obtained allowed this sequential reading but did not prevent (it is not necessary to repeat the reason here) many other constructions and images. In other words, they explicitly opened up a path of graphic investigation.

Connections

Conclusions –the end of the present experience and the beginning of the next– can be summarised as follows:
- by defining the distance between the eye that reads and the hand that draws as temporal, we place the reader in a necessarily active position (by understanding the meaning of the drawing as the result of a positioning, also with respect to the anachronism it proposes). In a graphic and architectural context, then, temporal vision plays as important a role as spatial vision;
- reversibility during reading is the main characteristic that allows one's own (re)considerations about the graphic to be synchronised with those proposed by the great philosphers and critics. This fact is also what allows the explicit assumption and consideration of a path of graphic research in an academic environment;
- irreversibility (during the process of constructing – signifiers that make up the drawing) requires that each graphic be understood as an independent effort to encode a series of ideas and prepare them for a temporal journey that, on most occasions, survives us, or is alien to us, but which always begins with our work of drawing.

Acknowledgements

This work has been developed as part of the R+D+I project entitled *The representation of time in graphic expression*, with reference project-emerging-GRE18-10 and financed, in public concurrence, by the Vice-Rectorate for Research and Knowledge Transfer of the University of Alicante.

Author

Pablo J. Juan-Gutiérrez, Department of Graphic Expression, Composition and Projects, University of Alicante, pablo.juan@ua.es.

Reference List

Brea, J. (2010). *Las tres eras de la imagen. Imagen-materia, film, e-image*. Madrid: Editorial Tres Cantos.

Carazo, E. (2016). The role of the drawing in the research and interpretation of urban form. En *Drawing and Architecture 1986-2016. Thirty Years of Research*. P. Chías, V. Cardone, (Dirs.), pp.32-45. Madrid: Universidad de Alcalá.

Carpo, M. (2017). *The second digital turn: Design Beyond Intelligence*. London: The MIT Press.

Cundari, C. (2016). Architectural survey as a merged interdisciplinary activity. En *Drawing and Architecture 1986-2016. Thirty Years of Research*. P. Chías, V. Cardone, (Dirs.), pp.90-103. Madrid: Universidad de Alcalá.

Didi-Huberman, G. (2008). *Ante el tiempo. Historia del arte y anacronismo de las imágenes*. Buenos Aires: Adriana Hidalgo Editora. [Orig. ed. *Devant le temps. Histoire de l'art et anachronisme des images*, 2000].

Gregori, M. (a cura di). (1991). *Michelangelo Merisi da Caravaggio. Come nascono i capolavori*. Firenze-Roma: Editoriale Electa.

Heidegger, M. (1975). *Ser y tiempo*. Madrid: Editorial Trotta.

Kandinsky, V. (1952). *Punto y línea sobre el plano. Contribución al análisis de los elementos pictóricos*. Barcelona: Editorial Labor.

Klee, P. (1976). *Teoría del arte moderno*. Buenos Aires: Ediciones Caldén.

Mitchell, W. J. T. (2005). No existen medios visuales. En J. L. Brea (coord.). *Estudios visuales: la epistemología de la visualidad en la era de la globalización*. Casarrubios del Monte, Toledo: Akal, pp. 17-25.

Moxey, K. (2013). *Visual Time. The Image in History*. Durham (UUEE): Duke University Press.

Ollman, L. (2019). Review: David Hockney's latest: 'photographic drawings' and delectable paintings. En *Los Ángeles Times. Recuperado de* <https://www.latimes.com/entertainment/arts/la-et-cm-david-hockney-review-20190314-story.html> (accessed 2021, May 10).

Pallasmaa, J. (2011). Materia, hapticidad y tiempo. En *El Croquis*, nº 158, pp. 226-241. Madrid: El croquis editoral.

Prigogine, I. Stengers, I. (1979). *La nueva alianza. La metamorfosis de la ciencia*. Madrid: Alianza Editorial S.A.

Sainz, J. (1990). *El dibujo de arquitectura. Teoría e historia de un lenguaje gráfico*. Madrid: Editorial Nerea.

Smithson, A. (1992). *The charged void: urbanism*. New York: The Monacelli Press.

Solnit, R. (2004). *River of Shadows: Eadweard Muybridge and the Technological Wild West*. New York: Penguin Books.

Tusquets, O. (2019). *Pasando a limpio*. Barcelona: Acantilado.

Wittgenstein, L. (1958). *Investigaciones filosóficas*. Barcelona: Ediciones Altaya.

The Architecture of Spacetime: Memory as a Project

Nicolas Turchi

Abstract

In the past decades, memory became one of the most popular thematics in architecture. Frequently associated with building restoration and historical design interventions, nowadays memory is acquiring new meanings which embrace its complexity by accepting the theoretical contributions coming from different fields and thus lending architecture an interdisciplinary aspect. This is particularly due to the breakthroughs achieved in both relative and quantum physics in the 20th century. With time, these discoveries introduced a new ontologic domain that questioned the scientific, artistic, and philosophical paradigms that are based on an outdated reading of reality. In the process of moving from discussing space to understanding spacetime, a designer discovers new dimensions, reconsiders his methodologies, and develops a unique vocabulary. In this scenario, to the intricate mechanisms that regulate the memory construction processes, Edmund Husserl and others added new representational techniques and computational workflows to suggest innovative alternatives to obsolete design methods.

Keywords: Memory, Architecture, Spacetime, Computational Design, Animation.

Space and Time

Space in architecture has, for a long time, been one of the most prominent subjects of debate and study, often standing as an *a priori* condition, a blank canvas open to any type of manipulation, either physical or conceptual. Every discipline that lived through centuries of historical and cultural layering needs solid foundations to serve as a basis for the evaluation of a period or a style. Space in architecture represents the empty pages waiting to be written on to be used by readers from various backgrounds and education to absorb the shared knowledge. What would happen if these blank pages started to blend with the written chapters, the index etc.? Space, as we know it, or even better as we customarily think about it, can be associated with a static object, an infinite yet measurable entity. The designer assigns qualitative aspects to space to overcome this notion and, thus, associates the contained qualities with those of the container. This way of thinking space is extremely functional to the human brain both thanks to its elementary mechanisms and its scalability. However, it might be time to reconsider some of these assumptions because of new scientific evidence discovered, particularly in the 20th century.

Architecture, and by extension the artistic and humanistic disciplines, respond to a spatial conception that dates back to the 17th century. The same spatial and temporal understanding has been the main reference until the early 1900s and relates to a true, absolute,

mathematical, and unidirectional model which will be the foundation of western thinking. Sir Isaac Newton published his most complete work *Philosophiae Naturalis Principia Mathematica* in 1687. In this treatise, he outlined the primary laws of physics of which many are still valid. Those empty pages, dissociated from any content as entities that justify their own existence, represent the 'way of thinking space, way of thinking time' that Newton postulates in the *Principia*: "Absolute space, in its own nature, without relation to anything external, remains always similar and immovable […] Relative space is some movable dimension or measure of the absolute spaces, which our senses determine by its position to bodies; and which is commonly taken for immovable space" but also "Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external […] Relative, apparent and common time, is some sensible and external (whether accurate or unequable) measure of duration by the mean of motion, which is commonly used instead of true time" [Newton 1934]. Newton precisely distinguishes between relative and absolute time, the first being a deceptive measure of the second, which is the only 'true' absolute and mathematical time which we will refer to as Newtonian time from now on. Movement and transformation pertain to relative time. Every object is placed 'in space and in time' within a precise order. If any of these objects were to be altered, it would be subject to an ontological shift, establishing a new identity that would fully replace its precedent without the possibility for any observation and correlation between the two (according to Newtonian space and time models).
The abstract tone of Newton's intuition so presents the time dimension as resistant to any external interference that it might be mistaken with Bergson's notion of 'duration'. Or it could be linked to a priori dimension which should not be confused with 'the a priori condition for each general appearance' described by Kant while associating it to the 'pure form of sensible intuition' [Kant 1987]. The Newtonian time or spatialized time (given the similar qualities shared by the two dimensions according to the English physicist) is a quasi-divine dimension, way far from Kant's time, which, along with space, cannot be a self-sufficient being. According to Kant, there would not be any blank pages as part of a greater, celestial universe, waiting to be filled by the events. Conversely, it would be the events themselves, as sensible relations developed by the intricate mechanisms of the human mind to generate the pages on which they would be recorded.
Nevertheless, Newton's models and postulates persisted for more than three centuries before being shaken by a scientific revolution that challenged the firmly established authority on physics.

Spacetime

In the early decades of the 20th century, this model of reality was wiped out thanks to the work of some of the greatest minds working on modern physics. Hermann Minkowski and Albert Einstein began to think that the two dimensions might relate to each other and theorized time as the so-called fourth dimension of space [Minkowski 2004]. The two dimensions blend into each other and become a *unicum*: the spacetime. The absolute, linear Newtonian time does not exist anymore. In the Special Theory of Relativity (1905), Einstein described: a) how time dilates relative to such qualities of space as mass and acceleration; and b) that a multiplicity of times not only exists but implies that all of them are equally real and can only be defined and measured relative to each other. The observer plays a key role in this. The observer is the 'external' entity that observes and measures properties in relation to its reference system. Physics seems to no longer describe how things evolve in time, but "how things evolve in their own times, and how 'times' evolve relative to each other" [Rovelli 2018, p. 16]. This Scientific revolution was rapidly followed by General Relativity and lit a vibrant debate between the most prominent scientists and philosophers such as Proust, Quine, e.g., the series of conferences and lectures by Albert Einstein and Henri Bergson, and inspired several movements and avantgardes such as futurism and cubism in art and such others in the literature.
The observer, who is capable of identifying himself with a reference system and measuring extraneous spaces and times, is the human being. However, as humans, we suffer the coexistence of a plurality of times that are often in conflict with each other. We are pushed to look for the meaning of this conflict by introspectively investigating our nature. Therefore,

it was thanks to modern breakthroughs in physics and the contemplation of the complex mechanisms of the human mind that we began to learn that "to understand ourselves means to reflect on time. But to understand time we need to reflect on ourselves" [Rovelli 2018, p. 155]. This form of research increased the tension between the scientific approach and the ideological introspection which characterized the past century and allowed hybrid figures such as Edmund Husserl to emerge.

Internal time-consciousness

According to Husserl, the key element for reading through the complexity of temporal phenomenon is perception. This is notably evident when he insists on the perception of temporal persistence in his famous treatise *The Phenomenology of Internal Time-Consciousness* where he also discusses the relationship between the observer and the immanent temporal objects (all the objects or entities that are subject to the mechanisms of temporal perception) in their 'modes of appearance'. Husserl uses 'sound' to describe the phenomenon of persistence. Sound manifests through its duration, which coincides with the experience of its perception. However, this also includes a second phase which involves the sinking of the unity of duration into the past. Husserl argues that, as long as memory recalls the sound, its unity of duration is not yet fully exhausted. By using sound to describe his spacetime unicum, Husserl openly engages the observer in one of his most peculiar abilities: memory: "To my consciousness, points of temporal duration recede, as a point of a stationary object in space recede when I 'go away from the object'. The object retains its place; even so, does the sound retain its time, its temporal points are unmoved, but the sound vanishes into the remoteness of consciousness; the distance from the generative now becomes ever greater. The sound itself is the same, but 'in the way that' it appears, the sound is continually different" [Husserl 2019, p. 45]. The temporal immanent object is defined by some of its inherent attributes including the 'lasting now', the existence of a portion of its duration that is already elapsed, and the recurring exchange of the 'now-points' across its duration. Yet simultaneously,

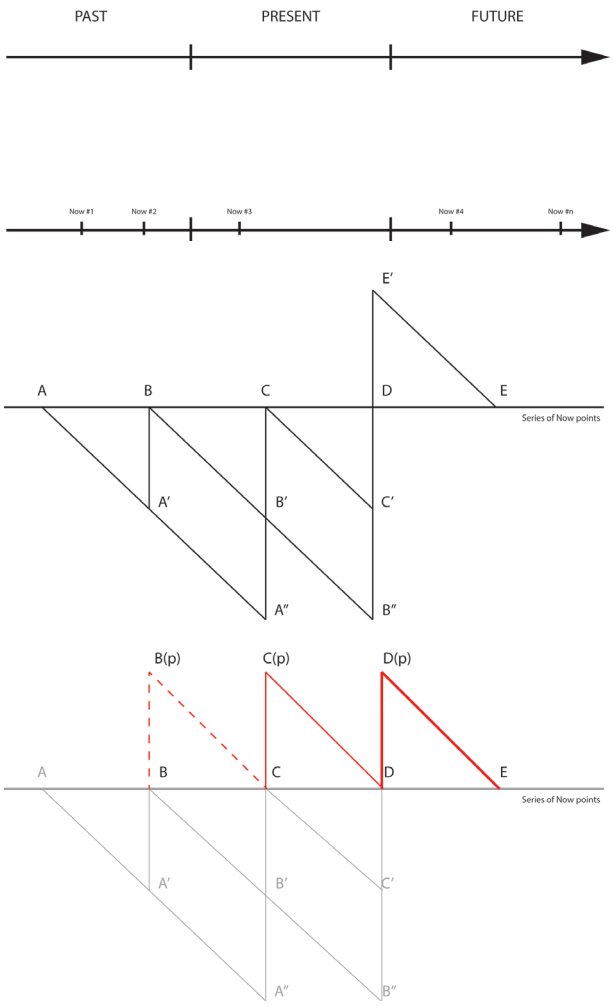


Fig. 1. Newtonian timeline diagram (elaboration by Nicolas Turchi).

Fig. 2. E. Husserl temporal diagram, 'D' as 'Now' momement (elaboration by Nicolas Turchi).

Fig. 3. E. Husserl temporal diagram, Running-off phenomena (elaboration by Nicolas Turchi).

being immediately correlated to the appearance (thus to any perception related phenomenon), the immanent temporal objects are additionally described by their reflections on the observer and specifically by how he draws distinctions between those and their original appearance: "We speak here with reference to the perception of the duration of the sound which extends into the actual now, and say that the sound, which endures, is perceived, and that of the interval of duration of the sound only the point of duration characterized as now is veritably perceived. Of the interval that has expired we say that we are conscious of it in retentions, specifically, that we are conscious of those parts or phases of the duration, not sharply to be differentiated, which lie closest to the actual now-point with diminishing clarity, while those parts lying further back in the past are wholly unclear; we are conscious of them only as empty. The same thing is true with regard to the running-off of the entire duration. Depending on its distance from the actual now, that part of the duration which lies closest still has perhaps a little clarity; the whole disappears in obscurity, in a void retentional consciousness, and finally disappears completely (if one may say so) as soon as retention ceases" [Husserl 2019, p. 46].
On Newton's timeline, it was possible to locate a series of points linked to events, no matter whether or not they were mutually related, that are temporal abstractions that run on an infinite plane without causing or being subject to modification (fig. 1). A mathematical matrix or a simple set of coordinates would suffice to describe the essence of time itself. On the contrary, Husserl's diagram of internal time-consciousness, where the observer is the real protagonist, is oriented according to every fleetingly perceived 'now' moment that is built on the flow of experience (*Erlebnisstrom*). Each of these 'now' moments is not static and generates a series of sub-entities, namely the 'no more' and 'not yet' (fig. 2) on which will later speculate, among the others, McTaggart. This is precisely where a new level of complexity gets introduced into Husserl's diagram: every 'now' point produces an echo of its own unity of duration which will thereupon bounce back on the banks of the perpetual 'now' that is perceived and thus cause a ripple projected towards the future. The series of 'echoes and ripples', which defines the dilation of a temporal object unity of duration, coincides with the retention and protention phenomena. Retention and protention are the main mechanisms deployed by humans to internally organize the phases of temporal perception and the major tools used by Husserl to recast the idea of temporality.

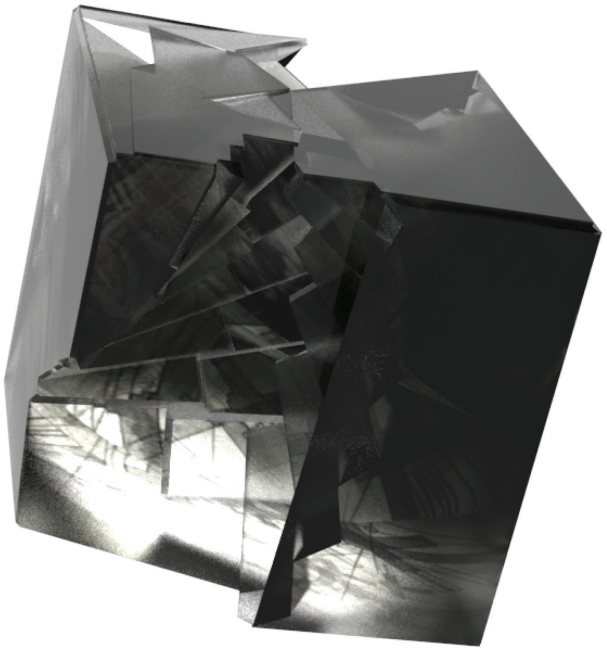


Fig. 4. Internal consciousness of time speculation on platonic object (elaboration by Nicolas Turchi).

Retention

Retention is described by the extension of the unity of endurance of an object perceived through the running-off phenomenon: "the further we withdraw from the now, however, the greater the blending and drawing together" [Husserl 2019, p. 47]. What is 'no more' tends to sink down into the obscurity of memory and resurface from time to time to varying degrees by the accumulation of the protention's ripples, defining: "a kind of temporal perspective (within the originary tem-

poral appearance) analogous to spatial perspective. As the temporal object moves into the past, it is drawn together on itself and thereby also becomes obscure" [Husserl 2019, p. 47]. The sinking down of the perception of a temporal object is the basis of the running-off phenomenon. Despite a quasi-antithetic position between this phenomenon and Bergson's use of the avalanche to disclose the idea of the time of consciousness and accumulation of experience, the two share certain similarities including the impossibility to be discretized without undermining their nature: "With regard to the running-off phenomenon, we know that it is a continuity of constant transformations which form an inseparable unit, not severable into parts which could be by themselves nor divisible into phases, point of the continuity, which could be by themselves" [Husserl 2019, p. 48].

Protention

Protention is the act of producing one or a series of anticipations based on the idea of possibility. It is not a simple forecast because these predictions are highly influenced by the involvement of stratification of running-off phenomena which results in a conditioned projection. The majority of neural signals does not travel from the eyes to the brain: it travels in the opposite direction, from the brain to the eyes. The brain builds an expectation of what is yet to be seen based on what has already happened or drawing from experience. It creates the image of what it anticipates the eyes will see. This information is sent by the brain to the eyes through intermediate stages. Only if any discrepancy is detected between the brain's prediction and the light that reaches the eyes will the neural networks send signals back to the brain. In other words, it is not the image of what is observed that is sent from the eyes to the brain, but only the information relative to the discrepancies from the brain's expectation. [Rovelli 2020, p. 190]. Retention and protention are surprisingly linked together within the cerebral activity. A series of studies on patients affected by amnesia demonstrates how difficulties in recalling certain events from the past would also deeply affect the capacity of imagining future events. This was confirmed by further investigations deploying tomographic images which high-

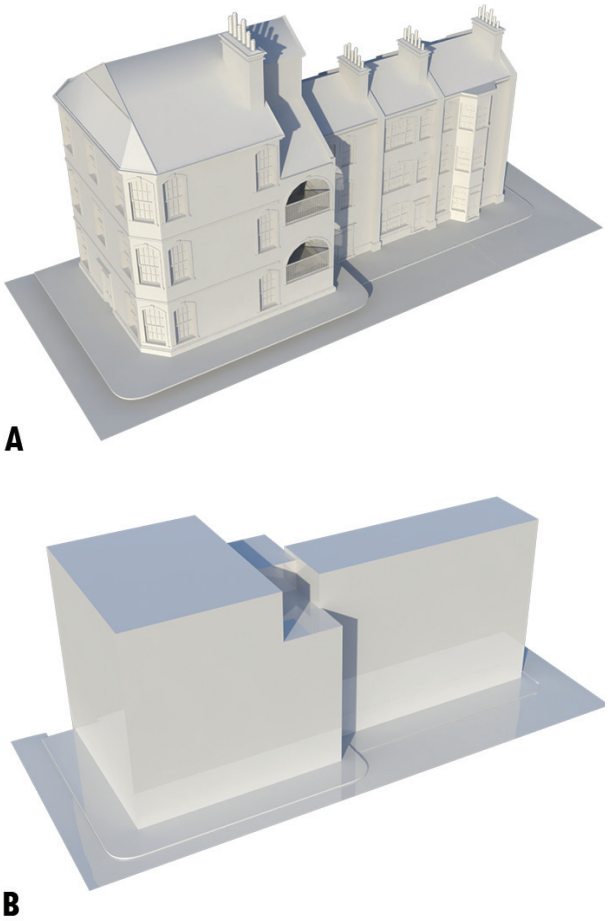


Fig. 5. Phase I, Recognition (elaboration by Nicolas Turchi).

lighted how the brain areas that are activated during the act of remembering and those lighting up during the formulation of possible futures showed extremely relevant matches [Schacter et al. 2013]. This also demonstrates that the act of recalling a memory involves the subject's creativity, thus making remembering a constructive process. In modern psychology 'reconstruction' and 'construction' are the terms used to describe respectively the act of recalling old memories and the act of creating new ones.
Retention and protention, both mechanisms that define human perception, are particularly embraced by one figure over the others: the designer. The designer is the one in charge of bringing to life shared memories and at the same time drawing from personal experience, but also the one who is responding to concrete matters such as bureaucratic issues and building site development. The designer also needs to have a peculiar inclination towards a synthesis that starts with the filtering of a multitude of information and is ultimately directed towards the final scope of a project. Furthermore, the designer is that profile who can better read the 'leap' that occurs when the sunk down information re-emerges as protention. Building on this idea, the analogy shows even more potential when a new entity –the project– is considered as a temporal existence built on a collection of immanent objects that exist in a series of 'now' points, generating a multitude of retentional and protentional connections across the same project. We can begin to read the 'project' through Husserl's diagram of internal consciousness of time, along with its constituents temporal objects, and the role of the 'observer' interpreted by the designer (in the involvement that arises from this position). Yet temporal objects build relationships via retentions, protentions and mutations from which is possible, by forcing the system in favour of a better reading, to extract temporal units from which to trace further connections. The architect becomes more and more subject to time, or the spatialized version of time, by experiencing the nonlinearity of events. With the rise of digitalization, the new representation techniques and computational methodologies shorten the distance between the temporal events of a project. New virtual dimensions are beginning to offer dynamic and interactive playgrounds that cannot be described by the Newtonian model anymore.

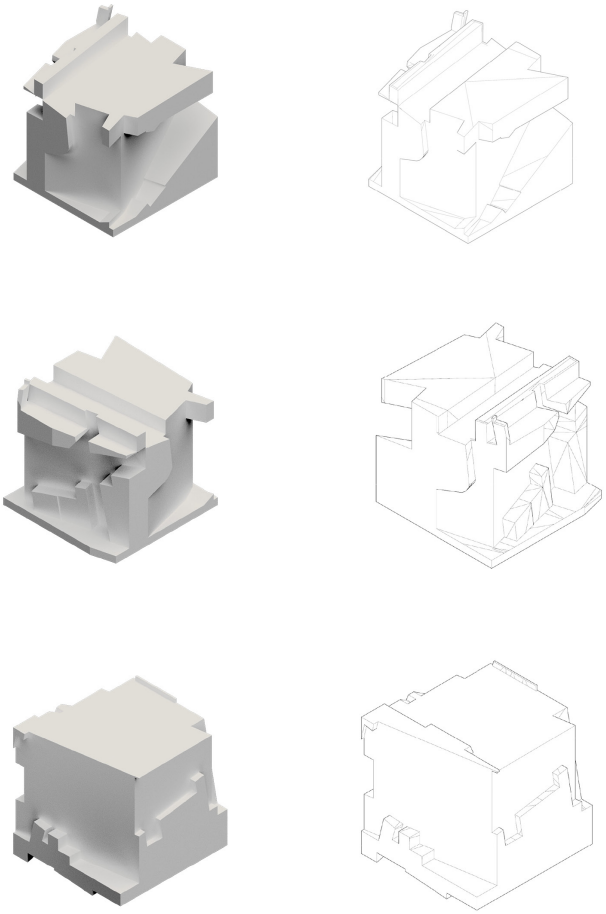


Fig. 6. Phase II, Fragmentation / Clustering (elaboration by Nicolas Turchi).

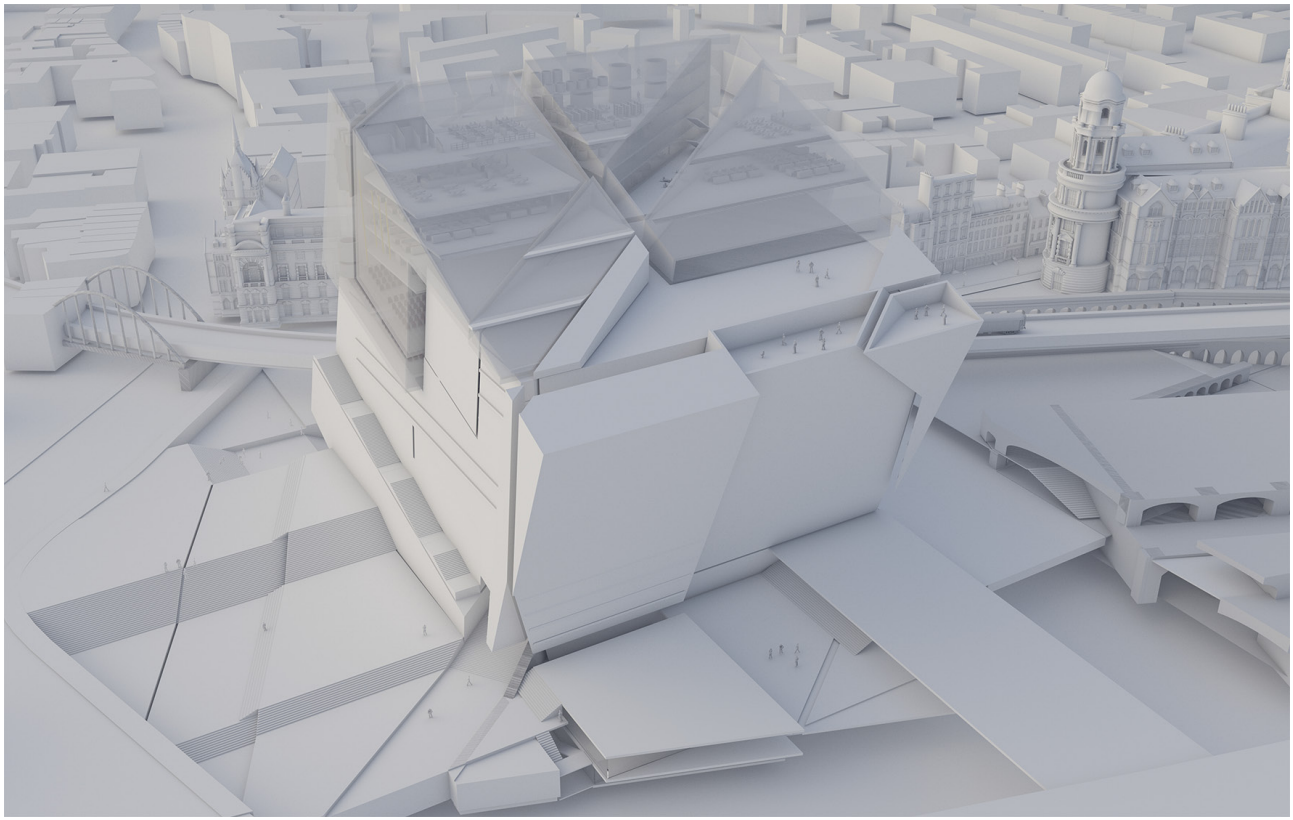


Fig. 7. Phase III, Projection / Manipulation (elaboration by Nicolas Turchi).

Case-Study

In this concluding part of this article, we will examine a case-study extracted from a more articulated research project which is part of a 2018 thesis in Architecture at the Harvard Graduate School of Design. One of the main goals of the thesis is an attempt to transpose the internal consciousness of time theorized by Husserl onto the generative design and representational workflow of an architectural project. It is the project for the new overground station of Bishopsgate Goodsyard in the heart of London. The project, described in a single volume, will also include a research centre and the department of physics of the New University of London. Bishopsgate area is the central node of London, the capital city, and has recently seen an urban restyling that attracted an impressive number of investors which contributed to the general upgrade of Shoreditch. However, the site is very heterogeneous, rich in leftover spaces that have seen several attempts at reuse and reclamation over time. A relatively young portion of the city that has been transformed several times already, starting with the conversion of the old railway station, which was destroyed by a fire on the 5th December 1964. Since 2000, the commuting and circulating trajectories are governed by the new overground station as part of the Circle Line that connects the major interest points across Central London. Thanks to its typological variety, the cultural mix, the urban decay, and the high density of infrastructures present on the site, Bishopsgate Goodsyard was the perfect case-study for this type of thesis. The case-study consists of three macro-operations that reflect the immanent temporal objects investigation. The first cognitive operation involves 'recognition', the perceptive moment when the first information is gathered, verified, and stored. The second stage involves both 'clustering' and 'fragmentation' and includes intrinsic retention and protention, both about the single existence of the project (its unity of duration). The third operation is the 'projection' which necessarily includes a certain degree of 'manipulation'. While in the first two stages the subconscious elaboration of any temporal object is crucial, in the third step the observer finally realizes his perceptive potential and thus becomes responsible for the existence of the project itself and becomes fully exposed to any third-party verdict.

Recognition

All the activities involving inquiry into immanent temporal objects can be listed as part of the recognition process. To give a few examples, analysis of the urban, historical, environment, and also the investigations of adjacent buildings and their residents, market analysis, and finally any competition brief and the reading of regulations. All these information sources constitute themselves as temporal identities that which play walk-on parts hierarchically subordinated to the superior temporal existence of the project (although they can still play a protagonist role by being considered as the centre of their own temporal existence, once again it is the observer who has the authority for reformulating this relationship). The most interesting aspect, which adds complexity to the first stage, is the implication of the presence of the observer, who is, the designer. The analysed information is subject to the first form of manipulation by the designer who, based on his previous experience with architectural interventions or his accumulated deep knowledge of old competition briefs or even his scholarly work on particular typologies that populate the area, etc., inexorably filters, and counterfeits the results of the first stage of the investigation. It is pertinent to recall how the brain elaborates a first image creating a prediction of what will be observed, operating a pre-selection of the information based on the temporal consciousness of the past [Rovelli 2020, p. 190]. This is another side effect of the impossibility of discretizing the temporal flow which remains a complete abstract manoeuvre that cannot be fully operated in reality, therefore we cannot section a portion of the same flow without avoiding maintaining all the passive retention that insists on it.
In the case-study, the designer, passionate about the history of architecture and particularly fascinated by the Victorian style and its declination across the British capital, filtered a good portion of the contextual information, synthesizing it (as it happens in the case of a synecdoche) in a typical Victorian style residential building in London (fig. 5A). However, even at this stage, there are multiple reductions already happening which tend to combine and affect each other rather than running in parallel. Following this first step, the Victorian building read as a more generic contextual unit is further abstracted to ease the possible translation into the next level of information (e.g., the masterplan reading, a physical model setup, a visualization that highlights the project vs the surrounding context etc.) (fig. 5B).

Fig. 8. Project bird view, new overground station, external agents' influence (elaboration by Nicolas Turchi).

Fig. 9. Retentional and Protentional echoes affecting the temporal entities beyond the project boundaries (elaboration by Nicolas Turchi).

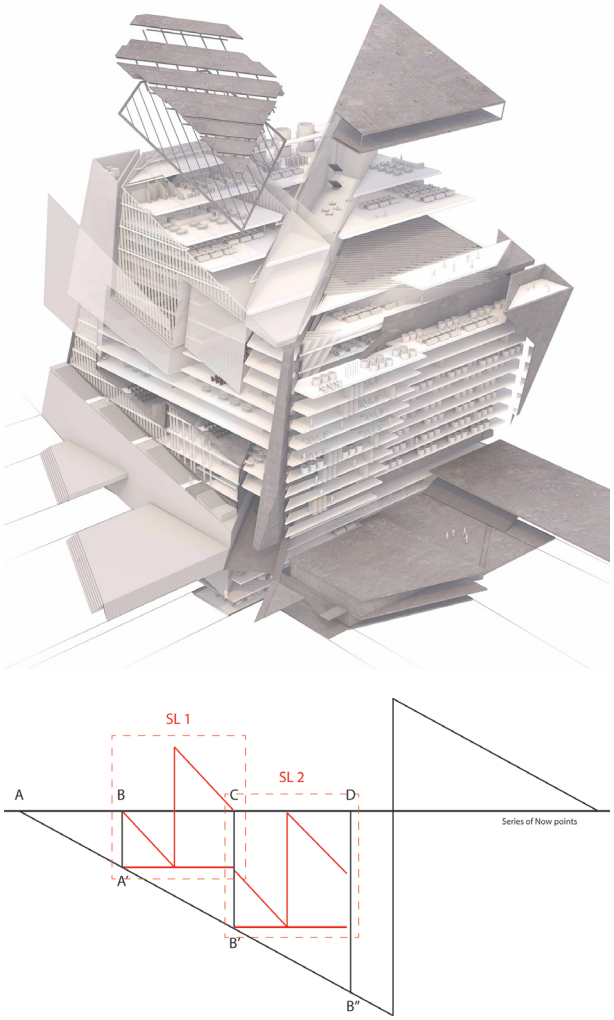


Fig. 10. Fragments of fragments, structural and programmatic investigations affect the internal retentional processes (elaboration by Nicolas Turchi).

Fig. 11. Fractal system of temporal influence, scaling (elaboration by Nicolas Turchi).

Fragmentation / Clustering

Once a certain reality recognition is filtered and stored, it becomes part of the individual's memory. Yet, the gathered information is still responding to the running-off phenomenon as it sinks from the chosen 'now' point of the temporal perspective. We cannot speak of static entities as if with no relations. Every set of information that has been filtered during the recognition process keeps transforming as it begins to interact with other fragments of sedimented memory which are indeed actively conditioning the newly stored information.
After the recognition phase, it is time to deal with the accumulated information. The study-case shows portions of the city that previously went through abstraction beginning to be altered by the fragmentation and clustering processes (fig. 6). Similar activities operate on the sedimented memory. As recollections fade out, they also tend to blend and hybridize with those events that are either close in time or qualitatively relevant to them (clustering process). The information is further optimized by the human mind by reduction and smaller fragments of memories are being lost down the temporal perspective (fragmentation process). Clustering and fragmentation, apparently antithetic processes, are forged by the same running-off phenomenon. The portions of the city are subjected to projection and solid Boolean operations (difference, intersection) until they organize in a multi-layered unit of information on which the observer can still read some temporal object traces. (Fragmentation + Clustering) (fig. 6).

Projection / Manipulation

IThe third stage of the investigation is perhaps the most complex one. The capacity of overcoming the 'leap' between retention and protention has been acknowledged as one of the human peculiarities and it is not limited only to serve the purpose of time perception, but it also constitutes one of the most crucial surviving tools humans possess. The ability to create and always refine future predictions is what feeds the species' evolution algorithm and drives our progress. The designer finally has the opportunity of materializing the processes of clustering and

Fig. 12. Programmatic vivi-sectioning of the building, example of scaling property applied to the project (elaboration by Nicolas Turchi).

cognitive synthesis of information into a projection, into a project (from 'pro'-forth + 'jacere'-to throw). At this stage, a multitude of instances and contingencies may affect the protention outcome starting with, for instance, the design team's final goals, which may be environmental, aesthetic, communicative, economic etc. Thus, the projection results in an altered version which is subject to manipulation to respond to external entities.
In the case-study, the multi-layered unit begins to compromise in response to the environmental and site strategies. The volume is tilted to maximize solar exposure and the environmental comfort (fig. 7) inside the main building as well as to avoid casting an undesired shadow on the nearby residences.
But it also responds to functional necessities such as those of a pre-existing railway that pierces through the volume causing the loss of a fragment of the building (contingencies, shocking events could also erase some portions of memories). A further rotation of the volume facilitates the connection between different levels of the site (fig. 8).
Another potential aspect of the internal time-consciousness research, yet only partially developed, is the fractal capacity of this procedure (fig. 11); the possibility of taking advantage of its scalability (by both enlarging or reducing its spectrum) (figs. 10, 12) which permits the propagation of the generated retentional echoes and the protentional ripples within and outside the project boundaries (fig. 9).
The 'leap' does not merely reflect the moment, the 'now' that is being manipulated by the designer, it further identifies and acknowledges the observer in his new role. From absolute and quasi-divine Newtonian space and time to a great responsibility that the designer, or the architect, must be ready to take on to fully become the observer-thus-the-creator of his own space and time, spacetime, and finally of his memory. A memory that becomes a project.

Author

Nicolas Turchi, Department of Architecture, Alma Mater Studiorum University of Bologna, nicolas.turchi2@unibo.it, turchinicolas@gmail.com

Reference List

Clark, A. (2013). Whatever next? Predictive Brains, Situated Agents, and the Future of Cognitive Science. In *Behavioral and Brain Sciences*, volume 36, issue 3. https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/whatever-next-predictive-brains-situated-agents-and-the-future-of-cognitive-science/33542C736E17E3D1D44E8D03BE5F4CD9 (accessed June 2013)

Husserl, E. (a cura di A. Marini) (2016). *Per la fenomenologia della coscienza interna del tempo*. Milano: Franco Angeli.

Kant, I. (a cura di G. Colli). (1987). *Immanuel Kant. Critica della ragion pura*. Milano: Bompiani.

Minkowski, E. (2004). *Il tempo vissuto. Fenomenologia e psicopatologia*. Torino: Einaudi.

Newton, I. (1934, ristampa 1962). *Mathematical Principles of Natural Philosopy and His System of the World*. Regents of the University of California, with permission of the University of California Press.

Rovelli, C. (2017). *L'ordine del tempo.* Milano: Adelphi Edizioni.

Rovelli, C. (2020). *Helgoland*. Milano: Adelphi Edizioni.

Schacter, D.L. et al. (2012). The future of memory: remembering, imagining, and the brain. In *Neuron*, n. 76(4). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3815616/ (accessed 3 November 2013)

Bodily Simultaneity in Avant-garde Art. Graphic Readings and Schemas

Starlight Vattano

Abstract

Starting from the graphic expressions pertaining to the artistic avant-garde and their influence on the performing arts, the aim of the article is to investigate the relationship between geometry and bodies in motion in costume and set designs dedicated to dance. The proposed readings concern the analysis of some emblematic representations of the artistic avant-garde that shared a profound interest in costume and set-design with those choreographers, dancers and music composers who were contributing to establish a vision of theatre strongly rooted in the socio-political worries of the time. The graphic interpretation dwells in the first instance on the sketches and costumes with the aim of tracing those geometric and distributive connections that exist between the totality of the human figure and the parts that define its dynamics. Subsequently some analytical schemas are proposed on the photograms of two ballets performed for the first time by Sergei Diaghilev's company, La Chatte *(1927) and* Les Noces *(1923). In this case the choreographic structure, the arrangement of gestures in space, the directions and the dynamic elements are analyzed in order to frame and distinguish relationships between things and movements by means of force lines, in a mosaic of weights and graphic balances, seeing in the drawing a possible dimension of choreographic explication.*

Keywords: schema, graphic analysis, avant-garde art, choreography, set-design.

Introduction

Following the theories developed by Adolphe Appia and Edward Gordon Craig, who experimented a vision in open rupture with the realist and naturalist style of the set-design tradition, the contribution of Russian theatre worldwide also revealed an aesthetic panorama now far removed from the exotic charm of the *Schéhérazade* of the *Ballets Russes*, of 1910, arriving at the *Victory over the Sun* that Kazimir Malevic created together with numerous poets and painters in 1913, proposing an intermediate space in which words, images and movements defined an abstract territory, thus directing the set-design and costume design towards a new scenic shape. From this moment on, the frenetic Russian theatrical activity developed through the coexistence of multiple art fields and multifaceted personalities who gave a contribution strongly rooted in the socio-political issues of the time and, during the first decade of the twentieth century, imbued with those subversive theories that were feeding the great masses of the October Revolution.

Dance, costumes and set-design of the Avant-garde art

Many of the Ukrainian avant-garde artists, travelling in Italy and France, as well as in Russia, showed a deep interest in the trends that were developing in visual arts although maintaining a strong connection with

their native language. The result was the definition of a nationalistic style that saw the representation of human figures using bright colors and costumes with dynamic shapes, characterized by blurred and bright contours.
One of the painters who contributed to the Russian theatrical turning point in the association between the figurative arts and ballet was Vadym Meller, who collaborated with the choreographer Bronislava Nijinska, starting work in 1920 at the Kiev Opera House, by then a place of design experimentation aimed at constructivist issues (figs. 1, 2).
In the same year he was costume and set designer at the Shevchenko Theatre, soon becoming a precursor of modern constructivism in the Ukrainian Soviet Republic [Mudrak 1986]. Meller's cube-futurist approach and the development of forms in space were influenced by Alexandra Exter's teachings and would also be the expression of a copious production of paintings and sculptures also accepted at the Berezil Theatre [1], which was founded as an artistic association that had renounced traditionalist aesthetics to embrace left-wing arguments linked to the cause of the proletarian revolution.
In 1923, he created one of his best-known works for the play staged on the work of the German playwright Georg Kaiser entitled *Gas I* (fig. 3), a symbolic representation of how industrialization led to destruction and skillfully told by the costumes designed by Meller [Bowit 1977]. Until the 1930s, the artist maintained, a style very similar to Exter's, exploring a dynamic three-dimensionality expressed in the construction of costumes and the choice of colors that influenced a large number of Russian artists of the time.
In general, the geometric construct, with a clear constructivist matrix, favored the recognition of the compositional structure, as occurs in the eccentric characters and costumes drawn by Anatol Petritsky, who defined his sketches by means of the emotional and behavioral value of the character, often favoring the rigor of the geometric structure over the choreographic one (fig. 4).
Together with Alexandra Exter and Vadym Meller, Anatol Petritsky was among the leading figures to dominate the Ukrainian constructivist scene in Russia and worldwide. After working for Exter like Meller, he drew numerous costumes for Bronislava Nijinska's company (figs. 5, 6), working as a set and costume designer for many theatres, including the Berezil.
After 1917, Petritsky turned much more to a traditional style, as in the *House of Interludes* of 1917 made for a theatre directed by Bonch-Tomashevsky. The large panel shows a simplification of forms contrasted in color and emphasized by the gestures of the characters, a realistic representation of the subjects, far from the abstraction of forms in favor of a simplification of the parts that manifest the emotional state through the sinuosity of the lines and the thickness of the contours.
His bodily transformations in drawing seem to follow the principle already expressed by Charles Darwin according to whom "movements […] always have a close relationship of dependence and correspondence with the form that produces them" [Tombari 2019, p. 22]. This transformation of the body during movement is also interpreted by Kasyan Goleizovsky who, in addition to his activity as a dancer and choreographer, left a significant latent graphic legacy of that symbiotic spirit between movement and its representation that defined a gestural language sacralized in the trace of the annotation (fig. 7).
Goleizovsky's costumes, like Meller's ones, became true masks that altered the human body, structuring repetitions and translations of forms, combining color and geometry in the aesthetics of action (fig. 8).
Constructivism entered the design and realization of stage costumes and sets as well as choreography, by means of a shift from composition on the plane to composition in space.
This process was implemented mainly by virtue of the collaboration of artists coming from different places and not only from Russia or Ukraine, as in the case of Meller, Petritsky or Nathan Altman, but also from Armenia, as in the case of Georgy Yakulov, artists who highlighted the differences between nationalistic visions for the resolution of theatrical issues and design choices.
In this context, the figure of filmmaker Vsevolod Meyerhold was of fundamental importance for the evolution of Russian theatre design in the 20th century; thinking of theatre as an extension of the actor, Meyerhold provided the artists who began to train with him the opportunity to use the stage as a space of integration between the body and the set [2].

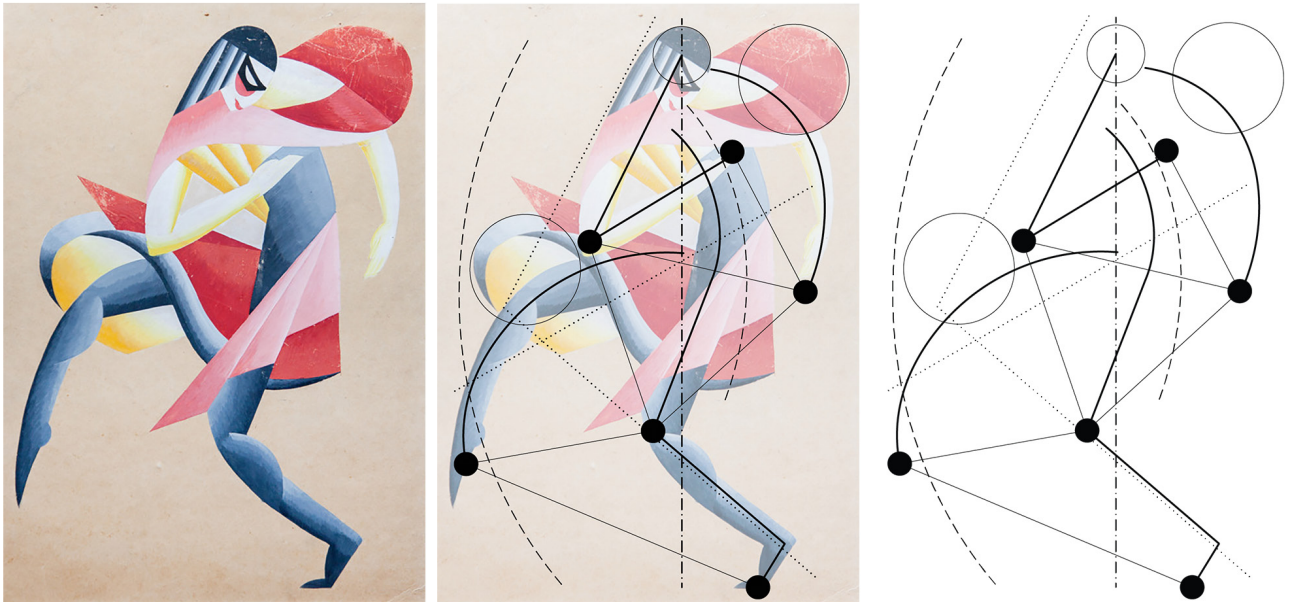


Fig. 1. V. Meller, costume for the choreography Masks, 1919 (elab. by Starlight Vattano).

In fact, the use of mobile elements and kinematics that could be activated directly on stage accentuated the emotional emphasis of the themes inspired by the drastic transformation that was no longer just theatrical but predominantly social.
Constructivism in Meyerhold's work thus made it possible to resolve the dichotomy between the conventional two-dimensional mode of set-design and the three-dimensionality of movement. A synthesis occurred in 1906 with Alexandr Blok's production, together with Meyerhold, *The Fairground Booth*, in St Petersburg, which staged the profound process of disenchantment with Symbolist ideals and at the same time the inevitability of existence, estrangement and the double [Bowit 1977].
The rejection of excessive stage decorations in favor of a scene undressed and completely shown to the public in its volumetric and compositive structure left space for the evolution of gestures and the movement expression, anticipating many of the principles later taken up in the works of the theatre artistic avant-garde.

Schemas and graphic constructions

The graphic analysis focuses on two types of images, static and dynamic ones, produced in the context of the artistic avant-garde theatre. In the first case, some drawings of stage costumes are schematized, then the graphic reading of the frames of two ballets is proposed. The type of graphic language used for the analysis is based on the synthesis of the objects, in the plane and space, in the form of meshes of lines and hierarchies of signs, according to an order of gesture execution that takes shape from the same scheme of analysis. The geometries that define the distribution of movements allow us to trace two and three-dimensional elements through which it is possible to grasp their unfolding in temporal fragments.
The graphic factors through which the schematic structures are configured are: the lines of the bodies (thick continuous lines), the directions of the main movements of the dancers (dotted lines), the spatial relationships/distances between the dancers (light

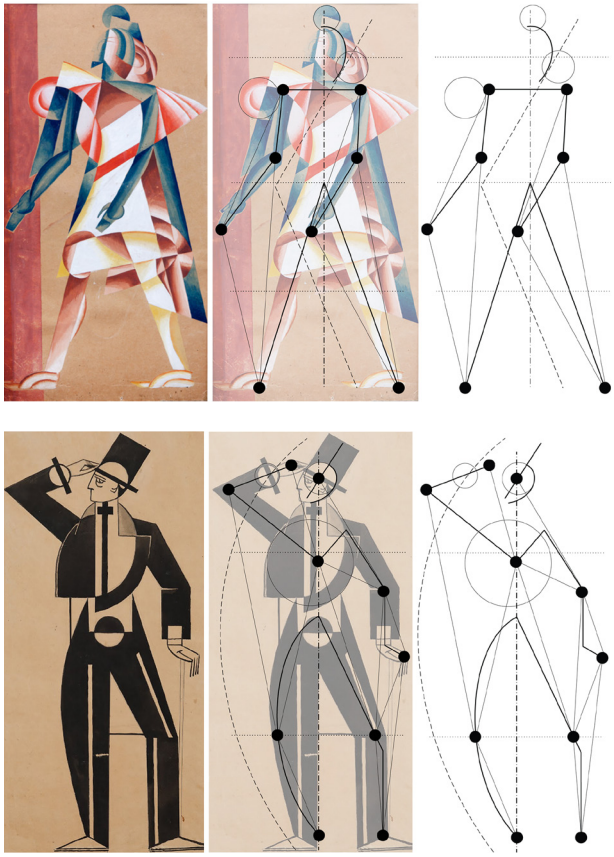


Fig. 2. V. Meller, costume for Assirian dances, 1919 (elab. by Starlight Vattano).

Fig. 3. V. Meller, costume of the capitalist for the opera Gas I by G. Kaiser, 1923 (elab. by Starlight Vattano).

continuous lines), the position marks (large circles), the pivot elements (small circles), the axis of symmetry (dash-dot).

The images

Vadym Meller was confronted with an artistic language that drew simultaneously on Expressionism, Cubism and Constructivism. Moving in both the theatrical and architectural spheres, his interpretations for stage costumes were influenced by the spatial issues between the body and the scenic object. The chromatic strength of his costumes does not require a clear outline but follows the plasticity of movement in geometric contrasts.
In the costumes drawn for *Le Maschere*, the artist concentrates the action in the curvature of the torso, which arches to the right concluding the expansion of movement with the arching of the left arm, whose hand once again indicates the origin of the action: the circumference at the top right which brings attention back to the figure's face.
The pivot points (black circles) define the relationships between the limbs (light continuous lines), while a game of cross-references and rebounds (dotted-lines) heralds a shift to the left (dotted curved-line) of the entire figure and the continuation of the movement with a slight rotation to the right (dotted right-curve) (fig. 1).
Her cubo-futuristic constructions anticipated the dynamic action of the choreographies realized by Bratislava Nijinska. The curved lines assumed by the body contrast with the sharpness of the contours, the pivot points (wrists, hands, shoulders and heels) interrupt the continuity of the movement, the broken dashed line shows the synthesis of the movements and the dotted lines the directions in which the limbs are arranged (fig. 2).
In 1923, Vadym Meller was director of set-design at Berezil theatre. In that year he staged Gas I based on Georg Kaiser's play, experimenting with a system of linear structures and curved surfaces defining a completely innovative theatrical effect. This work became a reference point for expressionist theatre, loaded with symbols and paradoxes latent with a strongly ethical message. The figure of the capitalist becomes one of the stage machines, the limbs move like parts

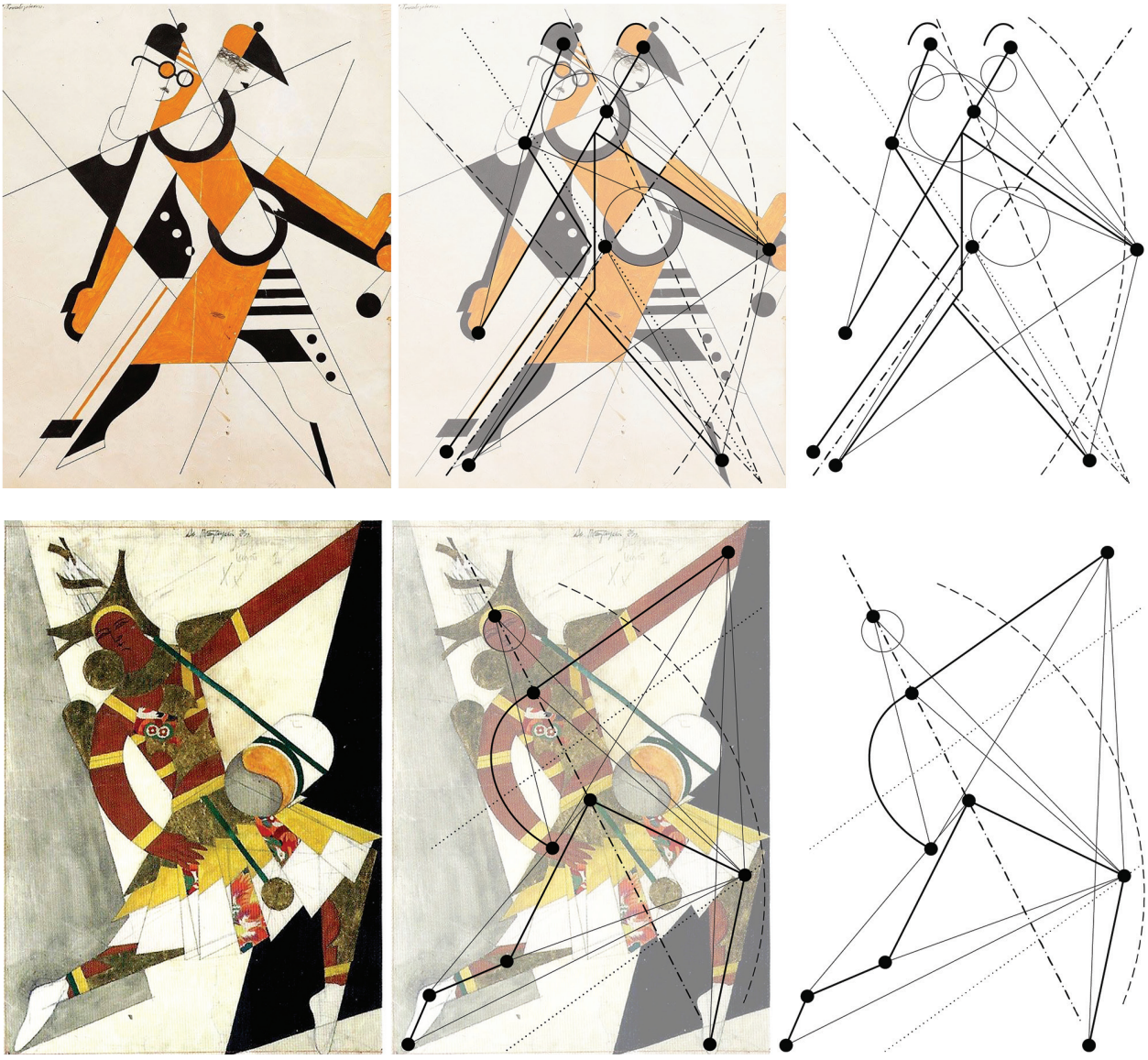


Fig. 4. A. Petritsky, costume for Eccentric dances, 1923 (elab. by Starlight Vattano).

Fig. 5. A. Petritsky, musician's costume for the ballet Nur and Anitra, 1923 (elab. by Starlight Vattano).

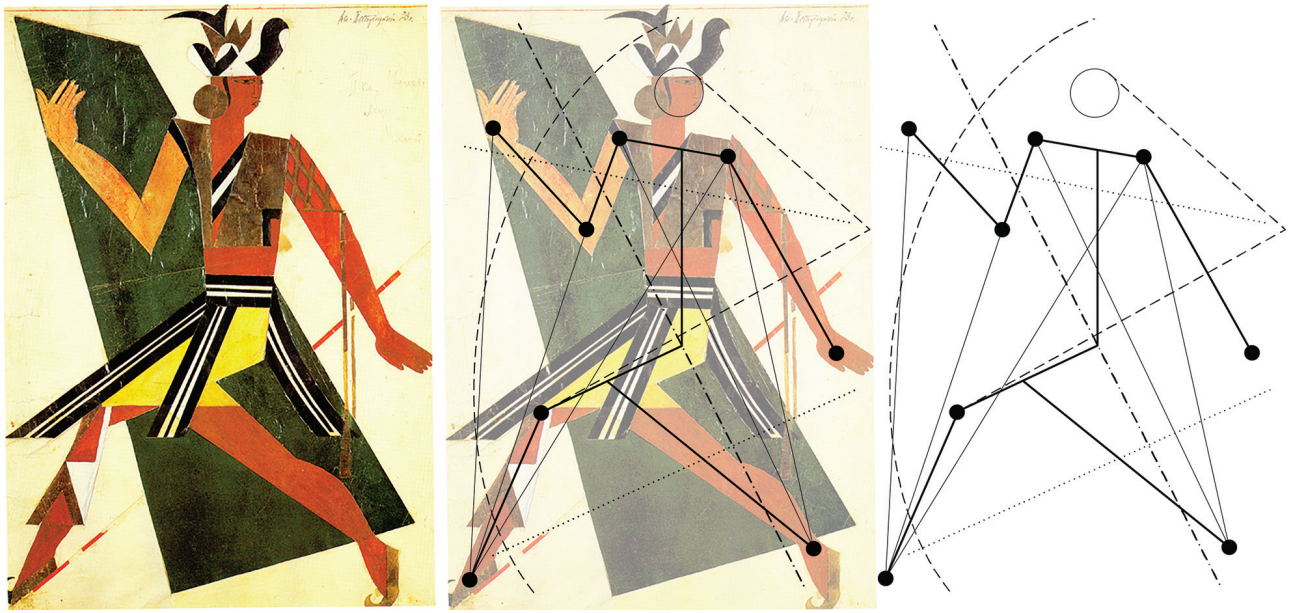


Fig. 6. A. Petritsky, costume for the ballet Nur and Anitra, 1923 (elab. by Starlight Vattano).

of a kinematism, and the rotations occur intermittently, the axis of symmetry stiffens the action turned almost completely to the left (dotted-curved line). The relations between the different parts of the body take place from a center (circumferences) to branch out towards the ends (the hands) arranged diagonally (fig. 3).

At the beginning of the 20th century, Ukrainian theatre became a place where national cultural traditions and international artistic currents mingled. Anatol Petritsky's work often aimed at the engineering of parts, the geometric unit rigor and the use of very bright colors. The two figures are translated into their parts and organized in three sections: the first, the heads; the second, the busts; the third, the legs (fig. 4).

His work always looked to the constructivist theme on the one hand and to expressionistic pathos on the other, aiming at a geometric and chromatic aesthetic under the control of convergent balances, made dynamic by the inclination of the symmetry axes. His approach to costume drawing is characterized by a multifaceted gaze that at times refers to monumental figures, iconic of a pasted tradition. In the musician's costume for the ballet *Nur and Anitra*, Petritsky used a geometric contrast between the circular shapes of the instruments and the broken shapes of the body. Only one arm curves, closing the diagonal movement that ascends from the bottom left to the top right (fig. 5).

Anatol Petrytsky's imaginative gaze permeates the human form in movement with constructivist and strongly tactile accents. His drawings juxtaposed surfaces, the composition of the image is that of a cubist collage which, through the use of different materials and textures, explored the body in its movement from different points of view. In this case, too, the action takes place along a diagonal line (dash-dotted line), highlighted by a green quadrilateral that does not correspond to the direction of the body, facing to the right (dotted-lines) (fig. 6).

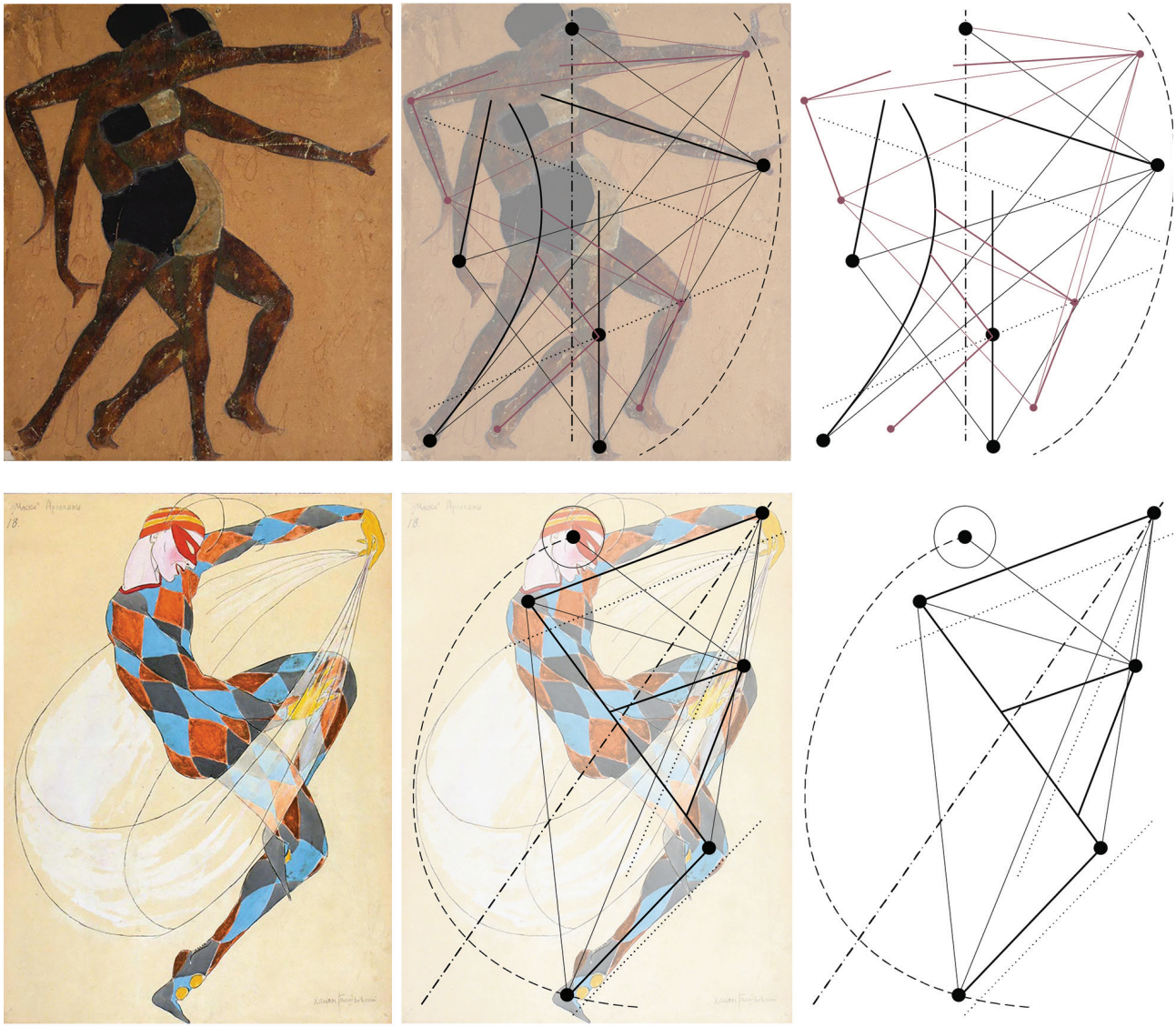


Fig. 7. K. Goleyzovsky, Dancing couple, 1920 (elab. by Starlight Vattano).

Fig. 8. K. Goleyzovsky, Harlequin, costume for Masks, 1918 (elab. by Starlight Vattano).

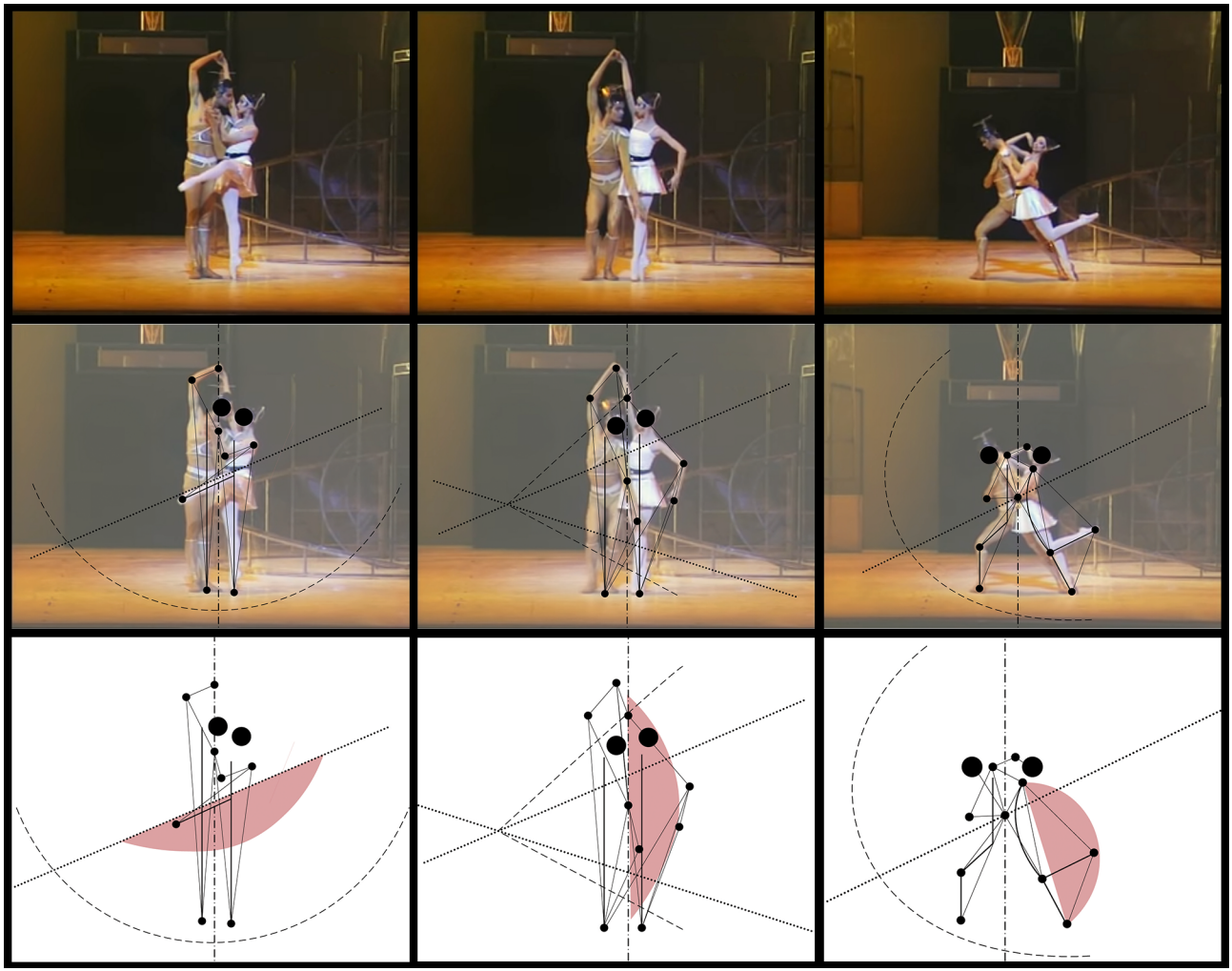


Fig. 9. Photograms taken from the ballet La Chatte, 1927 (elab. by Starlight Vattano).

Both choreographer and dancer, Kasyan Goleyzovsky succeeded in describing through his drawings for costumes and sets, the dynamic operation of the body with language that recalled the linearity of ancient Greek sculptures to interpret a dance far removed from the tradition of national ballet. In the *Dancing Couple*, Goleyzovsky positioned the two bodies facing to the right, represented in front and side views, thus providing information on the static posture and the evolution of the movement once the rotation is complete. The two colors in the diagram correspond to this offset between the figures but coincide with the expression of the two movements performed by the same body (fig. 7).
Starting from the basics of classical dance, Goleyzovsky experimented with the possible combinations of the body in movement on stage with the use of set and costume drawing as a means of completing the dance. His research aimed at exploring irregular movements, synthesized with broken-lines no longer extended in the verticality or horizontality of the stage, according to the choreographer "the line is broken, curved, softened, without internal force, as would be the case in circus or acrobatic, but refined and delicately bizarre, with a constant rejection of everything that resembles the classical" [Souritz 1988, p.16] (fig. 8).

The photograms

Diaghilev's production, *La Chatte* (1927) took up the constructivist themes in the three-dimensionality of both the set and costume design by Naum Gabo and Antoine Pevsner and the choreography by George Balanchine. The abstract forms on the stage, the lighting system, the transparencies and the use of reflective materials are a direct reference to the themes of the 1924 movie *Aelita*. The ballet developed in a constant crossing of the set-design device, the symbolism of the materials used, and the futuristic shapes of the costumes underlined the dimension rigorously controlled by the geometries and the linear verticality of the background [Bowit 1977]. In the schematic frames the poses are broken up in the gestures, the arms interrupt the fluidity of the movements, the pivot points (black circles) highlight the system of interruption and continuation of the action, the main directions (dotted-lines) describe a sequentially by pauses during which it is possible to trace the successive positions that the two dancers will perform (dotted-lines) (fig. 9).
In 1923, the ballet *Les Noces* was staged to music by Igor Stravinsky, with choreography by Bratislava Nijinska and set design by Natalia Goncharova. The Russian artist also designed the costumes, representing a peasant setting that evokes Russian tradition. The action is performed in a small space above the dancers who move in front of the stage, following different choreographic schemas which, together with the music, make the figures of the two main characters look more and more like puppets manipulated in an atmosphere of implacable solitude.
The structure of the ballet is very simplified, the study scheme of the frames highlights the static nature of the figures in the background, which leave all the space to the central body. The main movement is all upwards, the opening of the arms, the closing and the identification of an intermediate position describe the impossibility of escaping the hierarchy of gestures decided by the choreographer: the axis of symmetry interrupts the scene in two portions of space that do not come never into contact (fig. 10).

Conclusions

The first topic highlighted by the schemas study of both static and dynamic images concerns the final configuration of the graphic structure: directions, position marks and pivot elements function as coding and translation devices.
The coding process is affected by the migrations of meaning that weave the new relationships between the determinate and indeterminate into an event whose contours are defined by the rationality of operation. A further relationship that is revealed in this process of codification-translation is that between language and image, between language and painting. In this regard, Foucault asserted that "the relationship between language and painting is an infinite one. Not that the word is imperfect and, in the face of the visible, in a deficiency that it would strive in vain to fill. They are irreducible to each other: in vain do we

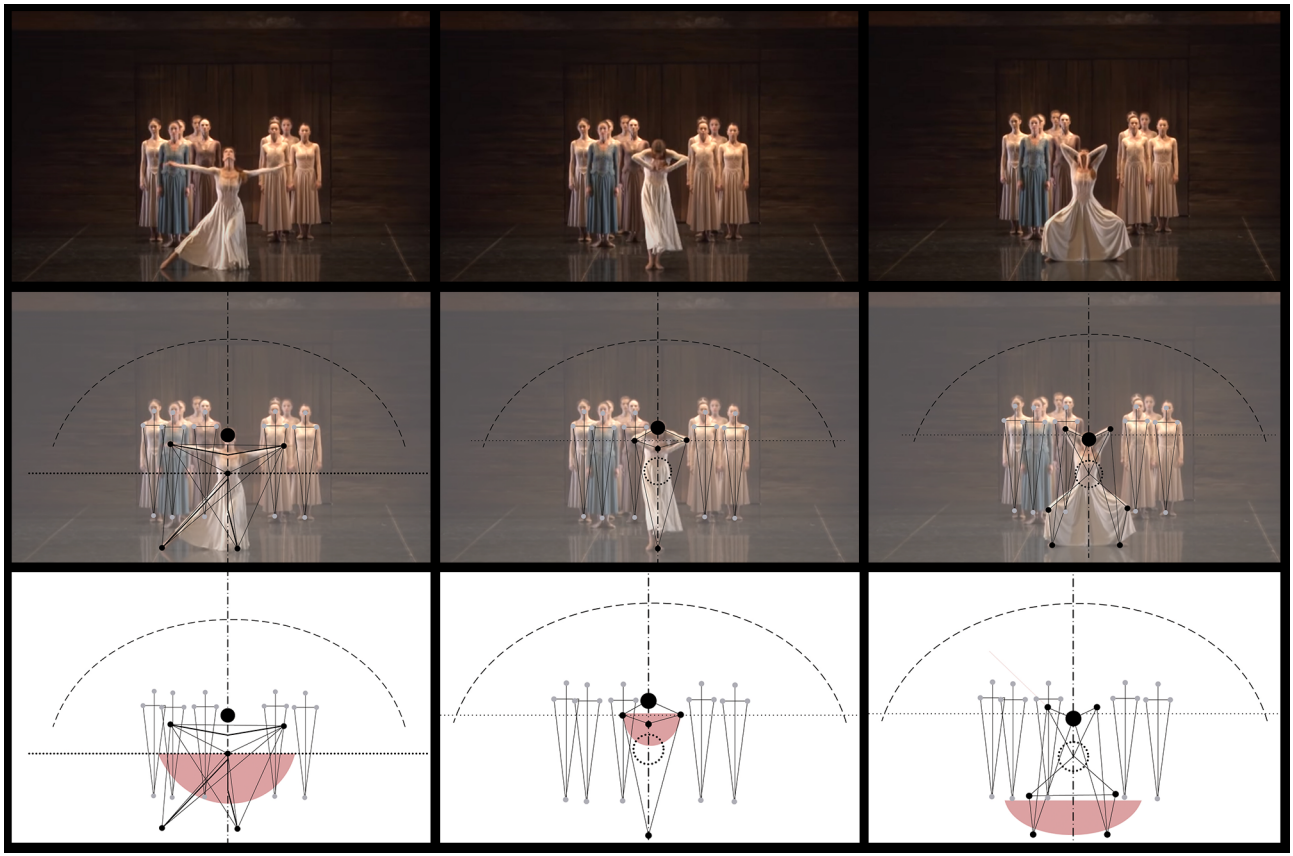


Fig. 10. Photograms taken from the ballet Les Noces, 1923 (elab. by Starlight Vattano).

try to say what we see; what we see is never in what we say; just as in vain do we try to show, by means of images, metaphors, comparisons, what we are saying: the place in which these figures shine is not that unfolded by the eyes, but that defined by the successions of syntax" [Cometa, Vaccaro 2007, pp. 42, 43]. A metaphor understood as a place in which the figures converge and unfold in their sequence of meaning, to define the invisible filled by the image in the absence of words.
The theoretical dimension of the movement representation, of the 'succession of syntaxes', is followed by that of the "double", of the external object that exercises its absence. The transcription of a movement in the form of a sign-object, and again of a hierarchy of signs, poses the question of the relationship between the image and its schema, between the set of signs and their 'other'. An 'other' produced by the immobility of the schema, by its duration and its isolation of meaning. On the moving images of cinema, Gilles Deleuze argued that "they no longer have anything to do with poses, if they are privileged moments, they are so by way of remarkable points that belong to movement" [Deleuze 2002, p. 16]. The 'double' expressed by the diagram contains a section of duration, a 'remarkable point'that manifests directions and relationships, revealing the hidden configurations on which the bodies rest to give form to the image as its double, to the image as a model of itself.

Notes

[1] The Berezil Theatre, recognized as the national theatre of the Ukrainian Soviet Republic, was established in 1922 in Kiev. It was an artistic association founded under the direction of Les Kurbas with the aim of developing experimental studies on avant-garde theatre and new teaching methods for actors and artistic directors. Les Kurbas never devoted himself to a single ideology or a specific program, but looked to Berezil as a dogma, a ceaseless research into new forms of artistic expression. For further details see: Rudnitskii K., Milne L. (1989). *Russian and Soviet Theater 1905-1932*. New York: Harry N Abrams Inc.

[2] In the 1920s there were many artists who trained and worked with Vsevolod Meyerhold. Among them: Yurii Annenkov, Nikolai Evreinov, Alexandra Exter, Alexandre Vesnin, Georgy and Vladimir Stenberg, Alexandr Tairov, Ignatii Nivinsky, Liubov Popova, Alexandr Rodchenko and Varvara Stepanova. Please refer to: Mudrak M. M. (1976). The Development of Constructivist Stage Design in Soviet Russia. In *Soviet Union*, n.3, pp. 253-268.

Author

Starlight Vattano, Department of Architecture and Arts, Iuav University of Venice, svattano@iuav.it

Reference List

Andréevskaïa, G., Smirina, A. (1998). *La grande histoire du ballet russe: De l'art à la chorégraphie*. Bournemouth: Parkstone press.

Bowit, J. E. (1977). Constructivism and Russian Stage Design. In *Performing Arts Journal*, Vol. 1, n. 3, pp. 62-84.

Cometa, M., Vaccaro, S. (a cura di). (2007). *Lo sguardo di Foucault*. Roma: Meltemi editore.

De Brunoff, M. (a cura di). (1922). *Collection des plus beaux numéros de Comoedia illustré et des programmes consacrés aux ballets et galas russes depuis le début à Paris. 1909-1921*. Parigi: M. de Brunoff Éditeur.

Deleuze, G. (2002). *L'Immagine-movimento*. Milano: Ubulibri.

Houghton, N. (1956). Soviet Theatres, 1917-1941. In *American Slavic and East European Review*, Vol. 3, n. 15, pp. 437-439.

Misler, N. (2018). *L'arte del movimento in Russia (1920-1930)*. Torino: Umberto Allemandi.

Mudrak, M. M. (1976). The Development of Constructivist Stage Design in Soviet Russia. In *Soviet Union*, n. 3, pp. 253-268.

Mudrak, M. (1986). *The New Generation and Artistic Modernism in the Ukraine*. Ann Arbor, Mich.: UMI Research.

Mudrak, M. M. (2015). From the Easel to the Stage Set: The Avant-Garde Painter and the Theater. In M. Mudrak, T. Rudenko (eds.). *Staging the Ukrainian Avant-Garde of the 1910s and 1920s*. New York: The Ukrainian Museum, pp. 16-43.

Pasi, M., Rigotti, D., Turnbull, A.V. (1993). *Danza e balletto*. Milano: Jaka Book.

Pritchard, J. (a cura di). (2015). *Diaghilev and the golden age of the Ballet Russes 1909-1929*. Londra: V&A Publishing.

Rennert J., Terry W. (1975). *100 ans d'affiches de la danse*. New York: Henri Veyrier.

Rudnitskii, K., Milne, L. (1989). *Russian and Soviet Theater 1905-1932*. New York: Harry N Abrams Inc.

Sirotkina, I., Smith, R. (2017). *The Sixth Sense of the Avant-Garde. Dance, Kinaesthesia and the Arts in Revolutionary Russia*. Londra-New York: Bloomsbury Methuen Drama.

Souritz, E. (1988). Soviet Choreographers in the 1920s: Kasian Yaroslavich Goleizovsky. In *Dance Research Journal*, Russian issue, Vol. 20, n. 2, pp. 9-22.

Spencer, C. (1974). *The world of Sergej Diaghilev*. New York: The Viking Press.

Tombari U. et al. (a cura di) (2019). *A passi di danza. Isadora Duncan e le arti figurative in Italia tra Ottocento e avanguardia*. Firenze: Edizioni Polistampa.

Veroli, P. (a cura di) (1991). *Un mito della danza fra teatro e avanguardie artistiche*. Bologna: Edizioni Bora.

Mnemosyne. The Construction of Memory

Documentation, Representation, Virtuality

The Crown of Thorns of Notre-Dame de Paris, Mythological Representations of Memory

Giuseppe Amoruso

Preamble

On April 15, 2019, the whole world found itself gathered, as happens few times and for long and interminable moments, around the images that transmitted from Paris: the cathedral of Notre-Dame de Paris, in its solid and immutable appearance, was wrapped inexorably from the fire that gradually caused the collapse of the iconic spire, roof, and limestone vaults.
Among the images of the smoking ruins, the tragedy was slowly and tragically becoming myth; a priest was in the fire theater in search of the relic and the most sacred symbol preserved among the treasures of the cathedral. The crown of thorns of Notre-Dame, an example credited as original and preserved in a reliquary commissioned by Napoleon III and designed by Eugène Viollet-le-Duc, miraculously remained intact as well as when John Paul II had personally transferred it from the Sainte-Chapelle in 1997.
A few years earlier, in the period between August 24, 2016, and January 2017, a sequence of about ninety-two thousand tremors (of which nine above the 5th degree of the Richter scale) catastrophically affected four regions of central Italy (Abruzzo, Lazio, Marche, and Umbria), causing 299 victims. This catastrophe involved six hundred thousand people; in the 138 mu-

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editorial director's responsability.

nicipalities of the crater about seventy-seven thousand houses were classified as uninhabitable and entitled to the contribution for the reconstruction. Amatrice represents the image of this earthquake; ironically, the oldest building in the city, the civic tower, has survived.
How can we preserve the memory of this extraordinary heritage?
Diodorus Siculus, a Greek historian born in the province of Enna, dedicated his entire life to the incessant collection of the memory of places, spaces, and times that made up the geographical-cultural mosaic of the known world, the *Bibliotheca Historica*, an articulated program of universal knowledge (60-30 BC). Concerning Mnemosyne, Diodorus says that it is due to her if humanity could discover the power of memory, that ability to discern without misunderstandings, which allows us to recognize objects by their name and encourage understanding among men to satisfy their need to communicate. Thanks to her work, events, cultures, people never told before and who would not have survived oblivion. Pliny the Elder, praising the work of Diodorus, described the method: a systematic account of facts as a synthesis of traditions supported by the documents that he collected in his travels and his ten-year documentary work. In the absence of direct observations and original documents, Diodorus had developed a scrupulous deductive method not to interrupt the continuity with the past by entrusting it to the most ancient among social arts, the oral narrative of the intangible.
Losing the heritage leads us to reflect on the art of memory as a complex exercise of interpretation of the landscape and its imagination process. The depiction is a universe composed of an alphabet of figures, objects, taxonomies, syllogisms that recall images that are formed and composed, favoring, as in a puzzle, the highlighting of emblematic elements between places and things.
Representing the lost landscape means organizing knowledge through images that return, through homologous figures, the significant elements. Those who daily deal with the transmission of heredity and cultural heritage are responsible for looking after both the expressive apparatus that helps us remember and imagine the remembered content by transforming it into figures and their correlation, including the intangible level.
Mnemotechnics and the science of representation are semiotic phenomena which, as the ancients taught us, allow us to apply methods to develop advanced expressive apparatuses, correlating them with those of the story and the production of silent, dynamic and tactile contents.

Memory as a tactile space of the imagination

With its points of view, drawing carries out a disciplinary action aimed at creating continuous mythological representations of the memory of people, places and facts; it connects them thanks to the power of imagination. It performs the double function of carrying out the story through its graphic codes and producing images and thus evoking cognitive dimensions on multiple levels.
On the Young Mnemonics Fund Umberto Eco writes that the forgetful no longer knows who he is; he loses his awareness of himself because he has lost the most critical faculty by which both individuals and communities nourish their own identity [Eco 2013]. Memory is a fragile organism if separated from the everyday experience of the senses, and it regenerates through direct transmission. Memory is a private heritage, but it also becomes collective. It becomes a myth: a schedule of stories, facts, and protagonists that belong to an entire community. These are the words Oliver Sacks uses to describe his phenomenal experience of memory that brings to light memories wich often haven't been experienced directly: "I accepted as inevitable having forgotten or lost a lot; however, I assumed that the remaining memories –especially the very intense, concrete, and detailed ones– were essentially valid and reliable, and it was a shock when I discovered that some of them were not at all. A striking example […]: one night, a half-ton bomb fell in the nearby garden, fortunately without exploding […]. A few months after the book was published, I talked about these episodes with my brother Michael […], my brother immediately confirmed the first episode. 'I remember it exactly as you described it'. Regarding the second bombing, however, he said: 'You did not see it. You were not there'. As human beings, memory is fallible, fragile, and imperfect –but also endowed with great flexibility and creativity–. Confusion about sources, or indifference towards them, can be a paradoxical strength: if we could identify the origin of all our knowledge, we would be overwhelmed by often irrelevant information. The lack of interest in sources allows us to assimilate what is written, what is told,

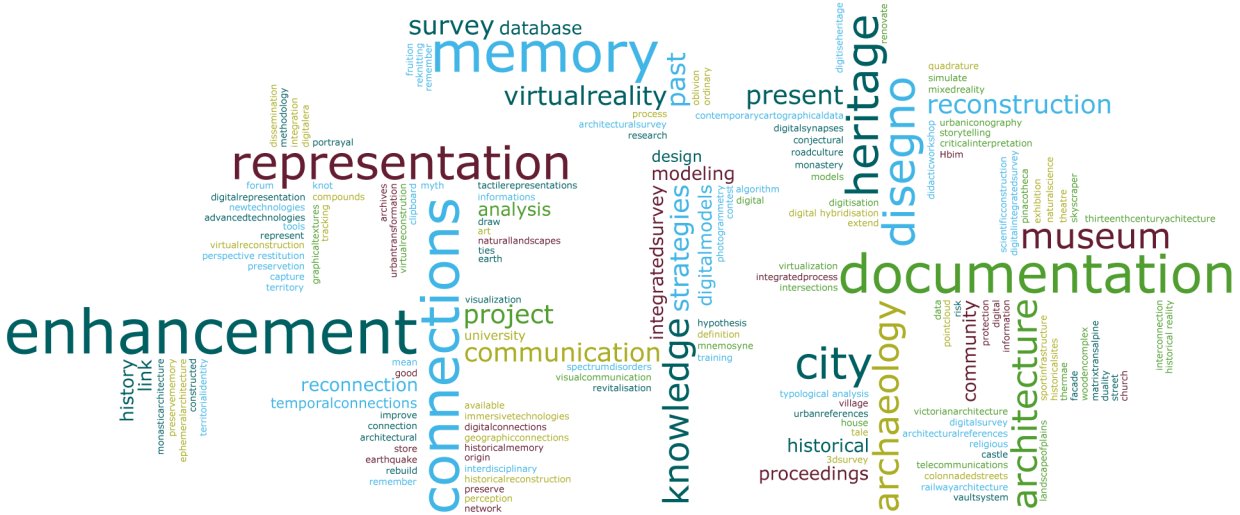
what other people say, think, write and paint, with the same intensity and richness as a primary experience. This allows us to see and hear with different eyes and different ears, enter the minds of others, assimilate art, science, and religion by drawing on culture as a whole, to penetrate and contribute to the collective mind commonwealth of knowledge. Memory does not emerge only from experience, but also from the relationship between many minds" [Sacks 2017].
In the medical literature, amnesia is described as a long-term memory disorder linked to the inability to remember events. The techniques for memorizing cannot counteract the decrease of cognitive faculties. However, they can offer a series of practical expedients to avoid the so-called "forgetfulness of past species", as defined by Johannes Spangerberg in his *Artificiosae Memoriae Libellum* of 1539 [Spangerberg 1539].
The art of memory is a practice of representation that follows a precise system of rules. The purpose is to conserve and use the information for the benefit of civilization and citizens; it made it possible to recall a locus and to associate and place the *imagine*s, images that were easy to memorize and addressed the memory of 'things' (*res*) and 'words' (*verba*). The unknown author of the treatise *Rhetorica Ad Herennium* was concerned with distinguishing between two kinds of memory, a natural one to be considered an innate faculty and an artificial one to be strengthened and consolidated through education, exercise, and dissemination. In one case, the images made it possible to remember topics and concepts, that is, the real subject of the speech. At the same time, the *imagines verborum* were an expedient to remember every word, that is a common language used to communicate the subject. They were both a kind of artificial memory: *memoria rerum and memoria verborum* to provoke an indelible emotion in memory.
Between 1292 and 1296, a pictorial cycle of 28 views called *Stories of San Francesco* was painted in the lower part of the Basilica of Assisi. Never before had an artist and his community narrated a landscape as a cultural synthesis of the time, in the specific case the Central Italy medieval one, steeped in devotion to St. Francis. That work introduced landscape as a common good, a new psychological space made tangible by pictorial consciousness and narrative invention. Like the universal library of Diodorus Siculus, the pictorial cycle of San Francesco is a narration of the cultural landscape as the summa of time. Characters, inserted naturally in architectures articulated on planes and perspective wings that create practicable spaces, represent the landscape and the contemporary environment with all its peculiarities and scales. The frescoes of Assisi are the expression of a mental form, perception, and figurative memory that reflects the society and culture of that historical era; a painting capable of "stimulating our tactile imagination", as Bernard Berenson wrote in the volume *The Italian Painters of the Renaissance* [Cappelletto 2017, p. 17].
The Italian National Institute of Statistics has included the one on "Landscape and cultural heritage" among the 12 fundamental domains to measure "Fair and sustainable wellbeing" using the definition of Renato Biasutti: "The sensitive or visual landscape, consisting of what the eye can embrace in a turn of the horizon or, if you like, perceptible with all the senses; a landscape that can be reproduced from a photograph […] or a painter's painting, or from the brief or minute description of a writer" and the geographical landscape, which is "an abstract synthesis of the visible ones, as it tends to detect from them the elements or characters that have the most frequent repetitions over a more or less large space, higher, in any case, than that comprised by a single horizon" [Biasutti 1962, pp. 1-3]. Therefore, the geographical landscape is to be considered a widespread heritage or cultural landscape according to the international meaning of UNESCO: representing its intangible form means dealing with the living heritage as the protagonist of the cultural diversity of humanity. "By intangible cultural heritage the UNESCO Recommendation of 2003 addresses the practices, representations, expressions, knowledge, know-how –as well as the tools, objects, artifacts and cultural spaces associated with them– hat communities, groups, and in some cases individuals recognize it as part of their cultural heritage" [UNESCO 2003, art. 2.1, p. 2]. In the Japanese tradition of cultural heritage protection, the term "*Mukei*" is used, which refers to what has no form, which is perceived, relies on the senses, and envelops itself in sacredness. The term, for example, indicates the privileged position in the art of the sword, wherefrom the 'formless' posture, the other positions evolve with a single movement. Therefore, a posture that indicates true strength, as reported by Sun Tzu, is credited with

collecting an oral tradition two centuries long, probably the oldest extant military art text (about 6th century BC). When the narration of events plays a sacred role because it describes the evolutionary forms of a people, mythos appears as a universal concept. The human figure becomes heroic, unique in the context, worthy of an exemplary undertaking where the protagonists unfold their stories. The myth is a tale entrusted orally to men and their language that retrospectively sinks into the past from the present, between the memory of things, reconstructing links, and reconnecting knowledge to places through practical examples by individuals. The drawing becomes the bearer of the myth when its ability to reduce historical episodes narratively adds symbolic and experience dimensions: this capacity is now enormously increased by the multimedia of digital tools. The drawing, through its representations, traces the facts, decisions, imagination of men and communities to provide new and in-depth explanations of social, historical, religious phenomena and innovative construction techniques. The representation process through signs, stories, and figures means symbolically handing down information on collective history, and this is the mythology. Visual communication emphasizes the sacred aspect of this history, the great religious or civil architectures, rather than the mysteries of civilizations that have now disappeared. Myth answers endless questions of humanity, who build bridges between the past and the future in the living exercise. Therefore culture evolves continuously as a living expression of individuals and represents the social organization of communities and cannot be described exclusively as a phenomenon that produces tangible manifestations. When the myth represents reality, it manages to tell the stories directly without filters, in subjective, as these stories were handed down in the past: live, by oral tradition.
The mythos is a circular tale that represents the story within a social framework which extends temporally and becomes multiscale thanks to digital technologies' introduction. Representing an action rather than a situation is today the frontier of the discipline when it brings innovation to the cultural and creative sectors. New traditions of transmission and communication advance disciplinarily, as evidenced by the wealth of contributions presented for the *Mnemosyne* focus of the 42nd UID 2020 Conference entitled *Connecting/ drawing for weaving relationships* to deal with the daily urgencies of the territories that have lost a part of their heritage, not only tangible. The answers they expect are often complex and go beyond conventional practices. They also address the listener's consciences to allow him, as in the story of fairy tales, to reach an understanding of phenomena even in an unconscious form.
In this sense, it is a question of drawing to go back to the original thought, that is, to the cause of things to explain how they took shape, becoming architectural material or rather habitat.
All this is dramatically urgent when a community suffers a severe loss which, pending its reconstruction. reflects not only on the material aspects but also psychological state of citizenship.

Representing the memory to imagine the future

After the loss of the cultural heritage begins, a psychological and material re-appropriation of the common goods the community has lost. The re-elaboration of memories becomes oral testimony and material documentation of what does not exist. Then it becomes the primary common good to represent, connect the different tangible expressions of knowledge, and reconstruct the narrative concept as a myth. This act of social responsibility extends the meanings of everything that has had physical form or allows us to enhance what has survived.
Amatrice, Notre-Dame, and Palmira demonstrate that the study of monumental heritage as episodic, material, and reserved for specialists is an innovative approach where the intangible, continuous, and participatory component of cultural heritage is at the center. A heritage of legacy as highlighted by the recent recommendations on intangible heritage and the 2005 *Faro Convention* [Faro Convention 2005]. The Convention transfers the need for identity to the territory and its individuals who transform and appropriate it according to a scale of meanings and uses that people attribute and self-represent themselves in daily practices. To this end, it introduces two innovative concepts:
a) cultural heritage is a group of resources inherited from the past which people identify, independently of ownership, as a reflection and expression of their constantly evolving values, beliefs, knowledge, and tra-

Fig. 1. Mnemosyne, word cloud representing the key concepts and their recurrence among the contri-butions published for the focus (elaboration by Sara Conte).



ditions. It includes all aspects of the environment resulting from the interaction between people and places through time;
b) a heritage community consists of people who value specific aspects of cultural heritage which they wish, within the framework of public action, to sustain and transmit to future generations.
In Italy, only in 2008, after the ratification of the UNESCO *Convention on the Protection of the Intangible Cultural Heritage* [UNESCO 2003; 2005], with an integration to the *Code of Cultural Heritage and Landscape* [2004, art. 7 bis], relating to *Expressions of collective cultural identity*. The statement "they are subject to the provisions of this code if they are represented by material evidence" does not consider the value of most of the cultural expressions of the territories related to popular culture [Tarasco 2004].
Even today, the intangible aspects are not included in national legislation despite the emerging issues introduced by the 2003 *Convention* [UNESCO 2003] have a notable impact on the research of our disciplinary sector. The survey experience transforms and extends culturally by representing the cultural processes and the definition of cultural heritage according to evolving methodologies and tools. Safeguarding does not mean conserving or protecting the monumental, landscape, or cultural heritages to avoid transformation by protecting original or authentic characters. It contributes to the construction of contexts favorable to the transmission and vitality of heritages in constant movement, recognized by the same social actors responsible for its conservation. Establishing inventories is one of the obligations to which States undertake with the ratification of the Convention to identify elements and the cultural expression context. The most important place to think about the evolutions underway, in the context of national cultural policies, are the choices related to the establishment of inventories of intangible cultural heritage and the participation of cultural communities [Lapiccirella Zingari 2015].
On April 15, 1935, in Washington, representatives of twenty-one nations signed the *Treaty On the Protection of Art and Scientific Institutions and Historic Monuments* known as the 'Roerich Pact', named after the Russian anti-militarist artist Nikolai Konstantinovich Roerich and based on the principle of the inviolability of goods and values belonging to humanity.
Roerich believed that all cultural values carry a spiritual charge and that by destroying them, humanity destroys the basis on which it can develop spiritually. The Roerich Pact was the first international act explicitly dedicated to the protection of cultural heritage. His words foster the most advanced and contemporary approaches to the economy of culture and address the disruptive capacity of his thought: "The man who cannot understand the past cannot think of the future" [Mironenko 2019, p. 147].

Conclusions

On April 15, 2019, the Notre-Dame de Paris cathedral rescue program began under the global gaze of the world. The story of the crown of thorns and that priest who had found it intact among the ruins is still a living; precisely the remains of the burnt cathedral, that 'shapeless' context, will be the subject of the most critical contemporary technological challenge applied to cultural heritage.
As a first step, the cathedral reconstruction depends on the three-dimensional simulations and the aggregation of data allowed by new cloud computing technologies to create a virtual clone and map every helpful element for the reconstruction.
Livio De Luca, research director at the French CNR, was the first to propose this challenge: the billions of points images will be integrated with high-resolution panoramic photographs to create the most technologically advanced virtual model designed for an asset belonging to the UNESCO World Heritage. With the help of artificial intelligence applied to the three-dimensional recognition of objects, it will be possible to identify and recognize the surviving architectural and ornamental elements. Comparing the images before and after the fire will make it possible to reconstruct the destroyed elements using the anastylosis technique [Marrazzo 2021].
Reconstruction practices have always created opportunities for reasoning on the future of cities. They have provided an exceptional wealth of technical and cultural experiences related to the conservation of monuments and territorial systems.
In the reconstruction of Amatrice, the integrated methodologies of documentation of historical urban

landscapes [UNESCO 2011], defining a typological representation protocol supported by Heritage BIM systems, propose algorithmic predictive simulations of the reconstruction scenarios. *The Prince's Charitable Trust* of London granted the research project *Regenerating Amatrice. The resilience of local identity* activated at the Politecnico di Milano (under the supervision of the author). The project is donating the graphical reconstruction of the historic center, drawings illustrating the traditional architectural character, the architectural lexicon, and the guidelines for the facades to maintain the identity of Amatrice. In the exercise of documentation and reconstruction of a lost landscape, knowledge technologies work together to produce an advanced and cost-effective approach for modeling, semantic representation, and documentation of the architectural heritage damaged by the earthquake, combining 3D investigation, critical investigation, and virtual reconstruction. Among the tangible and intangible benefits, more excellent knowledge of the urban landscape and local expression, an impulse to regenerate memory by integrating active participation and collaborative planning activities [Amoruso, Mironenko 2019; Amoruso, Mironenko 2020].
The representation of the expressions of intangible heritage as participatory cultural activity is now central to the social processes of re-appropriation of that cultural heritage lost after a catastrophe. In fact, in this unfortunate circumstance, instead of adding a level of subjectivity to tangible forms of heritage, these being lost or severely damaged, the multiplicity and diversity of stories, memories, and experiences of the inhabitants become the only possible way to preserve what still remains in the memory. If putting the rubble back together is not always possible, the use of technological but human-centered solutions can instead help to put together the experience and widespread knowledge of an entire community.
According to the Nobel Prize winner for economics Amartya Sen, social participation depends on what he defines as "capabilities" or how citizens need to exercise their rights. Citizens need to emotionally connect to places before participating in any cultural process [Erasmo 2020]. In this passage, our role can support social growth and well-being: in the enhancement of specific skills that can allow universal and collective access to knowledge. The focus called *Mnemosyne*, with its 169 authors, presented a set of experiences, methods, and techniques to identify the disciplinary role of Drawing in the narration of the myth of cultural heritage and good documentation practices to transfer this same heritage to future generations. So what must and can we do to save beauty and transmit that myth by using emerging scientific achievements? These will be the questions with which the 43rd UID Conference will open (fig. 1).

Acknowledgments

The author wishes to thank Dr. Sara Conte for the realization of the illustration presented in this paper.

Author

Giuseppe Amoruso, Department of Design, Politecnico di Milano, giuseppe.amoruso@polimi.it

Reference List

Amoruso, G., Mironenko, P. (2019). Heritage BIM descriptive models for the representation of resili-ent city. The case of Amatrice's reconstruction. In P. Belardi (a cura di). *Riflessioni: l'arte del disegno/il disegno dell'arte. Reflections: the art of drawing/the drawing of art. Atti del 41° Convegno internazionale dei Docenti delle discipline della Rappresentazione*. Perugia, 19-21 settembre 2019, pp. 1051-1056. Roma: Gangemi editore.

Amoruso, G., Mironenko, P. (2020). Memory as a Common Asset. Algorithmic Generative Representa-tions for the Reconstruction of the Community Identity after the Earthquake. In A. Arena et al. (a cura di). *Connettere/un disegno per annodare e tessere. Connecting/ drawing for weaving relationships. Atti del 42° Convegno internazionale dei Docenti delle discipline della Rappresentazione*, pp. 1528-1537. Milano: FrancoAngeli.

Biasutti, R. (1962). *Il paesaggio terrestre*. Torino: Utet.

Cappelletto, C. (2010). La natura finzionale dell'immagine nel confronto con le neuroscienze. In *Psi-coArt – Rivista di Arte e Psicologia*, 1(1).

Convenzione di Faro. (2005). *Value of cultural heritage for society. Council of Europe Framework-Convenzione quadro del Consiglio d'Europa (CETS no. 199)*, 18, 03-08.

Eco, U. (2013). *Mnemotecniche e rebus. Rimini: Guaraldi San Marino University Press.*

Erasmo, V. (2020). Homo capabilitiensis: un paradigma antropologico per il futuro ispirato alla riflessio-ne di Amartya Sen. In L. Alici, F. Miano (a cura di). *L'etica nel futuro*. Salerno: Orthotes, pp. 455-464.

Lapiccirella Zingari, V. (2015). Patrimoni vitali nel paesaggio. Note sull'immaterialità del patrimonio cul-turale alla luce delle Convenzioni internazionali. In L. Zagato, M. Vecco (a cura di). *Citizens of Europe. Culture e diritti*, pp. 425-456. Venezia: Cà Foscari Edizioni.

Marrazzo, D. (28 febbraio 2021). De Luca, l'architetto che restaura Notre Dame con 3D, digitale e vi-deogame. In *ilSole24ore*. <https://www.ilsole24ore.com/art/de-luca-l-architetto-che-restaura-notre-dame-3d-digitale-e-videogame-ADVsOrMB?refresh_ce=1> (accessed 2021, April 6).

Mironenko, P. (2019). Conservation Issues on UNESCO World Heritage Sites in Russia. From the Roe-rich Pact to Contemporary Challenges. In G. Amoruso, R. Salerno (eds.). *Cultural Landscape in Practice. Lecture Notes in Civil Engineering*, vol 26, pp. 145-150. Cham: Springer.

Sacks, O. (2017). *Il fiume della coscienza*. Milano: Adelphi.

Spangerberg, J. (1539). *Artificiosae Memoriae Libellus*… Lipsiae: Impressum per Michaelem Blum.

Tarasco, A. L. (2004). *Beni, patrimonio e attività culturali: attori privati e autonomie territoriali*. Napoli: Editoriale Scientifica.

UNESCO. (2003). *Convenzione per la salvaguardia del patrimonio culturale immateriale*. Trad. it. <https://ich.unesco.org/doc/src/00009-IT-PDF.pdf> (accessed on 2021, April 24).

UNESCO. (2005). *Convenzione per la salvaguardia del patrimonio culturale immateriale*. <https://delegazioneunesco.esteri.it/rappunesco/it/i-rapporti-bilaterali/informazioni-e-servizi/salvaguardia-patrimonio-culturale-immateriale> (accessed on 2021, May 10).

UNESCO. (2011). *Recommendation on the Historic Urban Landscape*. <https://whc.unesco.org/en/hul/> (accessed 2021, April 24).

Drawing Space in the Places of Myth: Luigi Moretti and Sicily

Salvatore Damiano

Abstract

How was architecture drawn in the 1930s? This is the starting question through which we want to set up a wider reflection on the architecture of that period, taking as reference a Sicilian project by Luigi Moretti: the Casa del Balilla in Messina, dating back to 1936. The initial analysis of the building's drawings is aimed at evaluating the expressive contents of drawing as a disciplinary instrument of architecture. But the fact that Luigi Moretti's first work in Sicily has never been built has also led to the elaboration of a further exegesis, consisting in the construction of a virtual three-dimensional model of the building: a process aimed at verifying the complexity of the forms transcending the unpredictability that pervades the final product of this logical-applicative consecutio of the tools of Science of Representation: digital images. Therefore, the reduction of the three-dimensional object (the model) into a two-dimensional entity (the image) poses both metalinguistic and projective questions: the model acts as a critical instrument that explains the reality imagined by Luigi Moretti, returning –through the heuristic force of images– all those syntactic, spatial, architectural, urban or even territorial tensions that the building would have possibly generated.

Keywords: Luigi Moretti, Messina, virtuality, 3D model, unbuilt architecture.

Introduction

History. This is the term we use to indicate –even more so in the scientific sphere– an investigation aimed at the reconstruction, not necessarily in chronological order, of circumstances, facts or events that are connected through a consequential development. History is therefore an action of rearrangement carried out mainly with the help of two types of testimony: one material or pseudo material, consisting of '*documents*', which usually make up a particular archive, and the other, more specifically intangible, embodied by '*memories*', which instead belong –in the strict sense of the term– to our mind. These are the two noble categories that will be used throughout this essay to reconstruct the history of a building in which the most striking feature is certainly that it was never built, an event that would make it rise almost to the category of 'myth'.

Let us begin with the last of the two cases mentioned above: memories. Speaking of myth and turning our minds back in time, through an ideal journey of inner fascination, it was the titanid Mnemosyne –in Greek mythology– who handed down as a gift precisely these intellectual faculties, after discovering them and personifying them in herself [1]: in fact, according to Diodorus Siculus, she (who was the daughter of Uranus and Gaea) is always credited with having unequivocally fixed a name for every object and every concept, thus giving mortals the possibility of understanding each other in their dialogues [2]. Vittorio Ugo asserted that myth

has a particularly distinctive trait, namely that of possessing a very high modelling power: unlike the rationality of mathematical models, however –Ugo continued– myth and its narration move through metaphysical and meta-rational models that take shape in the gods and in the representations of the various heroes as well as in their deeds and powers, although there remain other common characteristics between mathematics and myth, such as its all-encompassing nature, its persuasion to impose itself as an irrefutable truth, as a form that becomes a norm, as a value of mirroring, comparing or connecting different fields and contexts [Ugo 1994, p. 154]. Similarly, the notion of 'model' can be declined in architecture, as a form that scientifically expresses the qualities and properties of a work, also capable of delineating an exegetical truth, which, in turn, gives a picture of the ways and possibilities "of existence of an architectural space and its historical and critical relationships with theory" [Ugo 1994, p. 169]. Compared to the architectural artefact, the model constitutes, therefore, "a duplicate that denotes both its presence and absence" [Ugo 1996, p. 1]: moreover, on the concept of absence in architecture, we could say that modern digital three-dimensional models, considered through perspective representations, can be considered as the '*locus*' of the indissoluble connection between zero and infinity [Corbellini 2015, p. 88]. The model, therefore, is a "duplicate (or double) that unequivocally refers to the building, but through its immediacy and communicative evidence it bridges the spatial and temporal distance that exists between itself and its real physical counterpart" [Ugo 1996, p. 1]; nevertheless, in the present case under study the absence is of an absolute type, given that the building studied has never been built. But what about the other category, that of documents, which was mentioned at the beginning of the text? We certainly know that the document is an act that validates, certifies, provides us with proof. At the same time, it is implicitly a snapshot taken at a precise moment, and therefore belongs to history, and more precisely to an era. The task of a scholar capable of analyzing a document is to establish on the one hand its reliability and on the other its historicity, i.e. how it is critically placed in history and in what Vittorio Ugo defines as "epocality": if the former is a strictly technical task, for the latter it is necessary to bring into play "the entire methodological, cultural and epistemological scope of the discipline" [Ugo 1994, p.

Fig. 1. Luigi Moretti, Casa del Balilla di Messina, graphic abstract of the study carried out and illustrated in this essay.

135]; the document is then subjected to in-depth analysis, during which it is compared, broken down, classified, possibly ordered in an archive, inserted into an "oriented system of knowledge" [Ugo 1994, p. 135], then processed to decode its message in order to create 'our' story, in addition to the one it tells us, to compare it with this one, producing, in other words, a critical-analytical hermeneusis, a model capable of interpreting "form in all its spatial, historical, material and qualitative determinations" [Ugo 1994, p. 135]. In this paper, from an eminently operative point of view, an attempt has been made to transpose the methodological instances expressed so far into an effective investigation, beginning with the analysis of some of the drawings selected from the complex of graphic-design plates of the building, or rather carrying out a sort of new cataloguing (or filing) of the plates considered most significant, which is an act that fixes the memory, orders it and makes it available [Ugo 1994, p. 115], in order to investigate the expressive contents of the graphic medium and of drawing understood as a disciplinary instrument proper to the architectural project: the final objective of this phase is to identify any innovative components both in the final graphic expressions and in the techniques and systems of representation through which the designer controls and verifies the semantic values of architecture. But the fact that the building analyzed has never been built has also led to the elaboration of a further exegesis, consisting in the orderly application of the tools of the science of representation, to which we wish to give a role of absolute centrality in the general dissertation: starting with drawing and survey, immaterial devices for knowledge, not used as a mere, neutral record of the architectural fact, but as critical-hermeneutical agents; the survey, in particular, understood as the "inverse of the project" [Ugo 1994, p. 116]; the graphic analysis as an investigation into the reasons for the syntactic-linguistic choices made by the architect [Clemente 2012, pp. 35-37]; and finally, the three-dimensional digital modelling, as the *sum* of the previous operations, on the effectiveness of which will depend a whole series of subsequent reflections, that is, the possibility of investigating, evaluating and verifying the essence of the spaces that were never born and their way of presenting themselves in succession. In short, it is a search for the connections that this latent architecture could have generated or catalyzed, whether they be visual, perceptive, dimensional or more properly spatial, architectural and urban.

Fig. 2. Luigi Moretti, Casa del Balilla in Messina, project drawings: a) First floor; b) Principal elevation; c) Cross-Sections; d) Central perspective (Archivio Centrale dello Stato, Archivi di Architetti e Ingegneri, Fondo Luigi Moretti, Opere e Progetti 1930-1975, segnature 194|1|124/4, 194|1|124/7, 194|1|124/8 e 194|1|124/11, by concession of the Ministry of Cultural Heritage and Activities and Tourism).

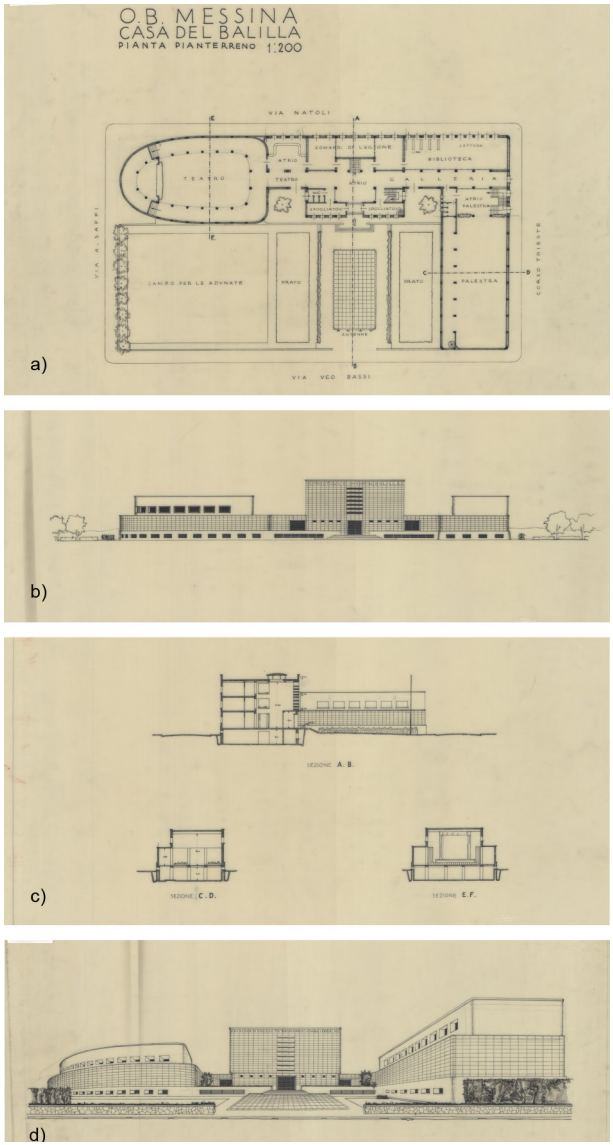
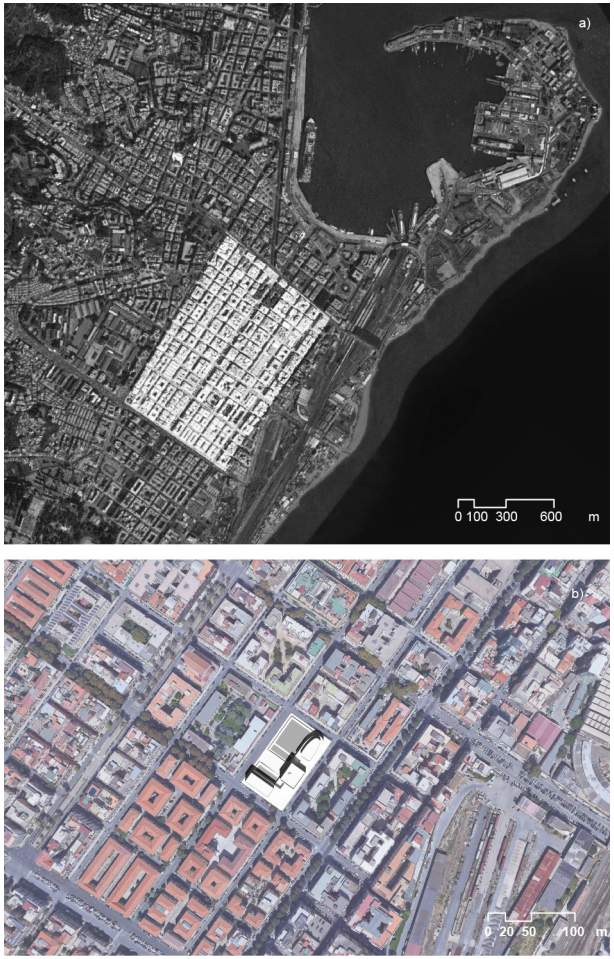


Fig. 3. a) Current orthophotographic view of Messina: the 'alle Moselle' district is highlighted; b) Planimetric photo-insertion of the building in the planned block (Basic image taken from Google Earth, software owned by Google LLC).

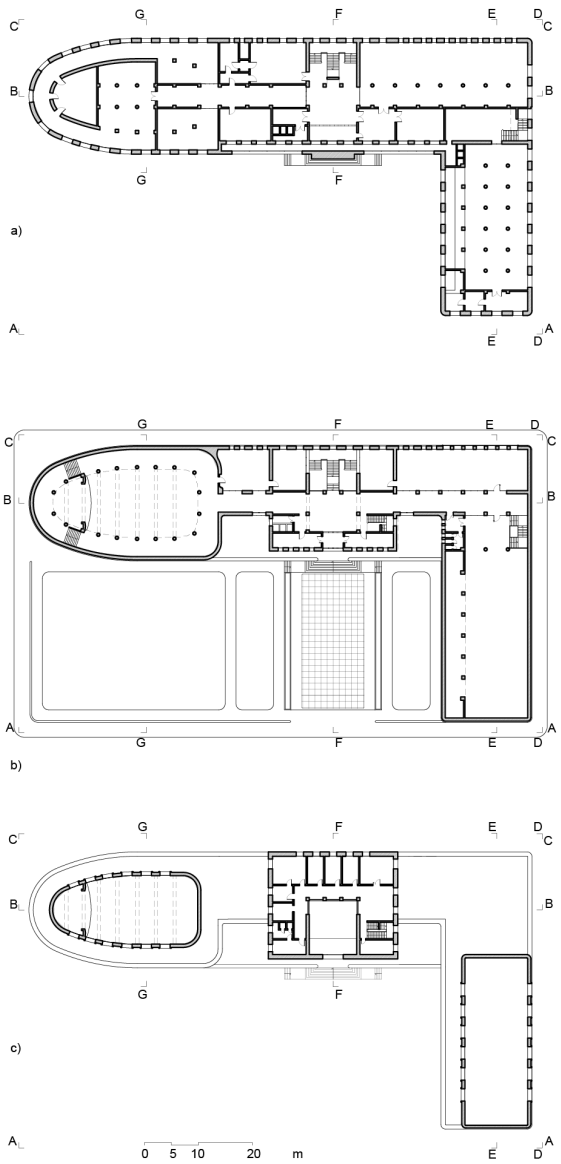


Luigi Moretti between myth and space. The first Sicilian experience: the Casa del Balilla in Messina

The project we have chosen to examine in this essay is the Casa del Balilla [3] (or "Casa della Gioventù") designed in 1936 for the Sicilian city of Messina by the architect Luigi Moretti [4]. The work, as already mentioned unbuilt, is amply documented by a rich and well-preserved collection of drawings, part of the fund dedicated to the designer, kept and protected by the *Archivio Centrale dello Stato* in Rome. These architectural graphs, all on glossy paper, include both pencil sketches and more definitive sketches in Indian ink. The drawings shown in this dissertation are the ground floor plan, an elevation, a table of cross-sections and a frontal perspective (fig. 2). Compared to the majority tendencies of those years, Moretti was no exception, 'conforming' to the use of that graphic technique that envisaged the use of modern ruling pens and of the even more recent and high-performance *graphos*, a method considered in some ways to be the transposition of the canons of rationalist architecture (expressive simplification, objectification of the building, dominion of function) into the drawing, which thus became a pure plastic-stereometric description, devoid of details, ornaments, effects [Santuccio 2003, p. 151] or anything that was considered superfluous, unlike what happened during the late season of eclecticism, modernism or floral styles, only a few decades earlier. However, it is necessary to remember that Luigi Moretti considered the 'phenomenon' of rationalist architecture as something insubstantial born exclusively from the "pure and simple projection of the graphic" [Diemoz 1937, p. 5] and therefore destined to extinguish rapidly and without particular regrets, so in a similar way, while welcoming the new techniques mentioned above, which "characterized the school of Le Corbusier" [Diemoz 1937, p. 5], he attempted to use them critically, using graphic expedients to make certain specific architectural solutions more evident, which he reiterated as if they were real stylistic elements in many of his other pre-war works. Let us see how this happened in the project drawings for the Casa del Balilla in Messina. If, for example, we observe the main elevation (fig. 2b), we will notice the presence of dots at the vertical limits of several of the volumes that make up the building as a whole, a graphic sign that indicates that these terminations are curved, a fact that is otherwise scarcely intelligible given that it is a

drawing in orthogonal projection. In the same drawing, one should note the dark backgrounds on the window and door frames (which clearly and immediately indicate the syntax generated by the relationship between empty and full spaces or between opaque and transparent parts) and the squaring on the intermediate paramental band, which effectively denotes the design indication of a possible covering in marble slabs. In order to understand the Roman architect's expressive intentions, it is sufficient to make a comparison with the greatest exponent of Italian rationalism, Giuseppe Terragni, who, in the various project drawings of the Casa del Fascio in Como, never represented the similar texture of stone slabs that would later cover the building in Como. In the iconic perspective drawing (fig. 2d), on the other hand, one immediately notices the incongruity regarding the number and size of the openings of the two lateral volumes, which turn out to be more and smaller than what is represented in the orthogonal projection drawings, probably to emphasize the expressive power of the curved volume on the left and the perspective depth of the gymnasium on the right. Lastly, as regards the representation of the context, Moretti seems to accept the canons of 'graphic rationalism' mentioned above without too much hesitation, since only in the elevations are the features of the landscape of the Strait of Messina or the Peloritan mountain range above the city just hinted at in the background, thus substantially and inexorably excluding it from the designer's graphic attention. Messina, however, was already one of the largest and most important urban towns in Sicily, given its enviable position as a real crossroads for commercial (and economic in general) traffic between the island and the rest of peninsular Italy. Its origins are undoubtedly very ancient and intimately connected with the mythological theme mentioned in the first paragraph: legend has it that the port of ancient *Zankle* (the primordial name for Messina) was generated by the fall of the scythe of the titan Kronos [5] into the sea during a battle with his father; still on the subject of connections, it should also be remembered that Kronos was the son of Uranus and Gaea, just like the goddess of memory Mnemosyne mentioned at the beginning of the text. In the recent history of Messina, however, the legend gave way to reality: in the last days of 1908 a terrible earthquake affected the city and the entire Strait area, causing tens of thousands of deaths and urban scenarios bordering on the apocalypse. Thirty years later, after Messina had been razed to the

Fig. 4. a) Basement (section plan at +1.80 m); b) First floor (section plan at +5.50 m); c) Second floor (section plan at +8.55 m).



ground, it was still a building site, albeit nearing completion (in accordance with Luigi Borzì's reconstruction plan [6]), with the work of nationally renowned architects such as Marcello Piacentini, Giuseppe Samonà, Camillo Autore and Angiolo Mazzoni, not to mention other designers whose work was confined to participation in architectural competitions, such as Adalberto Libera, Mario Ridolfi, Ernesto Bruno Lapadula and Gaetano Rapisardi [7]. Luigi Moretti's design for the local Casa del Balilla, which was to be built in the block between Via Giuseppe Natoli, Via Aurelio Saffi, Via Ugo Bassi and Via Trieste, in other words in the urban expansion already planned to the south of the old town by an unimplemented 19th-century plan and then further specified and implemented by the aforementioned post-earthquake Borzì Plan, falls in this modern vein [Mercadante 2009, p. 21]: the new neighborhood, called "alle Moselle" [Di Leo, Lo Curzio, pp. 11-16] (fig. 3a) because of the name of the plateau on which it was built, was conceived (by extending the road axes parallel to the sea of the existing city towards the south) according to a regular orthogonal layout, limiting the maximum height of the buildings to 10 m (later gradually derogated) [Mercadante 2009, p. 21; pp. 169-177]; expedients that gave this new part of the city a modern image, a characteristic that can still be perceived today throughout the city, in some ways in keeping with the Fascist regime's decision at the time to invest heavily in the Peloritan town devastated by the terrible earthquake, so that it could embody the much-vaunted dream of the «new city» [Barbera 2002, p. 78]. The same charge of modernity, however, did not physically manifest itself for Moretti and his Casa del Balilla, a building designed not to occupy the whole of the large rectangular block measuring 100 per 60 meters, on which it was destined, thanks to its L-shaped plan on the southern and eastern limits of the lot (fig. 3b). Here Moretti creates a large square in front of it, officially to be used for gatherings, but in fact functioning as a real 'churchyard', a defined urban space that in a propaganda perspective of the regime certainly preludes to the sacredness of one of the representative seats of the Fascist state, but that in reality constitutes – above all– the place delegated to the perspective perception of the building as a whole (fig. 11). The main façade of the Casa does not face the sea but opens towards the city, perhaps in Moretti's desire to prefer a connection that is more strongly urban than landscape; this thesis may be reinforced by the fact that the two directions delineated by the L-shaped plan form an ideal connection towards the city centre and its monuments (fig. 8b), such as the Duomo, its piazza, Palazzo Zanca (the city hall), the Palazzo di Giustizia, the Palazzo dell'Università or the Sacrario overlooking the strait, to name but a few. Of course, in the 1930s the area was not as densely urbanized

Fig. 5. a) Section AA; b) Perspective section AA; c) Section BB; d) Perspective section BB; e) Section CC; f) Perspective section CC.

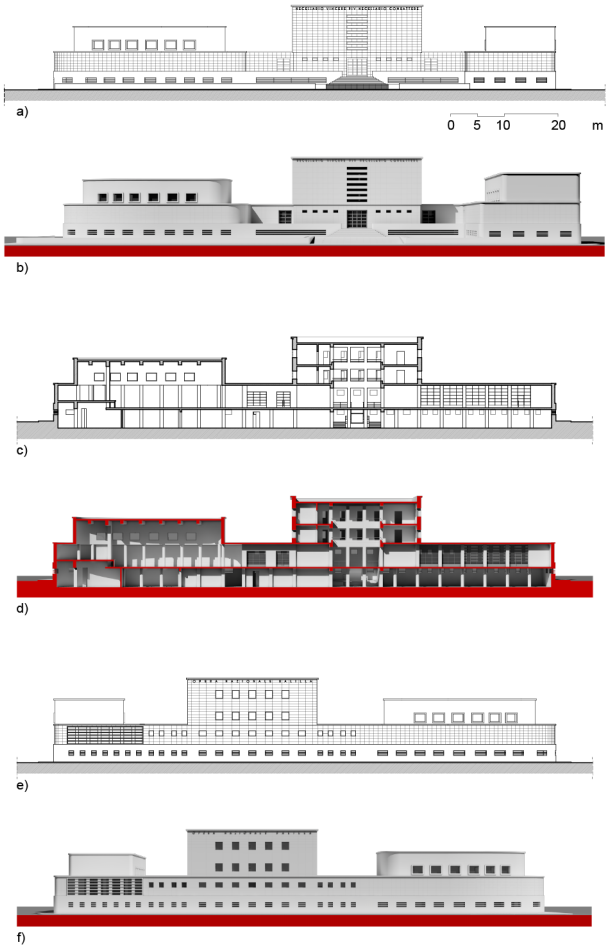


Fig. 6. a) Section DD; b) Perspective section DD; c) Section EE; d) Perspective section EE; e) Section FF; f) Perspective section FF; g) Section GG; h) Perspective section GG.

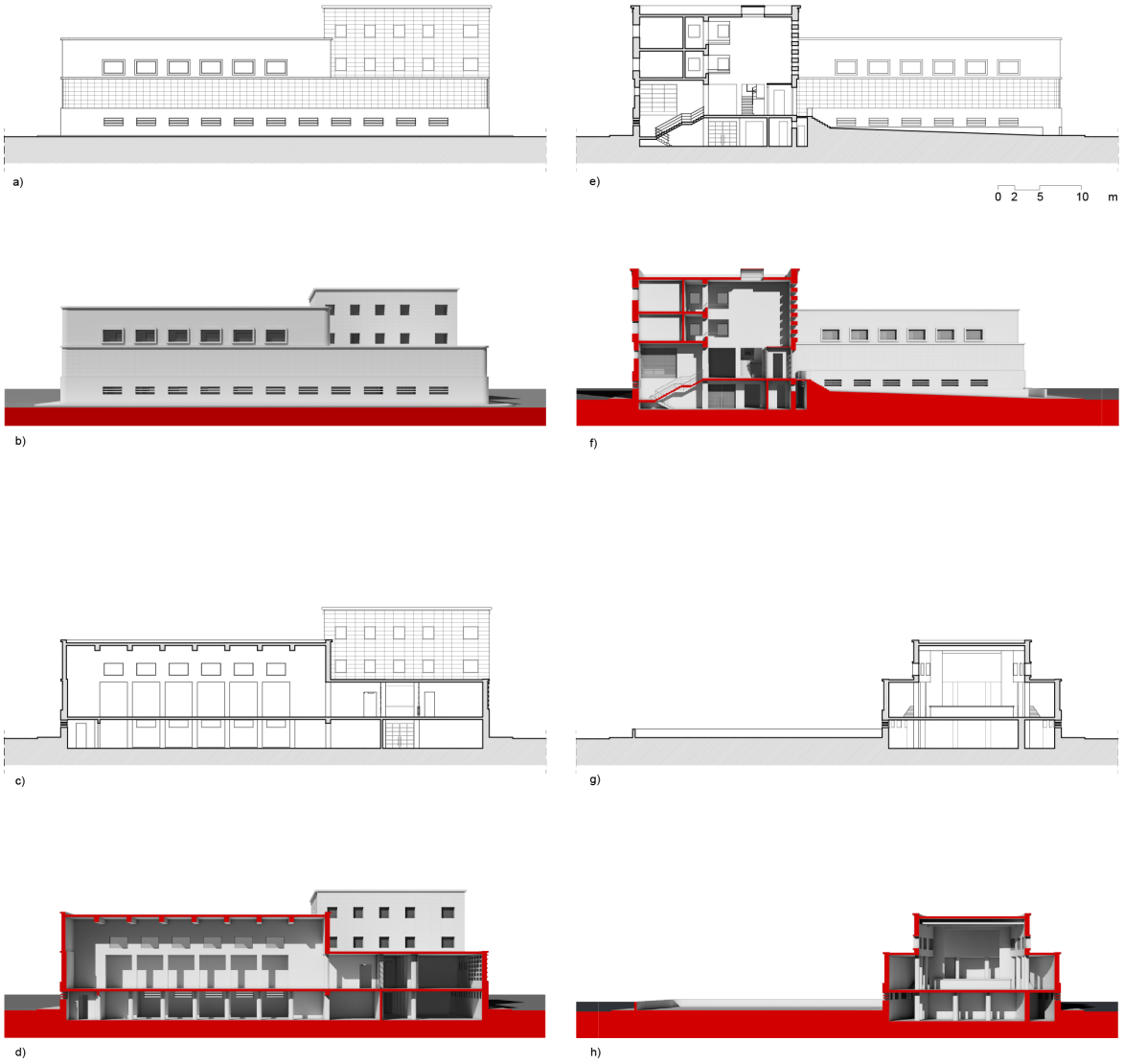
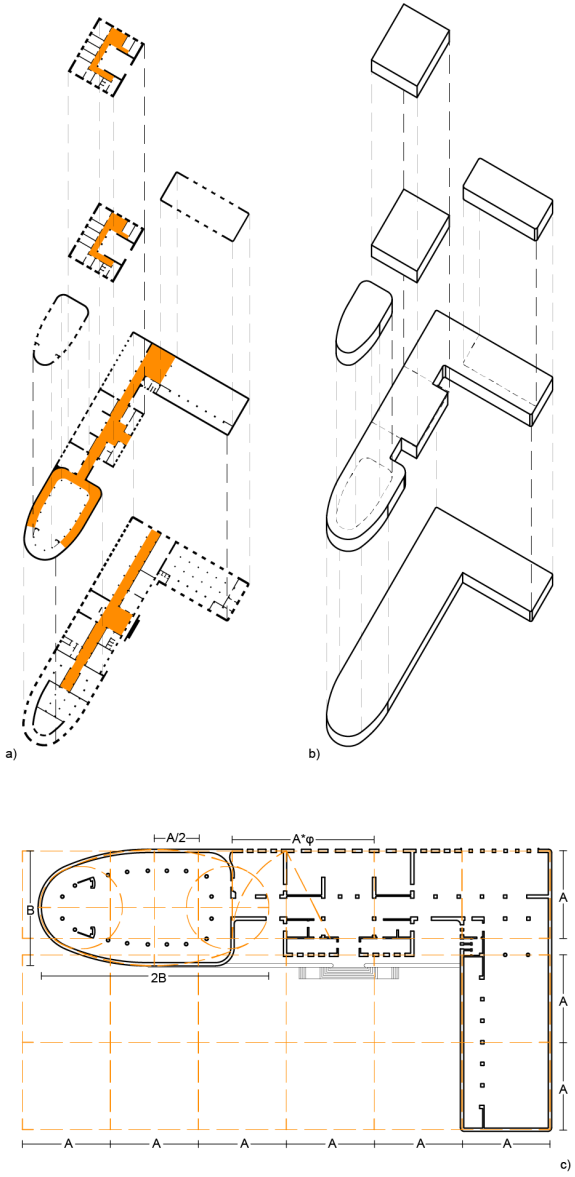
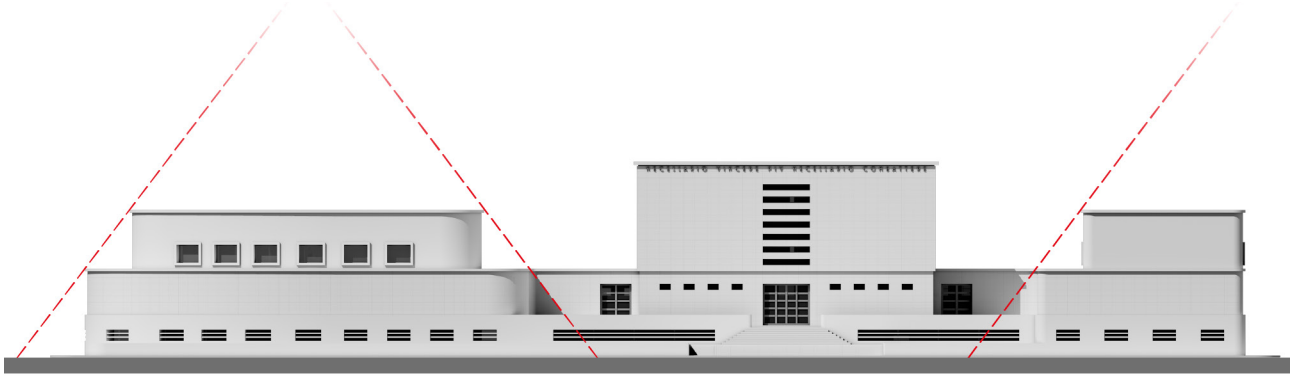


Fig. 7. a) Exploded axonometric projection with the identification of the service spaces; b) Exploded axonometric projection of the elevations; c) Regulatory layout governing the ground floor plan of the building.



as it is today, nor were there any buildings taller than 10 m, so it would have been possible to create a connection, not only visual but also physical, of flows, between the Casa del Balilla, as a possible urban backdrop, and the old town as a real hub, a reference point for the entire city. The exteriors of the building designed by Moretti present an accurate tectonic research (figs. 5, 6, 10 and 11): starting from the slightly tapered basement band that hides the basement spaces (fig. 4a), revealed by dosed openings with a prevalently horizontal axis, a continuous intermediate face rises (the raised ground floor of the building) covered perhaps with travertine slabs, (a technique already used by Moretti in the Accademia di Scherma at the Foro Italico and in the Casa della G.I.L. in Trastevere, both in Rome), in which sharp edges give way to curved chamfers that perceptively favour the continuity of the visual and physical connection between the various surfaces of the façade in succession [8], softening their volumes and making them more compact [Docci, Chiavoni 2017, p. 26]; above, there is a third level consisting of the two emerging parts of the theatre and the gymnasium [Santuccio 1986, p. 68], which, positioned at opposite poles, present, compared to the intermediate band, an evident tapering as well as a traditional surface treatment –perhaps plaster– interspersed with large rectangular openings with projecting external frames and placed in sequence. All of these elements probably combine to create a stylistic feature that identifies and clearly distinguishes the two stereometries emerging from the remaining parts of the building: both do not actually embody a function linked to human use, but are conceived by Moretti as true collectors of natural light, capable of illuminating these large exceptional spaces, the theatre and gymnasium, which, compared to the other rooms in the building characterized by a 'traditional' intermediate floor, have a considerable free light, about 9 meters high (fig. 9). An exception to this is the large central prismatic volume (figs. 5, 6, 10, 11), which has the same slab treatment as the intermediate strip: this office block is slightly projecting from the ground floor, has sharp edges, solid walls with calibrated openings and is 15 m high. On the whole, the graphic-perceptual investigation carried out on the model of the building reveals that this compositional logic, organized as a succession of material-constructive layers tapering off as the height increases, almost giving rise to a 'stepped' construction, may have derived from Moretti's desire to make the Casa di Messina an

Fig. 8. a) Frontal view of the model in orthogonal projection, study on the volumetric tapering and on the gradual connection between ground and sky; b) study of the possible urban connections between the building and the city (Basic image taken from Google Earth, software owned by Google LLC).

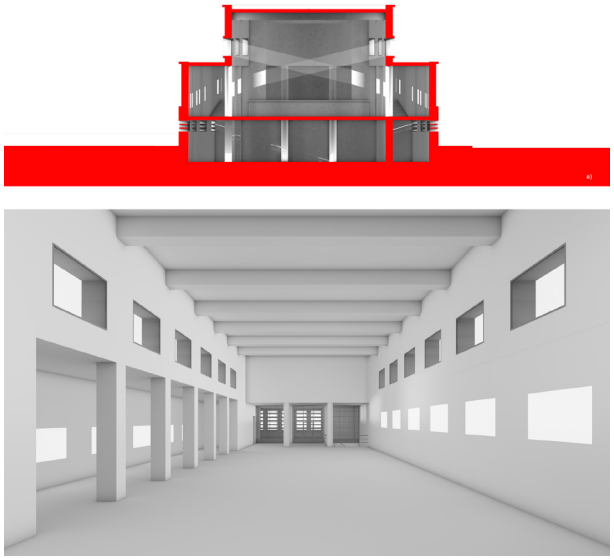


a)

b)

element of gradual connection between earth and sky (fig. 8a). The linguistic-figurative progress noted by Santuccio with respect to the previous Balilla buildings of the Roman architect concerns the rediscovered unity of the functional blocks (once clearly separated, as in the Accademia di Scherma in Rome or the Piacenza, Bitonto and Urbino buildings) [Santuccio 1986, p. 68], a characteristic that seems to reverberate clearly also in the architecture of the interiors: the entrance leads into a large, full-height space, illuminated by a skylight at the top and frontally by slit openings above the large entrance portal; this space (fig. 5d), reminiscent of the courtyards of Italian Renaissance palaces, is characterized by the presence of two superimposed loggias running along the three sides of the volume and serving as service areas for the executive rooms; these spaces are accessed by a small staircase to the right of the entrance, a fact that leads to the hypothesis that the project was not at an exactly definitive stage, also considering the scenographic importance that Moretti usually attributed to the stairs in this type of building [9]. This large central space is intersected by the pathway that crosses the building longitudinally (fig. 5d), which cannot be defined as a simple 'corridor' as it is a true and proper ordered sequence of perspective views and alternation of spaces made of light, shadow and transparent planes, culminating in the two extreme poles already mentioned: to all effects a connective *promenade* between the gymnasium and the theatre, which has in the latter the perspective outcome of the spatial explosion (fig. 9); in addition, the tapering of the exteriors, described above, produces in the two large poles a hierarchy of spaces (which could be a veiled reference to Roman architecture, often used as a design reference by architects working under Fascism), in which the zones of passage or waiting are distinguished from the fundamental volume and ideally separated by an alignment of pillars (figs. 6d, 6h and 9), whether circular or square, all in a logic of synchronic connection inside-outside [Avella 2012]. The graphic analysis [10] carried out on the drawings reveals that the design of the space described above is controlled in the plan through a square mesh grid (15.90 m on a side) that governs the general composition and even before, through the sub-modules, the pitch of the framed load-bearing structure; the width of the two specular indents placed on either side of the large central entrance prism respect precise golden proportions, while the organic form of the theatre derives from the construction of an octave oval (1:2, diapason) [11] in which the minor axis coincides with the centre line of the second column of squares (fig. 7c).

Fig. 9. Natural lighting: a) theatre, three-dimensional model view in orthogonal projection; b) gymnasium, internal model perspective.



Conclusions

Luigi Moretti was an architect who practiced drawing in depth, understanding the potential of this medium (probably due to his acquaintance at the beginning of his career with Vincenzo Fasolo), which is not only purely expressive, but above all cognitive. Perhaps it is precisely for this reason that he made judicious use of it, showing an interest in the technical and executive innovations of the period but eschewing those extreme "aesthetics of the machine" paradigms that pervaded architectural graphic expression during the 1930s. In fact, the Roman architect enriched his drawings –albeit sparingly– in such a way as to highlight what he felt strongly characterized his projects. On the other hand, as regards the subsequent analytical level, it is easy to understand that the study of an architecture that has never been built can

really become a moment of in-depth knowledge of 'how' our places could have been: the search for those spatial connections that the city of Messina has had to give up due to the failure to build an architecture designed by an architect like Luigi Moretti has made it possible to verify the irreplaceability of Drawing as an operational tool in an analysis that evolves into a true exploratory action. Starting with bibliographic and archival sources, a cognitive process was initiated that penetrated the essence of the architectural phenomenon: the methodological application of the tools of the science of representation highlighted a design consistency given by a form that underlies and generates a complete space, understood in its broadest sense. From the initial graphic-perceptual reflections on the *genius loci* [12] to the analysis of the regulatory layouts, we proceeded to select those facts, those elements and those connections considered significant for the structuring of the study model of an architecture that has remained confined to the project graphics only. This in-depth study of a project that has so far not been adequately treated by historiographic criticism adds an infinitesimal piece to our knowledge of the designer's general work and of 20th-century Italian architecture as a whole, revealing the almost spasmodic dedication that Luigi Moretti showed, even at the beginning of his career, in his search for a structured idea –from a mathematical, formal and perceptive point of view– of architectural space.

Fig. 10. Axonometric cross-section; central perspective.

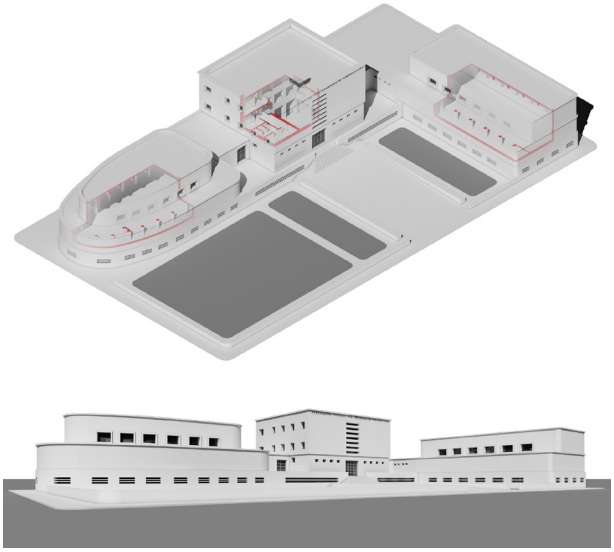
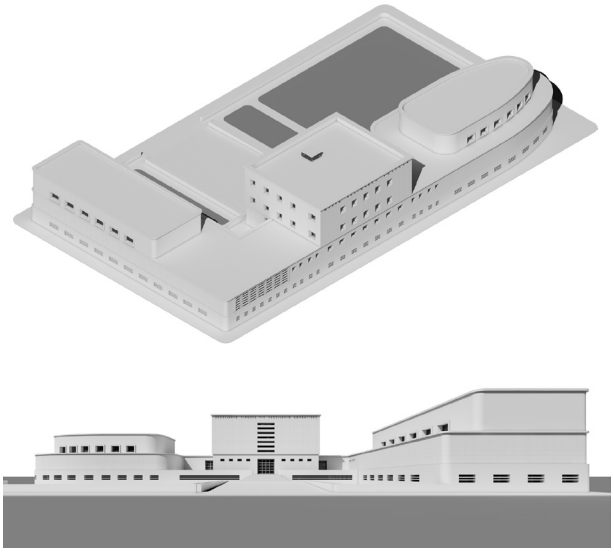


Fig. 11. Axonometry; accidental perspective.



Notes

[1] We refer to the description given by the scholar Diodorus Siculus in his work on universal history entitled Bibliotheca historica, for convenience consulted on the world wide web: <https://www.theoi.com/Text/DiodorusSiculus5B.html> (accessed 2020, January 10).

[2] *Ibidem*.

[3] In view of the aims of this paper, it is not appropriate to devote space to the history of the *Opera Nazionale Balilla* (an institution of the fascist regime for the physical education of young people) and to Luigi Moretti's role within it, aspects for which we refer to other much more exhaustive publications: Santuccio 2005; Capomolla, Mulazzani, Vittorini 2008.

[4] Capomolla, Mulazzani, Vittorini 2008, p. 246. For more detailed information on Luigi Moretti's life and work, see the various monographic publications dedicated to him, including Rostagni 2008. The Casa del Balilla in Messina was designed in collaboration with Cino Pennisi, a figure about whom there is no detailed information. The authors of the book cited at the beginning of this note and Daniela Fonti (in Bozzoni, Fonti, Muntoni 2012, p. 123) report a collaboration with Moretti that was not confined to the case of Messina discussed here. In addition, Cino Pennisi, also in 1936, designed the *Casa del Balilla* in San Severino Marche, in the Province of Macerata, which still exists today and is used as a conference hall, a building that in its stereometric configuration (and in part in its language) recalls the project for the Casa del Balilla in Messina: Capomolla, Mulazzani, Vittorini 2008, p. 248.

[5] In addition to the aforementioned Diodorus Siculus, for more in-depth information on the pre-Olympic divinity Kronos, please refer to any of the many translations of Hesiod's work currently on the market.

[6] For further information on the post-earthquake 1908 urban events in Messina, we recommend Di Leo, Lo Curzio 1985 and Mercadante 2009. These are two exhaustive texts on the subject from which this essay draws a great deal of information.

[7] For a complete overview of the debate and events surrounding architecture in the 1930s in Messina (briefly mentioned here) and throughout Sicily, see Barbera 2002 and Di Benedetto 2018.

[8] This detailed description of the tectonics of the facades is based on, and extends, the description in Santuccio 1986, p. 68.

[9] Just look at the spiral staircase in the Casa del Balilla in Trastevere or the small staircase designed, again by Moretti, for the Duce's gymnasium at the Foro Italico.

[10] Curiously enough, the person who codified and perfected the method of graphic analysis was Vincenzo Fasolo, an architect, engineer, lecturer in Rome on the subjects of drawing and architectural historian, whose assistant in the History and Styles of Architecture chair was Luigi Moretti [Rostagni 2008, p. 323] and probably a pupil.

[11] For an in-depth study of the design of harmonic ovals, see Dotto 2002. In this book, the 1:2 oval of the case analysed here is discussed on p. 42.

[12] For a comprehensive treatment of the concept of genius loci in the field of architecture, the reader is inevitably referred to Norberg-Schulz 1979.

Author

Salvatore Damiano, Department of Architecture, University of Palermo, salvatore.damiano01@unipa.it

Reference List

Avella, F. (2012). *Esterno interno. L'immagine sincronica nel disegno di architettura*. Palermo: Edizioni Caracol.

Barbera, P. (2002). *Architettura in Sicilia tra le due guerre*. Palermo: Sellerio Editore.

Bozzoni, C., Fonti D., Muntoni, A. (a cura di). (2012). *Luigi Moretti. Architetto del Novecento*. Roma: Gangemi Editore.

Capomolla, R., Mulazzani, M., Vittorini, R. (2008). *Case del Balilla. Architettura e fascismo*. Milano: Mondadori Electa.

Clemente, M. (2012). *Comporre e scomporre l'architettura: dall'analisi grafica al disegno di progetto*. Roma: Aracne Editrice.

Corbellini, G. (2015). *Exlibris. 16 parole chiave dell'architettura contemporanea*. Siracusa: LetteraVentidue.

Di Benedetto, G. (2018). *Antologia dell'architettura moderna in Sicilia*. Palermo: 40due Edizioni.

Di Leo, G.L., Lo Curzio, M. (1985). *Messina, una città ricostruita. Materiali per lo studio di una realtà urbana*. Bari: Edizioni Dedalo.

Diemoz, L. (1937). Propositi di artisti: Luigi Moretti Architetto, In *Quadrivio*, 13/12/1937, p. 5.

Docci, M., Chiavoni, E. (2017). Saper leggere l'architettura. Roma-Bari: Editori Laterza.

Dotto, E. (2002). *Il disegno degli ovali armonici*. Catania: Le nove muse.

Mercadante, R. (2009). *Messina dopo il terremoto del 1908. La ricostruzione dal piano Borzì agli interventi fascisti*. Palermo: Edizioni Caracol.

Norberg-Schulz, C. (1979). *Genius loci. Paesaggio ambiente architettura*. Milano: Mondadori Electa.

Rostagni, C. (2008). *Luigi Moretti 1907-1973*. Milano: Mondadori Electa.

Santuccio, S. (a cura di). (1986). *Luigi Moretti*. Bologna: Zanichelli.

Santuccio, S. (a cura di). (2005). *Le case e il foro. L'architettura dell'ONB*. Firenze: Alinea.

Santuccio, S. (2003). Il disegno razionale. In C. Mezzetti (a cura di). *Il Disegno dell'architettura italiana nel XX secolo*, pp. 149-192. Roma: Edizioni Kappa.

Ugo, V. (1994). *Fondamenti della rappresentazione architettonica*. Bologna: Società Editrice Esculapio.

Ugo, V. (1996). Rappresentare. In *RectoVerso*, n. 7, p. 1.

In-between Places. Multi-Scale Digital Hybridations of the Campania Caves&Quarries System

Giuseppe Antuono, Valeria Cera, Vincenzo Cirillo, Emanuela Lanzara

Abstract

Mining sites represent one of the greatest challenges for territorial regeneration policies in Europe and in the world, often defined, in their spatial-typological connotations, with meanings that generally suggest negative qualities such as episodic fragmented and, at times, degraded spaces, not highlighting their value as 'cultural landscapes'. Despite a preliminary and non-exhaustive national and regional regulatory framework, the issue of enhancing these areas needs greater attention from the scientific community, especially in respect of the current international scenario. Specifically, due to its numerous concentration of mining areas, the territorial reality of the Campania region deserves particular attention, with the development of an open information system from which to derive a synoptic representation of the state of affairs that integrates the historical-cultural identity with the figurative and perceptive dimension of places.

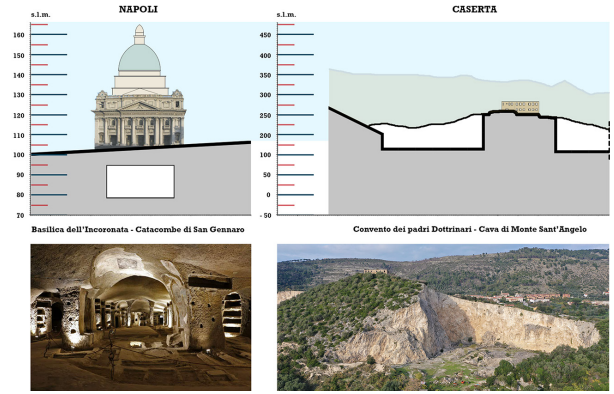
Keyword: quarries, Territorial Information System, multiscalar representation, perception, memory.

Introduction

In the broad panorama of the historical-cultural activities aimed at recovering ex-mining sites –described by two prevalent types of quarries, 'underground' and 'open-air'– there are not recent perceptive studies about these 'voids' considered as negative spaces both for their marginality and for their relationship with 'connected' relevant architectures.
According to a multi-scale semantic decostuction, this study deepens the results published for the UID 2020 Conference *Connecting. Drawing for weaving relationship* a by interpreting the *up&down*, *inside&outside*, morphological and compositional relationships between landscape, architectural heritage and natural and/or artificial quarries to investigate identity and transformations of the involved places.
More specifically, this research activity aims to configure a 'repeatable prototype' generated by comparing and integrating different data management and manipulation techniques (GIS/VPL). Digital survey and integrated representation activities are implemented with 3D Map Generators to design a multilevel GIS database.
Therefore, this research work expresses a complex, hybrid territorial reality, characterized by episodic fragmented and degraded spaces to reveal their genius loci through drawing as analysis tool to recover the memory of places [1].

Fig. 1. Underground cavities in Naples. Above, Catacombs of San Gaudioso; in the center, Galleria Borbonica; below, Fontanelle Cemetery, from Wikimedia Commons.

Fig. 2. On the left, 'underground' quarry: Catacombs of San Gennaro; on the right, the 'open-air' quarry of Monte Sant'Angelo in Caserta (elaboration by the authors).



In-between places. The 'empty' as a space-perceptual metamorphosis research area

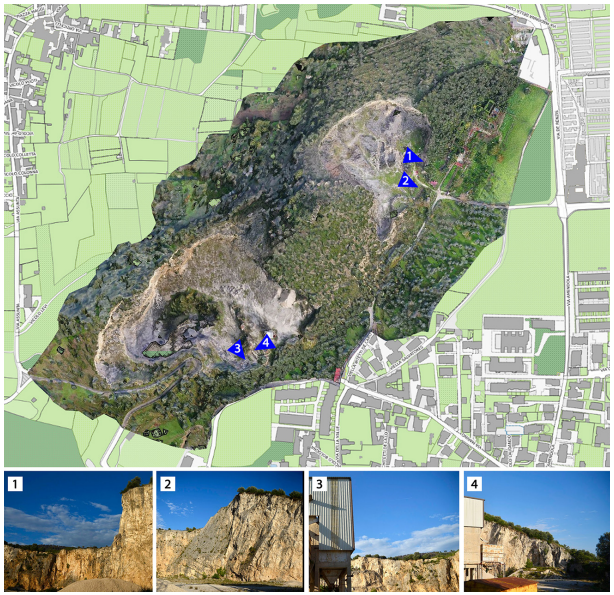
The caveal spaces, intended as places of material resources provision, possess in their metamorphic process, a great potential for experimental research. Their re-definition, in the light of contemporary national and international ecological directives, is becoming a privileged field of investigation for the discipline of drawing.
Categorized as 'open-air' (with a height level located near the ground surface) or 'underground' (below the ground level), all quarries are defined by the 'empty space', built by subtraction of matter, in which the primacy of the introverted dimension of space prevails [Bachelard 1999]. In this sense, they appear to be perpetually awaiting the conquest of a new role with respect to just having provided feed for the construction of 'urban memories' on the surface, especially for those that are abandoned [Trasi 2001].
Therefore, dealing with the ex-mining sites in Campania means looking at the spatial context of the quarries while respecting their formal identity, without affecting the superficial reservoir of the deposit, be it apogee or hypogeum. Furthermore, particular attention must be paid to the surrounding landscape which has unfortunately seen its spatial-perceptive values change over time.
Referring this first area of investigation to Naples and Caserta it is found that scientific research, in recent years, has largely paid attention to disused quarries.
In Naples, within this complex geological structure located to the center of a volcanic region between the crater building of Vesuvius to the east and the volcanic district of the Campi Flegrei to the west [Papa 1993, p. 94], there are countless underground cavities born from both natural and anthropic phenomena, previously already subject to investigation and cataloging by type of material extracted [Cardone 1993; Cardone 2008]. The latter arise both from the incessant action of water that over the centuries has dug deep furrows in the tuffaceous banks and from the extraction of building material that took place in situ.
Within this vast panorama of underground cavities, used utilitarianly for various purposes, there are cemeteries, catacombs, tunnels, wells, anti-aircraft shelters (fig. 1). The current spatial configuration of these quarries is a function of their 'underground' cultivation method and

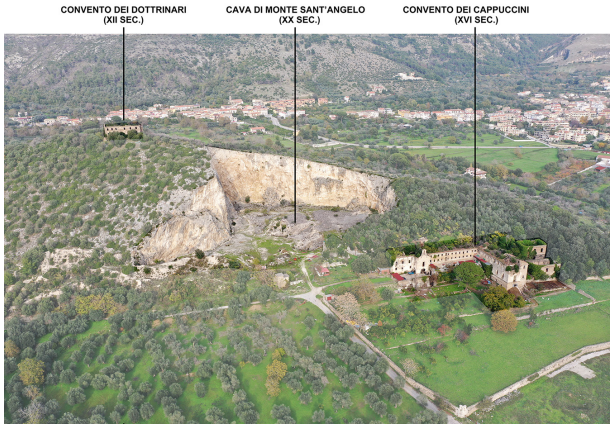
the excavation techniques. The most common are those 'gallery with side passages' and 'pillared rooms' [Santarelli 2015, p. 20]. The first example is attributable to the Catacombs of San Gaudioso; the second, to the Catacombs of San Gennaro (fig. 2, left).
In general, the underground quarries of the city of Naples, despite being excellent examples of enhancement (think of the Galleria Borbonica), did not enjoy the same interest as the 'open-air' caveal sites of the Caserta promontory. The reason would seem to be twofold. The first can be associated with the fact that 'underground' quarries of Naples, some of which have been considered a central fulcrum on which to superimpose an 'architectural memory', are mainly accessible. Therefore, the connection between the empty space in the ground and the full one on the surface, still establishes a bond of mutual belonging and cultural accessibility. The other reason, on the other hand, would seem to be attributable to the fact that the underground quarries, constituting a group of introverted areas, involve huge hidden areas, completely hidden from view, in which the main communicative flows of lights, sounds and colors that characterize the surface world are completely absent.
The 'open-air' quarries, on the other hand, represent uncomfortable environmental contexts, much more evident than the underground quarries. In fact, in most cases, large excavations on the surface impose themselves on the eye as 'interrupted' landscapes, which compromise livability, practicability and usability [Clément 2005]. Furthermore, in terms of aesthetics, they compromise the 'continuous' and 'overall' image of the territories, as well as the visual-perceptual relationship of the buildings facing them. This is what happens along the strip of the Caserta promontory: huge gaps of soil crack and deface the spatial complexity of the landscape. Furthermore, in the proximity of them there are a series of architectural emergencies in a state of abandonment and decay that establish a subverted perception with the surrounding environment, i.e. a double separation between the quarry element and the architectural emergencies present and, these last, with the landscape (fig. 2, right).
To understand how the latter constitutes a very widespread phenomenon in the Caserta area, just think of how the regional plans on extractive activities show a presence of caveal areas equal to 27.5% of the regional total against 14.7% of the area Naples underground [2]. More specifically, for Caserta, the 'open-air' typology shows a total of 422 quarries, of which 46 authorized, 59 closed, 317 abandoned. The latter amount to about 29.8% of the Campania total. Finally, to the 422 are added another 36 illegal quarries.
From the previous data it emerges that the Caserta area represents the main procurement activity of raw materials for the Campania region where the extraction activity of the last decades, mainly of calcareous matrix,

Fig. 3. The landscape of Maddaloni between past and present (in red, the quarries present today. In orange, the portion now absent), (elaboration by the authors).

Fig. 4. Summary overview of the environmental complex of the Monte Sant'Angelo caveal site (elaboration by the authors).

Fig. 5. Aerial view with indication of the main architectural emergencies adjacent to the caveal site of Monte Sant'Angelo (elaboration by the authors).



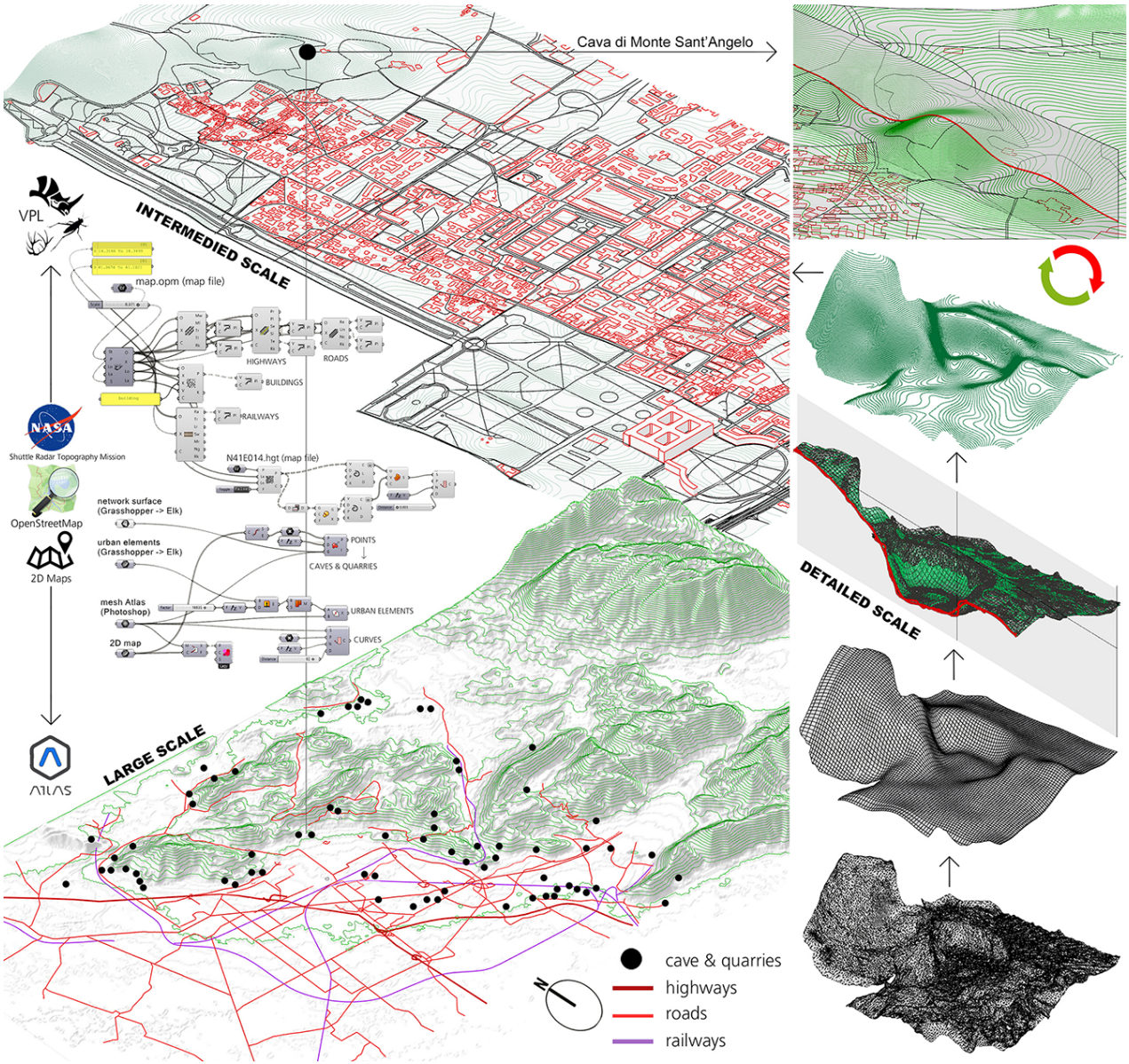


has produced a large number of brownfield sites and abandoned punctually scattered along the hillside of the Tifatini Mountains [Buondonno 2001], on the northern border of the Campania plain, close to the main infrastructural axes.
From Capua to Maddaloni the urban context is characterized by terraced and empty areas that have compromised the perceptive quality of the landscape (fig. 3); in particular today the hilly area in the city of Caserta is characterized by notable gaps that disconnect the landscape that once made up the scenic backdrop of the Royal Palace, a privileged place for travelers from which to portray the Caserta plain (for example, J. P. Hackert, A. Veronese, S. Fergola) [Conti, Valerio 2012].

The quarry system. Multi-scale re-presentation and multi-level interpretation of the places

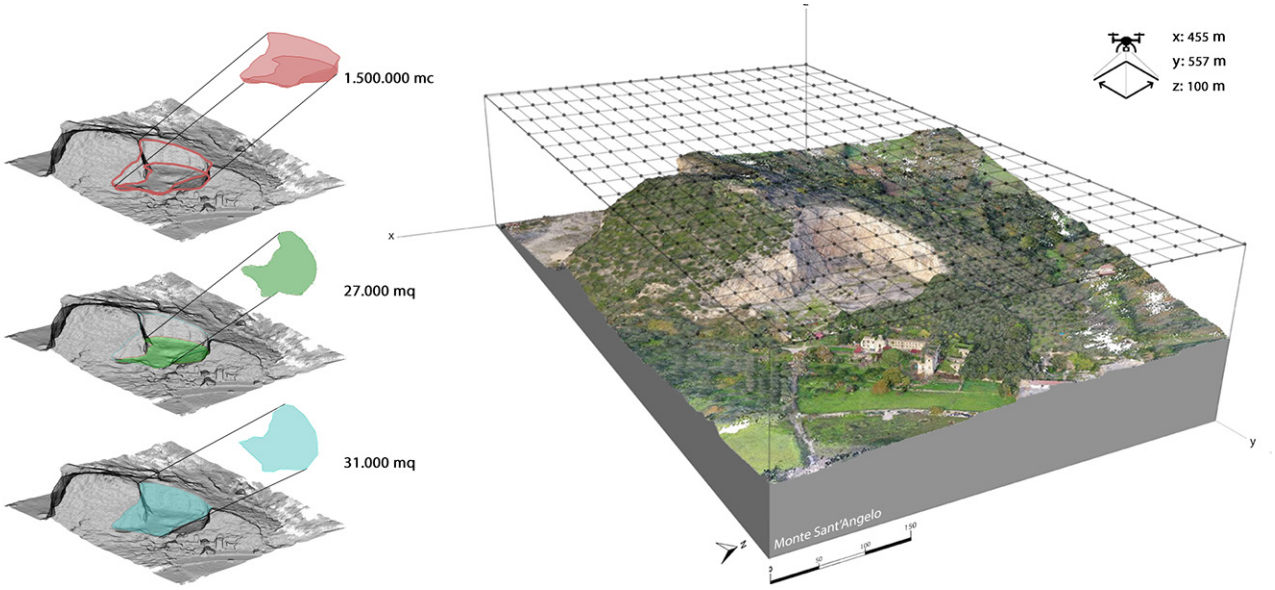
Referring to the Caserta caveal system previously described and according to the main goal of this research activity, a first case study was identified as a reference repeatable prototype: the disused quarry of Monte Sant'Angelo, located in the Municipality of Caserta (fig. 2, right).
This quarry is located on the hills of the Tifatini Mountains, near the Vanvitelli's Royal Park. Due to its size, it is both a physical and perceptive void characterized by a strong impact.
It is a real 'open-air void', with excavation walls up to 75 m high and an area of about 22,000 sq.m. This site is the result of an open-pit mining activity of a limestone bank, already inactive in the first decade of the 21th century (fig.4). Its choice is mainly due to its emblematic localization which requires a methodology supported by open and/or *reality-bases* models aimed at multi-scale representations (large and detailed scale). The site occupies a central position between two historical emergencies: the abandoned Capuchin monastery of Puccianiello of the second half of the 16th century (north-east) and the ruins of the convent of the Doctrinaire Fathers of the first half of the 12th century (north-west) (fig. 5). At the same time, it is closely related to the built urban environment. The uniqueness of this place is not a recent discovery. Thanks to its proximity to the Bourbon residence, perceived from a point of view on the whole plain of Caserta, Monte Sant'Angelo was a favorite location for landscape painters such as JP Hackert, who in the first half of the 18th

Fig. 6. Multi-scalar modeling to combine and manage heterogeneous data of Caserta territory for future integration with survey data (elaboration by the authors).



century created one of his most famous paintings, *La veduta del Palazzo Reale di Caserta dal Convento di San Francesco* (1782, Museo Reggia di Caserta).
These premises inspire the subsequent multi-scale analysis and digitization activities and the design of a digital platform: its graphic interface (3D model) derives from the integration between aerial photogrammetric survey data, 'digital map tiles' and georeferencing of traditional iconographic and cartographic sources.
The goal is to describe the morphological, urban, physical-geographical complexity of the site, according to multilevel interpretations and approaches based on its historical identity, its exploitation and its impact on the formation of the surrounding built landscape.
Digitization processes simplify dissemination and management of big data about cultural resources, enriches traditional collections and enhances data/user interaction to preserve and enhance cultural heritage [Bianchini et al. 2019]. The main advantages are direct access and clarification of information not yet available.
Digital tools simplify the acquisition (open data digital platforms) and manipulation of territorial and urban big data (GIS/VPL), geometrically defined as a discrete system –point grids, curves networks, polygons– to return terrain model, road systems, buildings, hydrographic systems etc. [La Russa et al. 2021].
Furthermore, this integrated approach is aimed to document and represent the places, as well as to plan future activities to enhance these areas and their cultural, architectural and environmental heritage. Therefore, this process is aimed at integrate informations of geolocated map tiles available from digital platforms such as *OpenStreet-Map and Shuttle Radar Topography Mission* (SRTM) with physical-geographical data (EPW *Weather data*), favoring the interoperability between different digital approaches [de Sousa et al. 2020; Fink et al. 2019].
More specifically, these digital tools have been integrated to extract and populate a DEM (mesh/NURBS) according to an integrated and multidisciplinary VPL/GIS process, aimed at managing and enhancing territorial (large scale) and urban resources (intermediate scale, particularly referring to the closer building environments) and individual buildings (detailed scale, particularly referring to 'magnet' buildings).

Fig. 7. Monte Sant'Angelo quarry. Photogrammetric survey and surface and volume data extraction (elaboration by the authors).



Therefore, these discrete models were implemented by geolocating quarries according to the information of territorial graphic maps [3]. Moreover, this semantic model supports the implementation of an integrated database, simplifying the localization of existing and/or designed elements (fig. 6).
More specifically, to test this process, this research activity is aimed at overlaping, manipulating and comparing open DEM and aerial photogrammetric survey to achieve the integrated model of the sample quarry. The choice meets two main operational needs: the accessibility of territorial features and the geo-metric detail data acquisition. According to a consolidated process, morpho-metric data of the Monte Sant'Angelo quarry were acquired through an aerial photogrammetric survey to detail the open territorial model [Torok et al. 2020].
The flight missions were programmed with waypoint navigation mode using a double orthogonal grid (fig. 7, right). The images were captured with inclined and nadiral axis shots [Antuono et. al. 2020]. The average flight height was set at 100 m from the altitude of the mountain: this height is due to the presence on site of perceptive and signal transmission interference elements. This data and the overlapping of the frames of about 65%, allowed to acquire information with an overall GDS of 7 cm.
The photogrammetric point cloud and the triangulated mesh define an extremely precise information system to extract some indicators and detail parameters aimed at correctly classify the quarry. The slope of the excavation walls varies from 92° to 112° (fig. 8, right).
The excavation fronts develop downwards as a single vertical wall made by abatement for side-by-side strips characterized by variable heights between 10.4m and 65.6m (fig. 8, left).
The 'open-air' cultivation activity resulted as a vacuum in the limestone bank for a volume of material about 1,500,000 cu.m. The parallel horizontal profiles (step=1m) return a surface extended outwards and upwards, determining an irregular region (quarry square) of 27,000 sq.m., and an area of 31,000 sq.m. at the edge of the excavation (fig. 7, left).
At the same time, a DEM of about 11 sq. km (2,720x3,988 m) was produced: the quarry is located in the north-west

Fig. 8. Down Analysis of the acclivity and elevation data of excavation faces (elaboration by the authors).

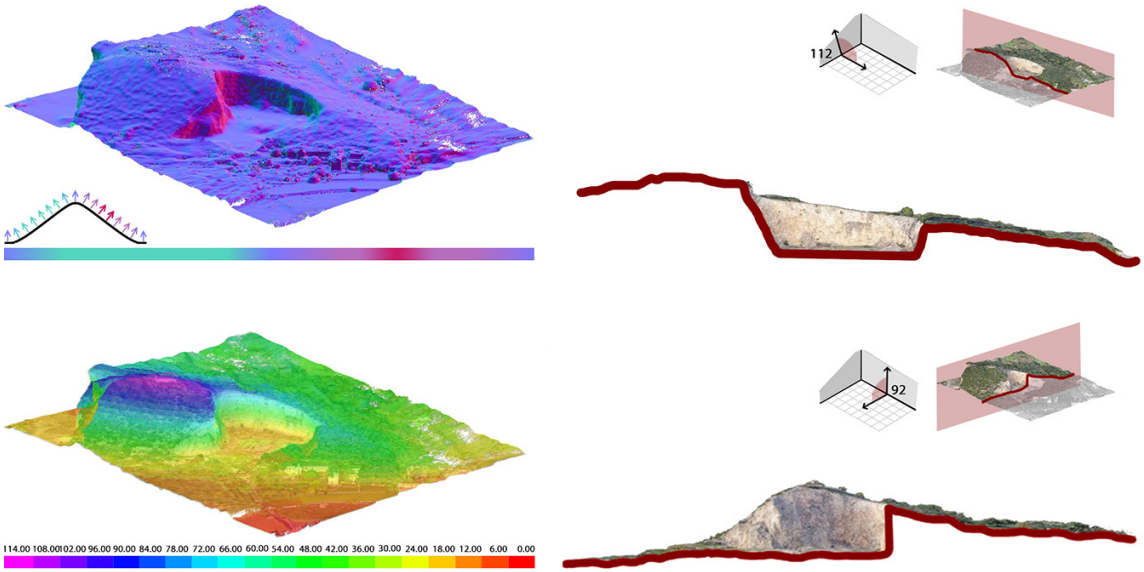
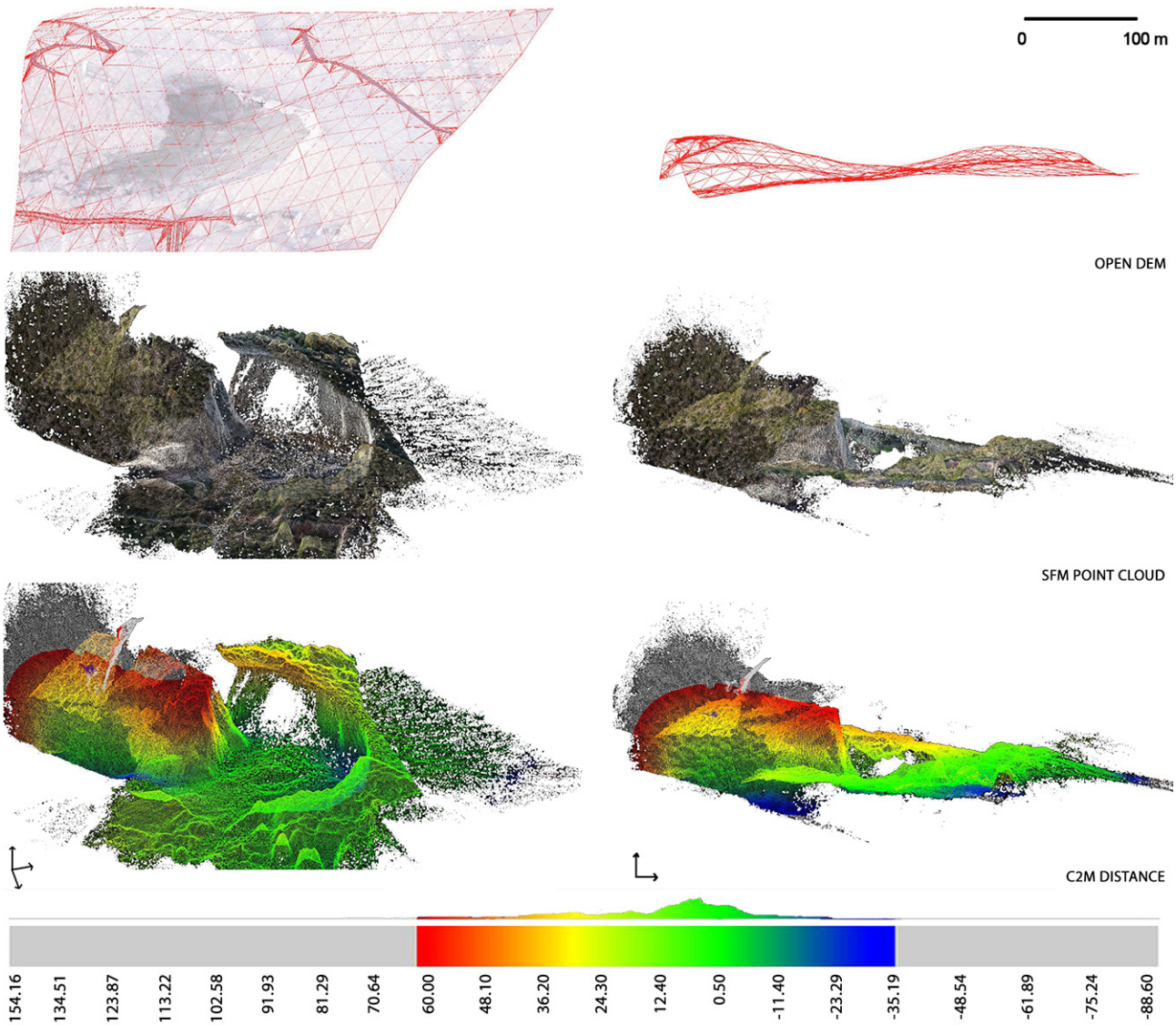


Fig. 9. Geometric distances between the photogrammetric point cloud and the open dem (elaboration by the authors).

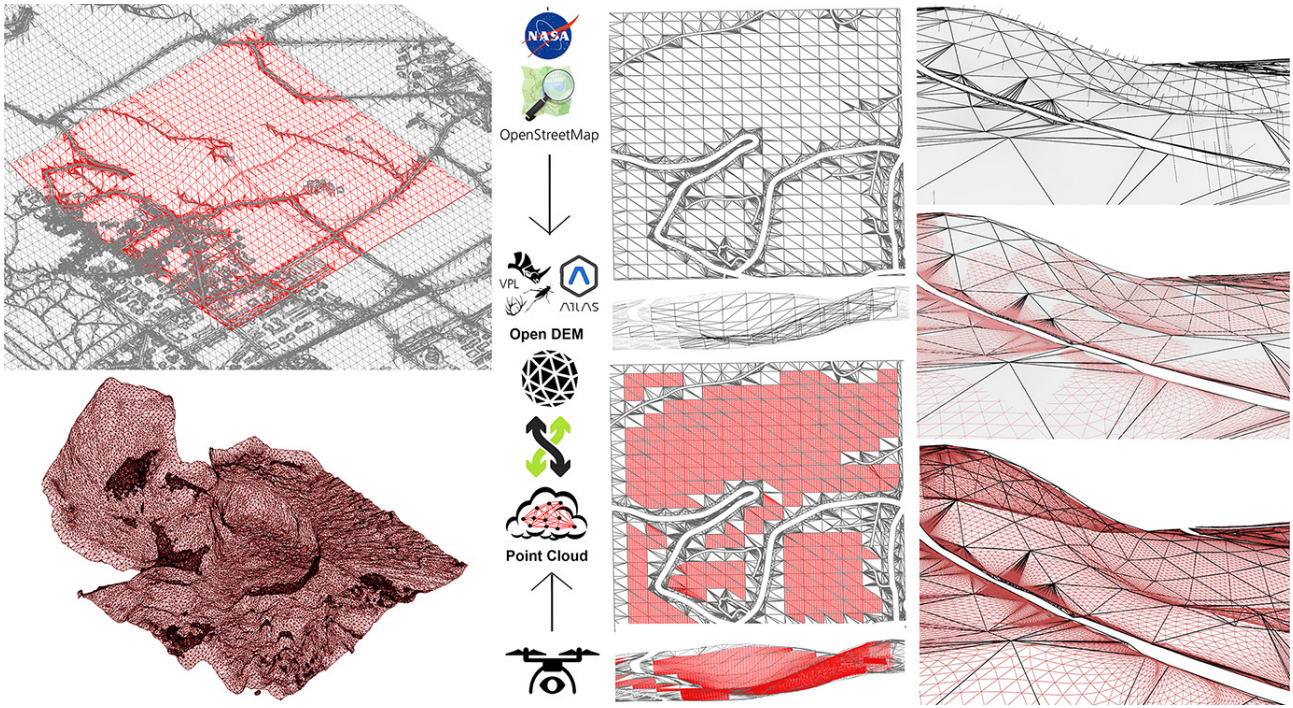


area. To the west, it includes the central system of the tanks of the Caserta Royal Palace, a very important landmark for the whole area.
Part of this research verifies the correspondence between open DEMs, characterized by a lower degree of accuracy [Schlögel et al. 2018; Milledge et al. 2009] and 'reality-based' model. This integration is aimed at returning a reliable and manageable system in GIS. Therefore, open DEM, point cloud and corresponding photogrammetric mesh are compared to each other from a larger area to a more detailed territorial portion.
Models were aligned by imposing the open mesh as a reference according to its satellite coordinates. Therefore, a rigid transformation based on the identification of 3 homologous points was applied to the photogrammetric cloud. The geometric divergence results a substantial misalignment of the models, with an average deviation of about 30m., with peaks of about 60m, both in the marginal and in the caveal areas.
The areas strictly affected by mining activities show the most significant deviations. Furthermore, as expected, the satellite data provide a DEM with a more homogeneous and uniform morphology than the real conformation of the site. [Antuono et al. 2020] (fig. 9).
The specific literature shows different approaches aimed at management and optimization of DEMs built on open data or extracted from accurate point clouds [Milledge et al. 2019].
The open DEM and the photogrammetric mesh were manipulated (smoothing) or used as a reference to model the corresponding surface (NURBS from point grid). Basically, this operation is useful for qualitatively improving surfaces (contour, texturing).
More specifically, topological editing of the open DEM allows the integration between the territorial model and the detailed 'reality-based' model, in order to ensure their geometric continuity. The main goal of this geometric-speculative process is aimed at optimizing the''local' reliability of open models, combining areas or elements requiring more specific analysis and simulations with the broader context (fig. 10).
In fact, a specific survey activity cannot be avoided: only the discrete model's 'reality-based' return indicators and semantic detailed parameters (slope angle, crop volume, optimal sunshine, connections etc.), aimed at managing cognitive and decision-making processes. However, it is evidently not possible to acquire detailed informations for large territorial areas. Therefore, this research activity investigates open DEMs manipulation processes aimed at their geometric improvement or integration with 'reality-based' models.

The Information and visualization system

The experiments on the integration of morphological-territorial models, through the comparison of geolocalized map tiles and 3D Map generators manipulated in the VPL environment, have allowed to integrate the information data into the SRTM-GIS elevation model of the portion of the investigated territory, implemented at the detail from the DEM of the outcome of the SfM photogrammetric process from UAV. The precision and accuracy of the survey data is explained by the degree of complexity of the architectural-landscape structures that characterize the site; thus to the discrete system composed of the networks of points and curves that structure the various elements of the large area model and that allow the restitution of the orography, road systems, buildings, etc., are added that territorial information, divided into Features Class, implemented qualitative, geo-metric and topological attributes (for example, extension of the site in plan and elevation; type and/or area of extraction, perimeter of the authorization, characterization of the profile of the shoe and of the quarry yard, steepness of the walls, presence elements of shading, conservation status, administrative constraints, duration of the cultivation activity, date of disposal of the site, relationship with the surrounding building etc.), representing the indicators of a matrix supporting the recovery and enhancement process of these sites in accordance with the objectives of the *2030 Agenda*. Therefore, the deep link between characteristics of raw materials, extraction systems and geometric-morphological data for the re-modeling of the territory, acquired as attributes in the GIS environment, constitutes an opportunity for interdisciplinary connection, for the analysis of the territory and its historical emergencies, to favor volumetric analyzes, studies on the orientation and inclination of quarry walls, *up&down* relational analyzes of the buffering type and morphological-compositional and visual impact investigations viewshed of the emerging architectural elements of the surrounding urban landscape [Cassatella 2011].
Providing detailed documentation, heterogeneous but systematized, implementable and spatialized also to the historical-iconographic documentation –through 'filtering' and rubber-sheeting processes structured starting from the

Fig. 10. Open DEM editing is aimed at combining it (large-territorial scale) with the reality-based model (quarry detailed model), (elaboration by the authors).



vector technical paper (in the reference system WGS84 UTM33N)– becomes strategic just to re-read the ancient configuration of the emerging historical cave-architecture system, as well as to guide the processes of management and sustainable development of the territory. Thus, the computerization of the cartographic and iconographic source acquires added value, becoming a meta-source [Genet 1994], especially if implemented in an information prototype [Ferrighi 2015] structured as a container of territorial models useful for reconstructing the historical-cultural dimension, in consideration of the peculiarities of the local realities necessary for the recovery also of the recreational dimension of these spaces (fig. 11). Added to this is the opportunity to integrate and view the data through a single Web-GIS information platform, as a queryable tool for critical pre or post design simulation themes to support proposals for restoring the 'cultural landscape', integrated with modern visualization systems of the partly lost heritage [Parrinello, Picchio, Bercigli 2016; Velho, Frery, Gomes 2009]. Thus, the vision that materialized to the eighteenth-century traveler reappears in an evocative, geo-referenced virtual path that describes, in addition to the cartographic and geometric-configurative component, the original physical and perceptive relationships that are established between space and context [Liuzzo, Giuliano 2016] (fig. 12).

Conclusions and future works

This contribution aims to highlight the mutation, over time, of image and perceptual identity of landscape-territorial realities through a first quarry sample in Caserta as a repeatable approach for other Campania quarry sites.
The construction of a multilevel digital database of the quarry system is aimed at explaining the features of a complex, hybrid territory, characterized by the presence of episodic fragmented and, sometimes, degraded spaces, as well as to recover the genius loci through design as an analysis tool between thought and project.
This ongoing research activities will be focused at implementing VPL/GIS interoperability and data systematization through semantic classification of quarries deriving from mining activities (both open pit and underground). The study will be organically extended from the provinces of Naples and Caserta to the entire Campania Region.

Fig. 11. Summary framework of the implementation of the multilevel information system, with the integration of the Rizzi Zannoni Topographic Map, 1784, (elaboration by the authors).

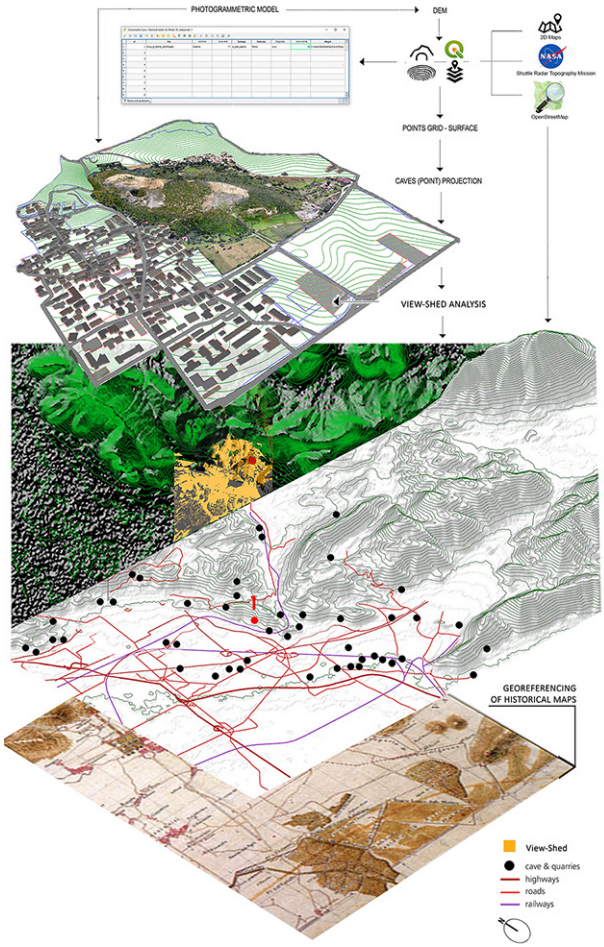
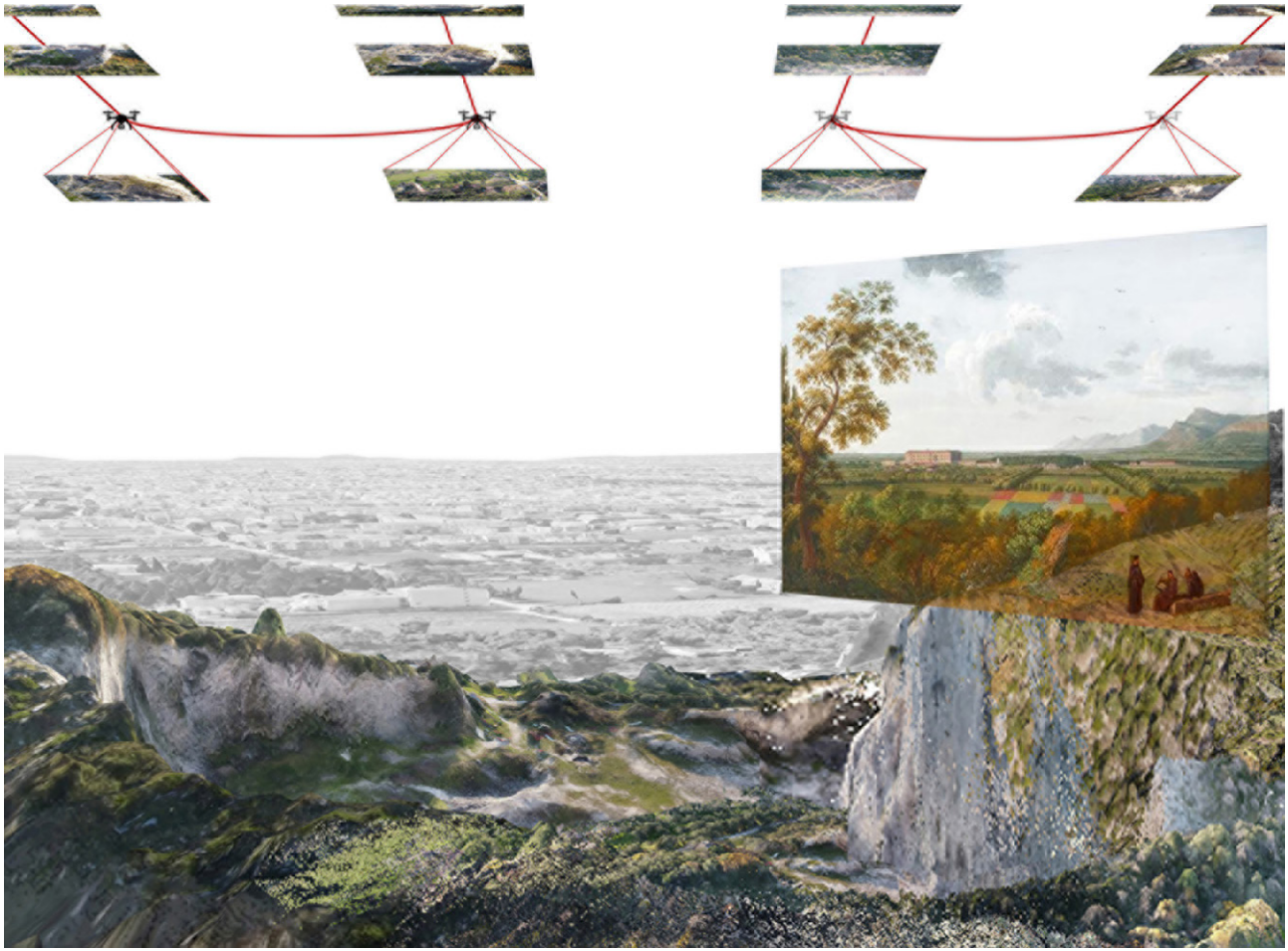


Fig. 12. View of the SfM UAV model of the quarry and reconstruction of the observation point of the view by J. P. Hackert (elaboration by the authors).



Credits

The contribution is part of the research activity *ex-caVIARe. Digital hybrids to re – present Campanian caves&quarries*, supported by the Directorate General for Public Works and Civil Protection of the Campania Region and by the international organization Global Digital Heritage, awarded with a special mention assigned by UID. Unione Italiana Disegno for *UID 2.0 - 3.0. Call for cultural activities proposed by Adhering Members*.

Notes

[1] This contribution is written in all its parts and belongs to all the co-authors.

[2] Regional Plan of Mining Activities of the Campania Region, 2005. Supplementary and updating document of the Final Report referred to in Regional Council Resolution No. 7253 of December 27, 2001.

[3] Municipal Urban Plan of the Municipality of Caserta. Table no. Knowledge Framework, 2014.

Authors

Giuseppe Antuono, Department of Civil, Construction and Environmental Engineering, University of Naples "Federico II", giuseppe.antuono@unina.it
Valeria Cera, Department of Architecture, University of Naples "Federico II", valeria.cera@unina.it
Vincenzo Cirillo, Department of Architecture and Industrial Design, University of Campania "Luigi Vanvitelli", vincenzo.cirillo@unicampania.it
Emanuela Lanzara, Department of Structures for Engineering and Architecture/ Department of Architecture, University of Naples "Federico II", emanuela.lanzara@unina.it

Reference List

Antuono, G., Cera, V., Cirillo, V., Lanzara, E. (2020). Digital management of quarries system for sustainable development of territory. In *SMC Sustainable Mediterranean Construction*, n. 12, pp. 221-228.

Bachelard, G. (1999). *La poetica dello spazio*. Bari: Dedalo.

Bianchini, C., Casale, A., Empler, T., Esposito, D., Inglese, C., Ippoliti, E., Ippolito, A., Ribichini, L., Valenti, G. & Viscogliosi, A. (2019). Ecosistemi digitali - Digital Ecosystem. In *Paesaggio urbano*, n. 1, pp. 42-51.

Buondonno, A. (2001). Le aree di cava della città di Caserta: dal dissesto geopedologico alla riqualificazione ambientale. In A. Rigillo et al. (a cura di). *La città continua. Il sistema urbano da Capua a Maddaloni*, pp. 77-84. Caserta: L'Aperia editore.

Cardone, V. (2008). *Modelli grafici dell'architettura e del territorio*. Salerno: Cues.

Cardone, V. (1993). Le attività estrattive. In V. Cardone e L. M. Papa (a cura di). *L'identità dei Campi flegr*ei, pp. 63-86. Napoli: CUEN.

Cassatella, C. (2011). Assessing Visual and Social Perceptions of Landscape. In C. Cassatella e A. Peano (a cura di). *Landscapes indicators*, pp.105-140. Dordrecht: Springer.

Clément, G. (2005). *Manifesto del Terzo Paesaggio*. Macerata: Quodlibet.

Conti, S., Valerio, V. (2012). *La Terra di Lavoro nella Storia. Dalla Cartografia al Vedutismo. Associazione Roberto Almagià*. Caserta: Roberto Almagià" Editore, pp. 102-103.

Comune di Napoli (a cura di). *Il sottosuolo di Napoli. Relazione della commissione di Studio*. 1967.

De Sousa Freitas, J., Cronemberger, J., Soares, R. M., Amorim, David, C. N. (2020). Modeling and assessing BIPV envelopes using parametric Rhinoceros plugins Grasshopper and Ladybug. In *Renewable Energy*, v. 160, pp. 1468-1479.

Ferrighi, A. (2015). Cities over space and time. Historical GIS for Urban History. In S. Brusaporci. *Handbook of Research on Emerging Digital Tools for Architectural Surveying, Modeling, and Representation*, pp. 425-445. Hershey: IGI Global.

Fink, T., Koenig, R. (2019). Integrated Parametric Urban Design in Grasshopper/ Rhinoceros 3D Demonstrated on a Master Plan in Vienna. In *Proceedings of the 37th eCAADe and 23rd SIGraDi Conference*. Porto, 11-13 September, v. 3, pp. 313-322. ECAADe.

Genet, J.P. (1994). Source, Metasource, texte, histoire. In Bocchi F., Denley P. (a cura di). *Storia e multimedia*, pp. 3-17. Bologna: Grafis.

La Russa, F. M., Santagati, C. (2021). Dagli OpenData ai modelli di città: un approccio Anti-Fragile per il City Information Modeling. In *Dienne*, vol.7, pp. 83-95.

Liuzzo M., Giuliano S. (2016). Dal rilievo alla divulgazione: metodologie integrate per la fruizione virtuale del territorio. In F. Capano, M. I. Pascariello e M. Visone (a cura di). *Delli Aspetti de Paesi. Vecchi e nuovi Media per l'Immagine del Paesaggio*, pp. 327- 336. Napoli: FedOA - Federico II University Press.

Milledge, D.G., Lane, S.N. & Warburton, J. (2009). Optimization of Stereo-matching algorithms Using Existing DEM Data. In *Photogrammetric Engineering & Remote Sensing*, v. 75, n. 3, pp. 323-333(11).

Papa, L. M. (1993). Le "miniere" dei Colli Leucogei. In V. Cardone e L. M. Papa. *L'identità dei Campi flegrei*, pp. 94-101. Napoli: CUEN.

Parrinello, S., Picchio, F. & Bercigli, M. (2016). La 'migrazione' della realtà in scenari virtuali: Banche dati e sistemi di documentazione per la musealizzazione di ambienti complessi. In *DisegnareCon*, v. 9, n.17, pp. 14.1-14.8.

Santarelli, I. (2015). *Riscritture per il sottosuolo ex-estrattivo. Strategie di recupero tra memoria, tutela ambientale e nuovi usi per la città contemporanea*. Tesi di Dottorato di Ricerca XXVIII ciclo. Tutor: prof.ssa Paola Veronica Dell'Aira. Sapienza Università di Roma, DiAP.

Schlögel, R., Marchesini, I., Alvioli, M., Reichenbach, P., Rossi, M. & Malet, J. P. (2018). Optimizing landslide susceptibility zonation: Effects of DEM spatial resolution and slope unit delineation on logistic regression models. In *Geomorphology*, v. 301, pp. 10-20.

Török, Á., Bögöly, G., Somogyi, Á., Lovas, T. (2020). Application of UAV in Topographic Modelling and Structural Geological Mapping of Quarries and Their Surroundings - Delineation of Fault-Bordered Raw Material Reserves. In *Sensors*, v. 20, n. 2, 489.

Trasi, N. (2001). *Paesaggi rifiutati Paesaggi riciclati. Prospettive e approcci contemporanei*. Roma: Editrice Librerie Dedalo.

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

The Virtual Tour as a Digital Tool for Linking the Disciplines of the Drawing and the Archaeology of Buildings

Ilaria Trizio, Francesca Savini, Adriana Marra, Andrea Ruggieri

Abstract

The tools and methods aimed at the documentation of the built heritage often follow different paths depending on the own languages of the different frameworks involved in the knowledge process. It is clear how this assumption comes out when working in fragile contexts, where the risk of losing heritage due to natural and/or anthropic events is especially high. Therefore, in order to promote a multidisciplinary research approach, it is often necessary to find a connection, even on methods, able to allow to reach in a shared way the common goal of the knowledge aimed to the conservation and communication of the heritage. Herein are presented the results of a research study aimed at testing the potential of a digital system for the integration of the languages of two fields: architectural drawing and architectural archaeology. Our spotted tool, the Virtual Tour, is flexible and easy-to-use, and when properly designed, it becomes a hub capable of linking several thematic readings and to make them available, in addition to the various professionals, also to a wider audience, promoting the managing of the Cultural Heritage by the institutions-owners, and the heritage's fruition. This tool's potential is here outlined through the application to a case study, the church of San Menna at Lucoli (AQ) characterized, despite its small size, by different constructive phases and by a rich decorative apparatus of great historic-artistic value.

Keywords: knowledge of historic architecture, architectural survey, archaeology of buildings, fruition and promotion of Cultural Heritage, 360° Virtual Reality.

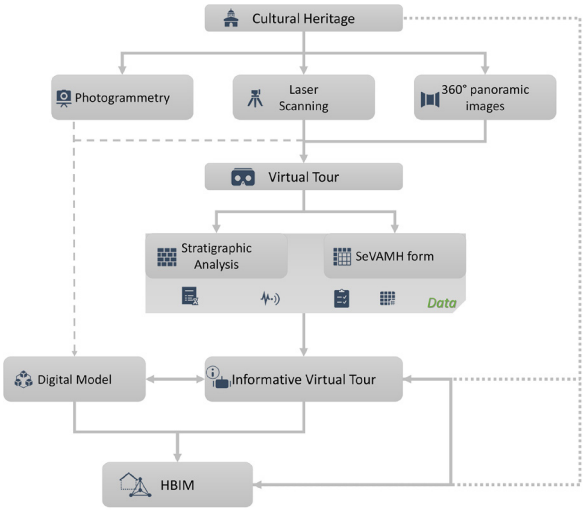
Introduction

The national and international scientific community usually gives great importance to the digital representation of the artefacts of the Cultural Heritage (from the GIS 3D to HBIM, going for semantic models where the topological link of information is possible), constantly trying to find in this expression a hub able to link the languages used by the various experts making them available and accessible. Therefore, the 3D digital model has been, and continues to be, the privileged tool able to guarantee an efficient managing of data derived from geometrical-formal, diagnostic, archaeological and historic-artistic analyses aimed to increase the heritage's knowledge and preparatory to the restoration planning. Thanks to it, the data acquired by classic methods of investigation flanked by those derived from in-depth analyses can be visualized, stored and managed, realizing a real integration between the disciplines involved in the knowledge process.

Despite the evidence that this is the preferable tool, the time required for building the model often conflicts with the necessity of a quick documentation of the heritage, in ordinary condition as well as in emergency. In order to overcome this issue has been tested a tool, the Virtual Tour, that sets itself in an intermediate temporal phase, between the survey and the building of the 3D digital model, representing an alternative manner to visualize and share data. In the case of study chosen to outline the system's potential, the church of San Menna, the Virtual Tour has been created starting from the rectangular images obtained during

the laser scanner survey campaign. The visualization digital system, which simulates a tour of the artefact through its 360° photorealistic representation, has been properly enriched with the research study contents and turned into an Informative Virtual Tour capable not only to guarantee the collaboration among the various professionals but even to remotely support the building of digital models, numeric and parametric. Furthermore, the potential of the system has emerged especially with respect to the particular historic moment we are living, marked by the pandemic and the impossibility to perform *in situ* inspections. The flexibility and the connectivity potential of the Virtual Tour allows indeed to visualize and to access a lot of information that could be easily increased over time, turning the tool into a complex virtual repository capable of linking heterogeneous data to the virtual representation of the artefact (fig. 1). The Informative Virtual Tour, when well designed using a logical as functional architecture, finally provides a real opportunity for the spreading of data and information of a scientific nature given that it can reach not only the insiders but also a wide target of users with different cultural backgrounds, interests and age groups.

Fig. 1. Flowchart for the implementation of the knowledge and documentation process through the use of digital systems (elaboration by Adriana Marra).



The church of San Menna in Lucoli (AQ): territorial organization and historical background

The church of San Menna is located in the small eponymous hamlet in the municipality of Lucoli, in the province of L'Aquila, 25 km far from the Abruzzo's capital. The scattered settlements distinguish still nowadays this municipality, consisting of sixteen hamlets situated in the Rio torrent's valley, at the northern borders of the Sirente-Velino regional natural park. The so-called *Ville* of Lucoli in fact, recall the settlement systems that distinguished this territory, as the one of the italic *vicus*, of the scattered villas in the Roman era, of the settlements organized around the curtes and the *farfense cellae* of the early middle ages or the forms of the medieval *encastellation*. On the territory of the municipality of Lucoli are still present many material traces that, when properly interpreted, can describe the evolution of the territory and its past importance. This is the case, for instance, of the pre-roman high-ground settlements [Mattiocco 1995], the many Latin inscriptions signs of the Roman age, of the monastic holdings of the VIII century cited in the *regesti farfensi* (monastic chronicles) [Chr. Farf. 1903], the military medieval architecture [Chiarizia and Properzi 1993] and of a large number of religious buildings [Chiappini 1986; Murri 1983].
The church of San Menna (fig. 2) has a peculiar configuration that reveals the several interventions and reconstructions undergone over time. It is a modest masonry building, with a bell gable on the rear side, divided in its inner into two naves compounded by two rooms located behind the choir, serving as a sacristy. Apparently poor in its appearance, this small artefact houses refined frescoes of the Abruzzo Renaissance, as the Crucifixion attributed to Saturnino Gatti [Arbace 2012] and realized in the late 15th century during his period of apprenticeship in the workshop of the painter Sebastiano di Cola of Casentino.

The digital integrated survey of the church

The building was surveyed through the integration of laser scanning and photogrammetric procedures aimed at the stereometric survey of the fabric and the acquisition of high-quality orthomosaics, with high metric precision and image resolution (fig. 3). The laser scanning acquisi-

tion was carried out with a FARO Focus S70, equipped with an integrated camera with HDR function, in two survey campaigns for a total amount of 24 scans. The scan parameters (definition, quality, HDR) were set up according to the dimensions of the surveyed spaces, their complexity and the articulation of the decorative apparatuses to be acquired, as well as on the lighting condition, inside and outside, at the time of acquisition. The post-processing was carried out in the software SCENE 2018, grouping the scans into two clusters (one for the interior and the other for the exterior) and continuing with the registration phase and the processing of a point cloud formed by over 315M points. A rectangular image was acquired from each station point and was used as a starting point for the creation of the Virtual Tour of the church.

The photogrammetric survey was carried out with a set of 299 photos acquired by a Nikon D610 camera equipped with an AF-S NIKKOR 24mm f/1.4G ED lens. The images were processed in the software Agisoft Metashape Professional 1.5.1 in two different chunks: one for the inner, obtaining a dense cloud of over 35M points; one for the exterior with a point cloud of over 17M points. The clouds, according to a procedure previously tested on similar artefacts, were subsequently merged thanks to the common points located at the entrance door. After validation of the metric data through comparison with TLS, from the total cloud was generated a mesh of 500K faces. From this model, properly scaled, and post-processed in the colorimetric data thanks to the application of photorealistic textures, the high-resolution orthomosaics of the external façades were cre-

Fig. 2. Church of San Menna of Lucoli AQ (photos by authors).

ated, used as support for the archaeological analyses of the masonries.
The point clouds obtained from the two different survey methods were used as a base for the two-dimensional restitution of the church (floor plans, elevations and sections) as well as for the building of the parametric model in BIM environment within which some architectural elements and part of the decorative apparatus were parametrised [Trizio et al. in press a] and, during the implementation phase of the parametric model, 'families' of sensors, useful in terms of management of data for the monitoring of the artefact, were also added [Marra et al. in press]. During the definition of parametric modelling, the Virtual Tour resolved the issue related to the impossibility of performing in situ inspections (due to the pandemic), testing the effectiveness of the tool also in this phase and showing an unexpected potential of the virtual informative system.

Archaeology of buildings: the constructive phases and the evolution of the church

Every historic building, as a real palimpsest, tells its past preserving the material traces related to the construction and destructions phases due to anthropic as natural causes. The archaeology of buildings [Francovich, Parenti 1988; Brogiolo, Cagnana 2012], a branch of the archaeological discipline, deals with tracking down these aspects through the application of the stratigraphic method to the masonries and the subsequent data interpretation concerning the characteristics of the territory, to the settlement dynamics and the power strategies that characterised the places over time. The application of the stratigraphic method to the built heritage is aimed at the identification of the Stratigraphic Unity of Masonries (SUM) and to their link with the phases of the artefact (construction, interven-

Fig. 3. Digital survey of the church: top, the laser scanner cloud point; below, the photogrammetric model (graphic elaboration by Francesca Savini).

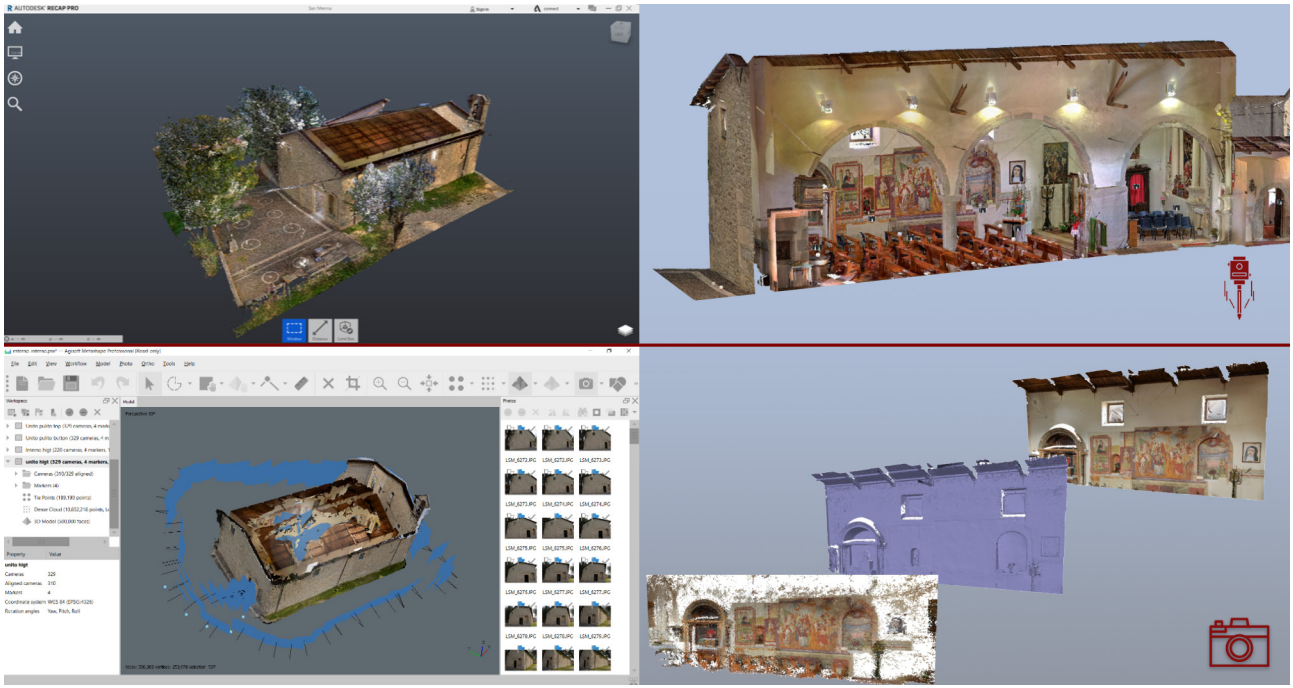
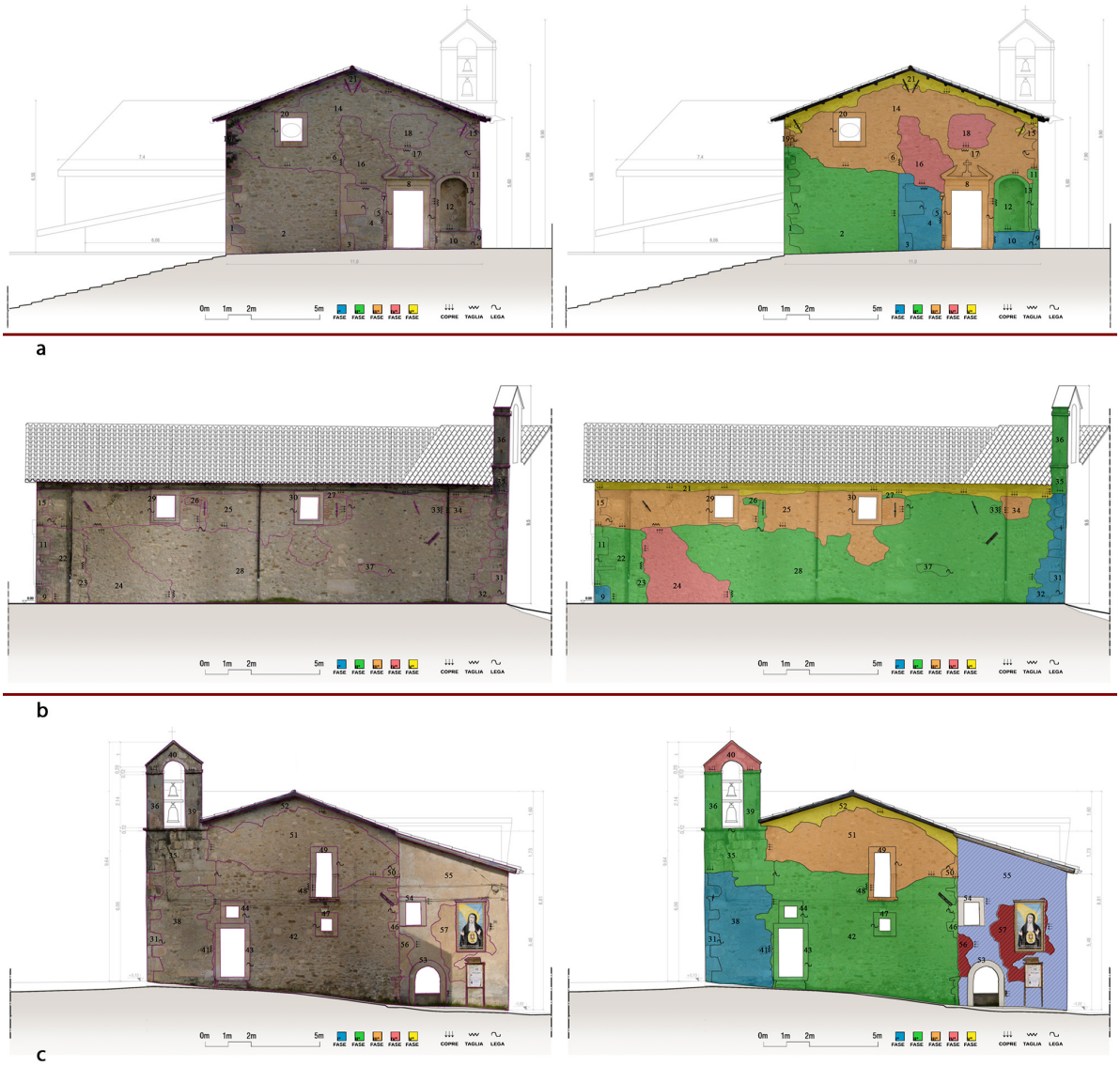
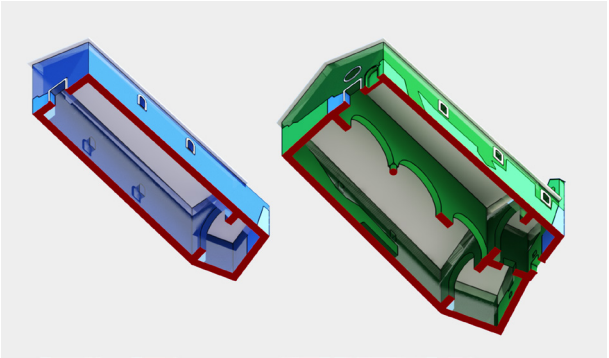


Fig. 4. Church fronts with the results of the stratigraphic analysis of masonries: a) main elevation; b) side elevation; c) back elevation. (graphic elaboration by Francesca Savini).



tions, maintenance) and so to the definition of a chronology, relative first, and absolute then.
The church of San Menna, analysed from this perspective, is rich in material traces witnessing its historical evolution which can be correlated to the settlement dynamics and to the power strategies that characterised these places. Though the first documental evidence of the artefact dates back to 1215, when it is cited in the Papal Edict by Pope Innocenzo III [Placidi 1988; Lico 2001], the toponym *Sancto Mennate*, already documented in the 8th-9th century, refers to an older occupation of the area. The hypothesis that the toponym refers to the *villa* of San Menna [Marcotulli 2008 and 2011] is supported also by the documents of the early Middle Age that refer to the presence of the name "S. Mendati" to identify the church under discussion [Muratori 1742, p. 950].
Unfortunately, the massive modern and contemporary restoration interventions that interested the building both in the 19th century and after its closing during the 1970s, have considerably complicated its archaeological interpretation. The finishing of the masonry joints carried out during these interventions has turned the masonries chromatically uniform and, even though it was still possible to recognize the different methods of laying the material, it was not possible to identify, through the only visual inspection, remarkable differences regarding the mortar used. However, the stratigraphic analysis of the masonries (fig. 4) allowed the recognition of different masonry types, distinguished on the basis of the installation method and the typology of stone material used and also, although the stratigraphic reports were not always clear, the identification of five phases corresponding to actions ranging between the edification of the artefact and the contemporary restoration.
The first phase refers to a single nave church, about 20 meters long and 6 meters wide, probably closed by an irregular polygonal apse. At this phase belong the two corner walls of the current south-west side front and the SUM 3 right visible on the façade. The masonries in phase with the corner walls are characterised by small and medium sized limestone, installed with larger well-squared blocks, probably reused. The second phase corresponds to the enlargement of the building that determined the actual layout, through the adding of the left nave, well visible in the stratigraphic report of the façade (with the SUM 2 resting on SUM 3), and of the bell gable on the rear side, in line with the first phase's wall and heavily altered by the late 19th restoration [Vivio 2011]. The masonries that characterize this construction phase are more uniform than the earlier and are composed mainly of medium size blocks installed in sub-horizontal courses. It is also possible to ascribe the windows to this phase, walled later and still visible at the sides' front, realized in bricks with the low arch typology. At the third phase, it is possible to attribute the upper part of the building, probably realized after a collapse. The presence of brick wedges in the masonry, combined with the style of the windows and the portal, allows to assume that this is a restoration intervention realized after the 1703 earthquake. The fourth phase can be attributed to restoration interventions most likely occurred after collapses and failures, such as that visible in the SUM 24 on the side elevation, where clearly appears the restitching slightly off-squared performed. The location of this SUM and its particular shape refers to a local damage mechanism with the ejection of part of the masonry [Borri et al. 2020]. The disruption of parts of masonry belonging to phases two and three, suggests a collapse following the event of 18th century, that might be caused by one of the seismic events that struck the territory during the 19th century. This hypothesis is supported by some documents kept at the National Archive of L'Aquila, witnessing the necessity of urgent restoration work on the church of San Menna [Vivio 2011]. The fifth phase certifies, instead, the more recent interventions starting from the post-war reconstruction documented for the north-east wall [Chierici s.d.] up to the recent restorations concluded in 2000. The last two phases,

Fig. 5. Hypothetical evolution of the building defined from the archaeological data: 3D reconstruction of the first two phases (graphic elaboration by Andrea Ruggieri).



characterised by massive interventions on the masonries, has considerably affected the stratigraphic analyses of the walls, therefore it was only possible to assume hypotheses about the evolution of the building (fig. 5). Nevertheless, it could not be excluded that the building, nowadays visible in its medieval facies, was built on older structures, as suggested by the re-use of the material of Roman origin in the masonries [CIL IX, pp. 534-535], that may have influenced the particular planovolumetric layout.

VR environments for the integration of data

The use of digital technologies for the representation and documentation of the cultural heritage represents a particularly topical field [Ioannides et al. 2018], as well as is recent the study of digital environments aimed at the management and integration of multidisciplinary data arisen from the investigations on the historical buildings to promote the system interoperability and the conservation of the built heritage that characterizes the whole of the national territory.
Within this framework, much efforts of the international scientific community are aimed at the comprehension of the potential of the most common digital environments in the field of valorisation and education through gamification techniques, and to evaluate this system's flexibility with regard to research fields intended to increase the knowledge, documentation and analyses of historic built heritage [Apollonio et al. 2018].

Fig. 6. Virtual Tour of the church for the enjoyment of historical and artistic information (elaboration by Francesca Savini).

Among the various available tools, those used for the Virtual Reality experiences are able to match at its best the technics requirements with the valorisation and dissemination ones, due to the communication skills broaden by the immersive environments. In addition to the virtual worlds created with Game Engine platforms, which allow to visualize and explore the representation of real artefacts, virtually reproduced through photorealistic meshes [Trizio et al. 2018] or numeric or parametric models [Banfi 2020], are widespread the Virtual Tours generated started from the images. This latter type is widely used in the field of museums and archaeological sites enhancement since it promotes the fruition and the accessibility of the heritage [Neovesky, Peinelt 2015; Kersten 2018; Maach et al. 2018; De Fino et al 2020]. The use of the Virtual Tour, however, has great potential also for the recording and the interchange of data since, when properly structured, it becomes a hub capable of storing multiple information and meeting the requirements of different professionals, as well as the ones of operators and administrators involved in various ways in the field of the built heritage. In this direction, the multilevel structure promotes access, after prior authorization, to more technic-scientific information,

Fig. 7. Mode of overlapping thematic readings for data access in the Virtual Tour (digital elaboration by Francesca Savini).

as for the case of the structural monitoring of the architectural and infrastructural heritage [Trizio, Savini, Ruggieri 2020; Trizio et al. in press a] Furthermore, the widespread use of these tools is promoted by the ease of acquisition of the representation and the quite short time required for its realization. Indeed, although the case of study used to test the tool shows an example of the tour created starting from the images taken at each station point of the laser scanner, the single spherical panoramas can be easily obtained with an image taken from a Cam360 or through sketching operations (processed by specific proprietary or free software) of a set of images acquired with a digital camera assembled on a rotating head and taken with a good superposition.

The Virtual Tour of the church of San Menna, partially realized for the inner of the building during a monitoring project of the state of conservation of the frescoes [Trizio et al. 2019], has been subsequently implemented with the adding of the stations at the exterior of the building. The images acquired during the laser scanner survey campaign have been expressly edited in the original dimensions in order to uniform them at the equirectangular format, and subsequently imported in the proprietary software 3DVista Virtual Tour Pro (release 2020.5.23) to generate spherical panoramas and link them to each other, thanks to specifics hotspots that allows to move into a simulated view.

The Virtual Tour of the church, used also for the building of the parametric model of the church, was from time to time enriched with multidisciplinary data arisen from the scientific research, redesigned in a divulging way and enjoyable from the drop-down menu, constantly accessible, as through appropriate buttons that can be triggered by each panotour (fig. 6). Particular attention was paid to the integration of the data from archaeological analysis with the 360° VR representation of the artefact, and through specific paths to which was added information derived from the superposition of thematic readings obtained by editing the equirectangular images. In this case the Virtual Tour, thanks to specific commands as 'split' or 'twin' allows to visualize simultaneously on the spherical images the scientific results (fig. 7). In addition, to promote the comprehension of the historical evolution of the building, reconstructed starting from the evidence of the archaeological analysis of the masonries, was designed a diachronic view that, through the activation of appropriate buttons, allows to visualize the building in the identified historical phases (fig. 8). Furthermore, in order to increase the knowledge

of the artefact and the exchange of data between professionals, the Virtual Tour was designed in a multilevel manner, making possible the access to more technical data (fig. 9), peculiar of the archaeology of architecture (fronts whit stratigraphic analysis of the masonries, matrix etc.) and to the discipline of drawing (graphic restitutions of the survey, digital models etc.). The strength of the proposed system, therefore, appears to lie in the ability to bring together into the tool, through containers inherent in the software and links to external platforms, different formats of data: from the bi-dimensional drawings to the historic photos, from the alphanumeric data to the digital numeric and parametric models (fig. 10). Indeed, the research team has been conducting for a long time tests aimed at the three-dimensional representation of the archaeological stratigraphic analysis in a digital environment: from the texturing of photogrammetric models to 3D GIS and the creation of HBIM starting from archaeological data (Marchetti et al. 2017; Trizio et al. 2019; Trizio, Savini 2020), which have demonstrated the potential of the BIM environment. Therefore, the parametric model already connected to the Virtual Tour will be implemented with the results of archaeological analysis guaranteeing its management and its use in the monitoring and design phases of conservation, interventions, or fruition.

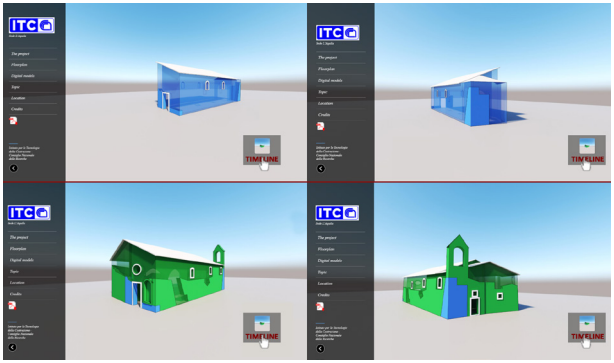
Conclusions

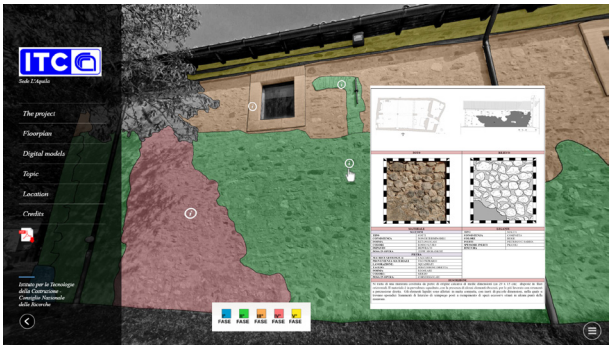
The three-dimensional models deriving from the process of digital acquisition of the real, in addition to connect the research of the various disciplines involved in the knowledge process, owns intrinsic flexibility that can be used in a divulging way. Indeed, the strong communicative value of the science of drawing is broadened and enriched by the digital technologies, and the integration process of languages from different disciplines, like those of drawing and archaeology, is promoted by computer vision and the world of graphics and 3D animation. The test carried out on the church of San Menna in Lucoli actually confirmed that the Informative Virtual Tour represents a quick method able to integrate the heterogeneous data promoting, at the same time, the fruition and valorisation of the cultural heritage. The fruition is guaranteed by the various modes, ranging from the desktop and tablet format to the immersive version, that allow to descend into the virtual world with a simple smartphone paired with a cardboard

Fig. 8. A diachronic virtual tour for moving in the space and viewing the building in its historical phases (digital elaboration by Francesca Savini).

Fig. 9. Visualisation of archaeological data and form in VR environment (digital elaboration by Francesca Savini).

Fig. 10. Link to online platforms for displaying digital models (digital elaboration by Francesca Savini).





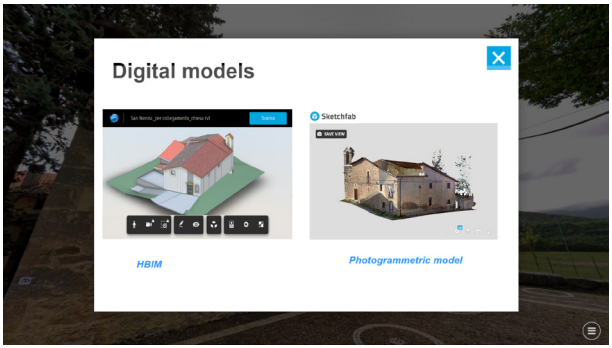


Fig. 11. Ways of using the Informative Virtual Tour (photo by authors).

or a VR box (fig. 11) and, when well converted, the Virtual Tour can be enjoyed with more performing devices like the Oculus Go. The tool, furthermore, has proved to be suitable even for a constant implementation in the time, enriching itself with informative contents, more and more articulated and complex, in relation to the progress of the research study and the analyses conducted on the artefact.

Credits and acknowledgements

Although the paper was conceived together from the authors, are attributed to Ilaria Trizio the paragraphs *Introduction* and *The digital integrated survey of the church*, to Adriana Marra the paragraphs *The church of San Menna in Lucoli (AQ): territorial organization and historical background* and *Conclusions*, and to Francesca Savini the paragraphs *Archaeology of buildings: the constructive phases and the evolution of the church* and *VR environments for the integration of data*. To Andrea Ruggieri are attributed the laser scanner survey and the reconstructive models of the church. To Adriana Marra is attributed the analysis of the state of conservation of the frescoes and the implementation of the HBIM model. To Francesca Savini are attributed the stratigraphic analysis with the archaeological interpretation, the photogrammetric model of the church, and the realization of the Informative Virtual Tour with the adding of data.
Thanks to Alessandro Giannangeli for having acquired the set of images necessary for the photogrammetric model. Thanks to Alessandro Agrusti, Roberta Battista, Gianluca Ciuca, Federica Miconi, Daniele Serpetti and Simone Zonfa, students of the course of Survey and digital modelling of the architecture at the Università degli Studi dell'Aquila, A.Y. 2019/20, for having realized, with the coordination of the professor, Ilaria Trizio and the tutors, Alessandra Tata and Andrea Ruggieri, the parametric model of the church and the numeric and mathematic models of the decorative apparatus.

Authors

Ilaria Trizio, Institute for Construction Technologies, Italian National Research Council, ilaria.trizio@itc.cnr.it
Francesca Savini, Institute for Construction Technologies, Italian National Research Council, savini@itc.cnr.it
Adriana Marra, Institute for Construction Technologies, Italian National Research Council, marra@itc.cnr.it
Andrea Ruggieri, Department of Biosciences and Territory, University of Molise, a.ruggieri3@studenti.unimol.it

Reference List

Apollonio, F. I. et al. (2018). A 3D-centered information system for the documentation of a complex restoration intervention. In *Journal of Cultural Heritage*, 29, 89-99.

Arbace, L. (2012). *Saturnino Gatti: i volti dell'anima. Vita e opere di un artista del Rinascimento*. Pescara: De Siena.

Banfi, F. (2020). HBIM, 3D drawing and virtual reality for archaeological sites and ancient ruins. In *Virtual Archaeology Review*, 11(23), 16-33.

Borri, A., Corradi, M., De Maria, A. (2020). The Failure of Masonry Walls by Disaggregation and the Masonry Quality Index. In *Heritage*, 3(4), 1162-1198.

Brogiolo, G. P., Cagnana, A. (2012). *Archeologia dell'architettura. Metodi e interpretazioni*. Firenze: All'insegna del Giglio.

Chiappini, A. (1986). *Lucoli Medioevale*. Lucoli: Amministrazione Comunale.

Chiarizia, G., Properzi, P. (a cura di). (1993). *Abruzzo dei Castelli. Gli insediamenti fortificati abruzzesi dagli Italici all'Unità d'Italia*. Pescara: Carsa.

Chierici, U. (s.d). *I danni della guerra al patrimonio artistico degli Abruzzi e del Molise, Aquila 1945*. Soprintendenza ai monumenti e alle gallerie dell'Abruzzo e Molise.

CIL = Mommsen, T. (a cura di). (1883). *Corpus Inscriptionum Latinarum vol. IX Inscriptiones Calabriae, Apuliae, Samnii, Sabinorum, Piceni Latinae*.

Chr. Farf. = Balzani, U. (a cura di). (1903). *Il Chronicon Farfense di Gregorio di Catino*. Roma: Forzani e c. tipografi del Senato.

De Fino, M., Ceppi, C., Fatiguso, F. (2020). Virtual Tours and Informational Models for improving territorial attractiveness and the smart management of architectural heritage: the 3D-IMP-ACT project. In *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLIV-M-1-2020, pp. 473-480.

Francovich, R., Parenti, R. (a cura di). (1988). Archeologia e restauro dei monumenti. Firenze: All'Insegna del Giglio.

Ioannides, M. et al. (a cura di). (2018). *Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection. EuroMed 2018.*

Lecture Notes in Computer Science, vol 11196. Cham: Springer.

Kersten, T.P. (2018). 3D Models and Virtual Tours for a Museum Exhibition of Viet-namese Cultural Heritage Exhibits and Sites. In M. Ioannides et al. (a cura di). *Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection. EuroMed 2018. Lecture Notes in Computer Science*, vol 11196. Cham: Springer.

Lico, M. (2001). *San Menna di Lucoli. Cenni storici ed agiografici sulla Chiesa e sul Santo*. L'Aquila: Tipolito 95.

Maach, I., Azough, A., Meknassi, M. (2018). Development of a use case for virtual reality to visit a historical monument. In *2018 International Conference on Intelligent Systems and Computer Vision*, pp. 1-4.

Marchetti, A. et al. (2017). La chiesa di San Cipriano a Castelvecchio Calvisio (AQ) nella Baronia di Carapelle: documentazione speditiva e analisi stratigrafica 3D del manufatto. In *Archeologia dell'Architettura*, XXII, pp. 239-253.

Marcotulli, C. (2008). Il conte e l'abate. Incastellamento comitale e trasferimento dei poteri sui monti di Lucoli (AQ) da un'indagine di archeologia 'leggera'. In *Temporis Signa. Rivista di archeologia della tarda antichità e del medioevo* III, pp. 117-139.

Marcotulli, C. (2011). Chiese, castelli e strategie 'baronali'. Le trasformazioni del paesaggio medievale abruzzese fra feudalità signorile e città fondata alla luce della ricerca archeologica: un caso di studio. In *Ricerche Storiche* XLI (1), pp. 181-208.

Marra, A., Trizio, I., Fabbrocino, G. (in corso di stampa). Digital Tools for the knowledge and safeguard of historical heritage. In *Proceedings of 8th Civil Structural Health Monitoring Workshop* (CSHM-8).

Mattiocco, E. (1995). Sistemi fortificati preromani lungo la dorsale appenninica abruzzese. In R. Papi (a cura di). *Insediamenti fortificati in area centro-italica, Atti del convegno*, pp. 35-58. Pescara: Tip. Sigraf.

Muratori, L.A. (1742). *Antiquitates Italicae Medii Evii*, vol. VI. Roma: ex Typographia Societatis Palatinae in Regia Curia.

Murri, F. (1983). *Lucoli. Profilo storico*. L'Aquila: Japadre.

Neovesky, A., Peinelt, J. (2015). A Virtual Tour to the Inscriptions of the UNESCO World Heritage Site St. Michael in Hildesheim. In *Electronic Visualisation and the Arts*, pp. 285-290.

Trizio, I. et al. (2019). Photogrammetric survey and 3D GIS management of mesh in the integrated investigation of complex sites. The case study of the archaeological complex of the Terme di Vespasiano at Cittaducale (RI), Italy. In C. Inglese, A. Ippolito (a cura di). *Conservation, Restoration and Analysis of Architectural and Archaeological Heritage*, pp. 48-80. Hershey PA: IGI Global.

Trizio, I., Savini, F. (2020). Archaeology of buildings and HBIM methodology: integrated tools for documentation and knowledge management of architectural heritage. In *IMEKO International Conference on Metrology for Archaeology and Cultural Heritage*, MetroArchaeo, pp. 84-89. Roma: Athena Srl.

Trizio, I. et al. (in press a). Advanced Digital Technologies for Built Heritage Survey and Historical Analysis. In *Proceedings of XV International Conference on Graphic Expression Applied to Building - APEGA 2021*, Redrawing the Future.

Trizio, I. et al (in press b). Digital environment for remote visual inspection and condition assessment of architectural heritage. In *Proceedings of 8th Civil Structural Health Monitoring Workshop (CSHM-8)*.

Trizio, I., Savini, F., Ruggieri, A. (2020). Archeologia dell'architettura e rappresentazione digitale: procedure e strumenti tra connessioni e intersezioni. In A. Arena et al. (a cura di). *Connettere. Un disegno per annodare e tessere. Atti del 42° Convegno Internazionale dei Docenti delle Discipline della Rappresentazione*, pp. 2821-2842. Milano: Franco Angeli.

Trizio, I. et al. (2018). Lost and inaccessible sites: The Heritage Interpretation through applications of VR. In R. Salerno (a cura di). *Drawing as (in) tangible representation. Atti del 40° Convegno Internazionale dei docenti delle discipline della rappresentazione*, Milano 13-14-15 Settembre 2018, pp. 831-836. Roma: Gangemi Editore.

Trizio, I. et al. (2019). Versatile Tools: digital survey and Virtual Reality for documentation, analysis and fruition of Cultural Heritage in seismic areas. In *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLII-2/W17, pp. 377-384.

Vivio, B.A. (2011). *Relazione tecnico-scientifica 4. Relazione storica, allegato al Piano di Ricostruzione di Lucoli*. Roma: La Sapienza.

Reconnecting Past and Present with Old Photos. Reconstruction of the Church of the Stimmate in Palermo

Fabrizio Agnello, Laura Barrale

Abstract

Perspective restitution has rarely been used in researches aiming at the reconstruction of past monuments and urban contexts from old photos, due to the approximation that affected the process of restitution with pens and rulers. Digital drawing tools decidedly reduce the approximation and allow a straight 3D reconstruction of buildings displayed in a single photographic image. The chosen case study is the church of the Stimmate in Palermo, demolished at the end of the 19th century for the construction of the Massimo theater, the lyric theatre of Palermo. The church was decorated with valuable stucco sculptures that were saved from demolition and are now exhibited at the oratory of the Bianchi in Palermo.
Three low-quality photos show the stucco sculptures in their original arrangement around two facing niches of the nave, close to the entrance.
Perspective restitution and the survey of the sculptures allowed the 3D reconstruction of the niches with the stucco sculptures. Further images and surveys led to the reconstruction of the façade of the church with the annexed monastery and of a nearby city gate that was demolished at the same time.

Keywords: church of the Stimmate, Massimo theater, perspective restitution, 3D reconstruction, equirectangular images.

Introduction

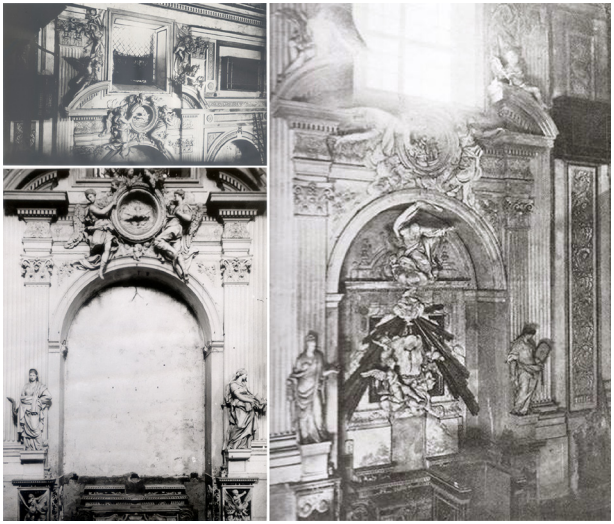
Perspective restitution, driven with digital drawing tools, allows to model, straightly in 3D space, buildings that are displayed in a single photographic image. This technique therefore allows the reconstruction, from old photos of buildings and urban sites which were destroyed or modified by war events, natural disasters or urban renewal programs.
In 1864 the municipality of Palermo resolved to build an opera house; the new theater would be sited in an area at the northern edge of the walled town, close to Maqueda street, one of the main axes of the historic city center.
Along the axis of Maqueda street, the demolition program includes the homonymous urban gate, the church of the Stimmate and the annexed monastery.

The initiative of the municipality aimed at a twofold purpose: provide the city with an opera house, according to the use of the time; open the historic city center towards the northern urban expansion, through the partial demolition of the city walls.
The municipality promoted an international design competition; the jury, composed by Gottfried Semper and two eminent delegates of the municipality, in 1868 bestowed the victory to the proposal of Giovan Battista Filippo Basile. In 1874 Basile draws up a *piano di massima della ubicazione del nuovo Teatro* (rough plan to locate the new theater) that displays the location of the new theater in the extant urban context and the perimeter of the buildings that should be destroyed: together with the church of

the Stimmate, the annexed monastery and the urban gate Maqueda, the new theater demanded the demolition of the church of San Giuliano, of the annexed monastery, of many residential blocks.
Unluckily the *piano* does not display a graphic scale, nor we could access the original document; this is why, in order to extract the overall dimension of the church of the Stimmate, the *piano* has been scaled with reference to a 1984 map of the historic city center of Palermo and to the laser scanning survey of the area; the comparison showed the accuracy of Basile's survey (fig. 1).
The church of the Stimmate, built at the start of the XVII century, was, like most of the churches annexed to female monasteries, a hall church; the nave was delimited by walls with shallow niches and terminated in a rectangular apse. The facing niches placed near the entrance were decorated with stucco statues sculpted by Giacomo Serpotta, a prominent artist in the late-baroque Sicilian cultural context.
The memory of the original location of the statues in the church is kept by three low quality images, published in books that do not provide any suggestion supporting the retrieval of the original photos; it is known that these photos were taken in 1890, soon before the demolition of the church; the subject of the photos focus are the decorated niches and no other part of the nave is displayed (fig. 2).
The photos were probably commissioned to document the original position of stuccoes, before their removal and relocation in a hall of the archaeological museum of Palermo. In the 90s, the stuccoes were restored and moved to a large hall in the oratory of the Bianchi, a peripheral location of the regional Sicilian gallery of Palazzo Abatellis; the limited height of the hall prevented the exhibition of the sculptural groups according to their original arrangement.
The reconstruction of the façade of the church could not rely on better documentary sources; the façade appears in an anonymous painting dated from the early eighteenth century, which depicts several monuments of Palermo sited along the route of the religious procession of Santa Rosalia.
In the painting the façade of a church with the inscription 'Badia Delli Stimmati' shows the typical layout of a three naves church, therefore incompatible with the actual church of the Stimmate. Nonetheless, some elements could be reused, since they appear in the photo where the façade is displayed.

Fig. 1. The Piano of Basile dated 1890.

Fig. 2. Period photos of the niches with stucco sculptures, taken in 1890, soon before the demolition.



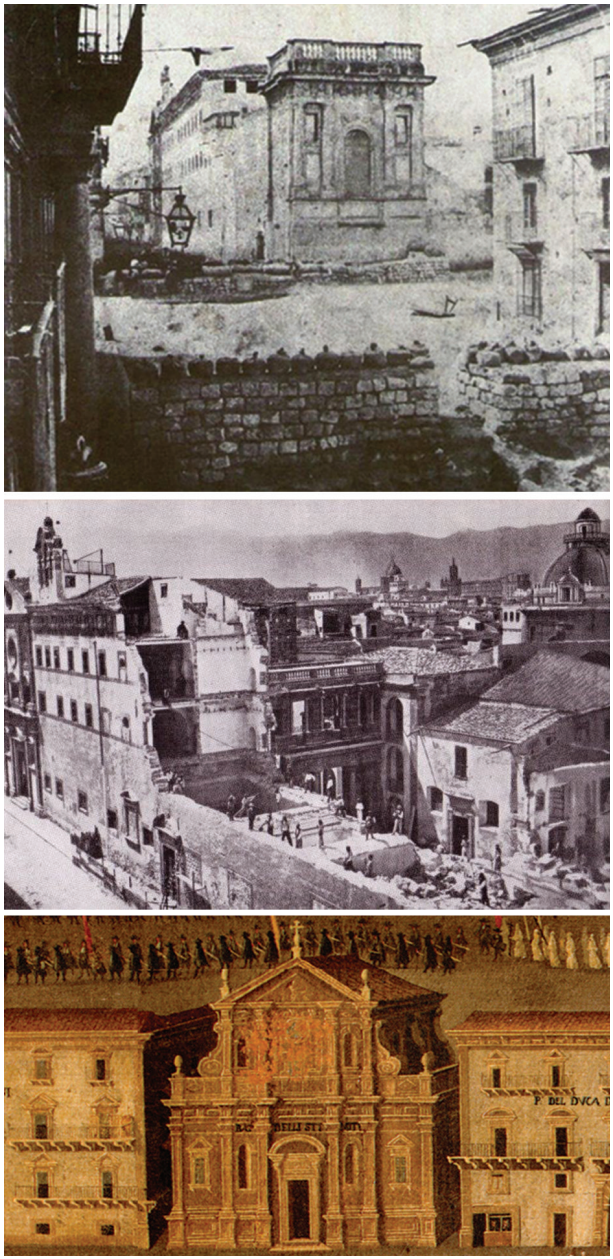


Fig. 3. The documentary sources used for the reconstruction of the façade and the urban context. From top: a photo of Maqueda gate dated 1860; a photo that displays the demolition of the monastery and, foreshortened, the façade of the church; a detail from Il Quadro.

The photo, taken from the roof of a building facing Maqueda street, focuses the demolition of the monastery; the half part of the façade of the church appears foreshortened at the left edge of the image (fig. 3).
Due to the unavailability of adequate documentation, surveys and drawings, the photos are the sole resources that witness the arrangement and the architectural quality of the church and its surroundings before the construction of the theater.
That's why the church of the Stimmate is an excellent case study to test the potential of digital perspective restitution for the reconstruction of buildings and urban sites from period photos.
The first step of the reconstruction process aimed at the virtual re-location of the surveyed sculptures in their original arrangement around the niches at the sides of the nave.

State of the art

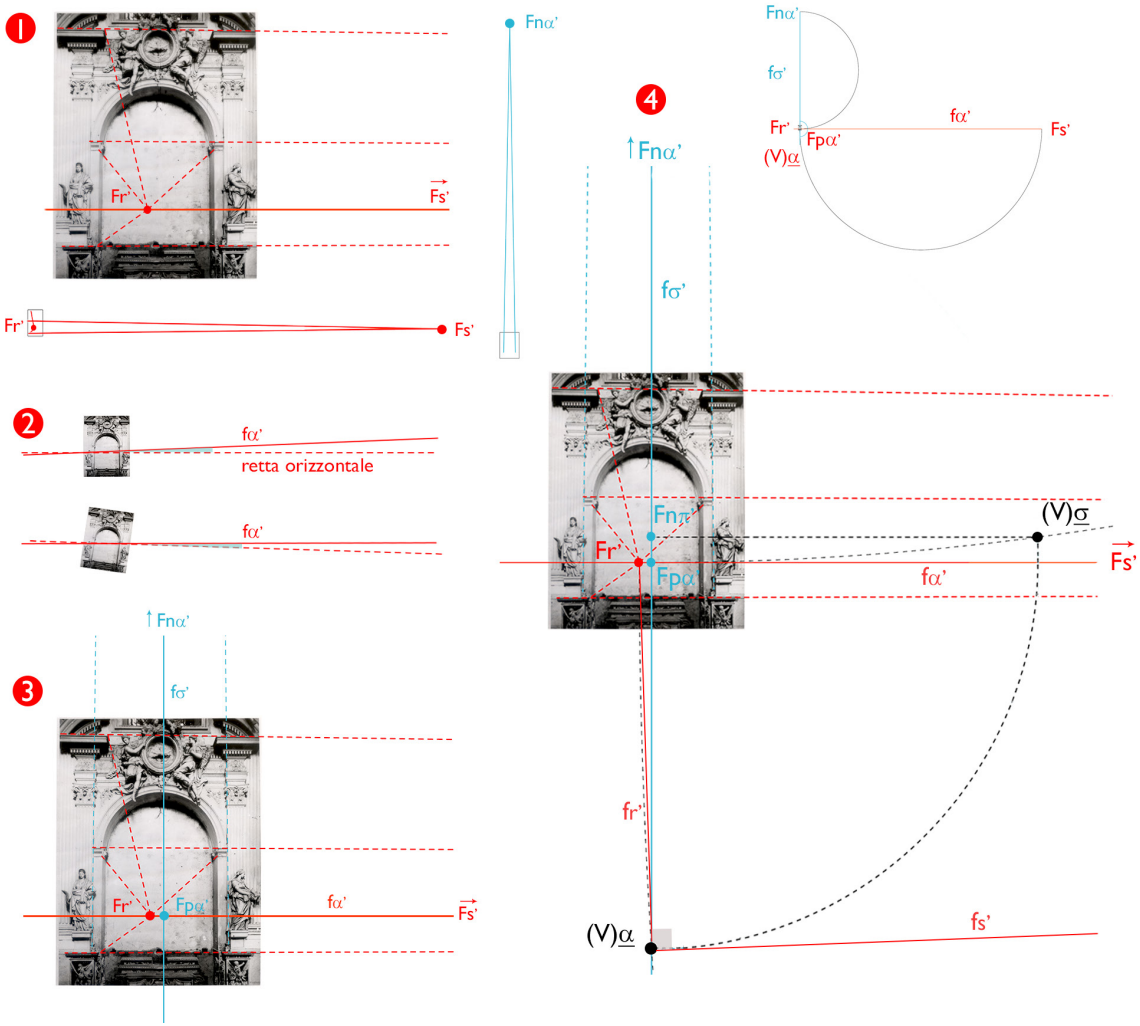
Perspective restitution is the inverse solution of perspective and hence belongs by right to the corpus of descriptive geometry. Perspective restitution from photos belongs, at the same time, to photogrammetry, since its output is the dimensional restitution of the portrayed buildings.
Nonetheless, due to the approximation that affected perspective restitution with pens and rulers, the technique was rarely used both as a surveying tool [Docci 1994, p. 253] and for the reconstruction of demolished buildings from old photos.
The limited size of printed photos and the occurrence of vanishing points located at a great distance from the image, made internal orientation difficult and approximate; the outputs of perspective restitution were 2D figures that were revolved onto the pictorial plane, thus missing the potential of a direct link between the point of view, the image and the object.
These limitations account for the marginal role played by perspective restitution in processes aiming at the conjectural reconstruction of building and urban sites.
New digital drawing tools offer today the opportunity to enhance this old technique, improving its accuracy and effectiveness.

Manuals of descriptive geometry almost ignore perspective restitution; a small but precious book published at the end of the '70s focused perspective restitution with traditional tools, providing a good gallery of examples and restitution strategies that could be used in the restitution from photos as well [Fano 1979].

Fig. 4. Sculptures above the niche on the left side in the nave of the church of the Stimmate: photo and laser scanning survey.

At the end of the '90s scholars in computer engineering experimented automated processes for line extraction, vanishing point identification, intrinsic and absolute orientation through the combination [Van den Heuel 1998] of line-photogrammetric measurement and geometric constraints, i.e. coplanarity, parallelism, orthogonality and so on. The purpose of most studies was the automated restitution of a 3D textured model from a single image. At a later stage tentative software packages were developed and discussed in publications [Arslan 2014], but no evidence of their use in further researches has resulted.
Architects and scholars in architectural representation perceived that digital drawing could enhance perspective restitution. A book dedicated at this subject [Paris 2000] reports, for the first time, a detailed gallery of methods and strategies for perspective restitution discussed in historic treatises on perspective. The second part of the book focuses the use of digital drawing tools for the restitution of fronts and plans from photographs.
The feasibility of a convenient combination between descriptive geometry and digital drawing leads to the proposal of a solution [Fallavolita et al. 2013] that uses 3D modeling tools for the internal orientation of a photographic image and for the restitution of demolished buildings.
Later studies use descriptive geometry to calculate photos orientation [Dzwierzynska 2017], but no use of 3D tools is proposed or discussed [Ramon-Constanti, Gomez 2020], thus missing the opportunity, provided by digital tools, to build up 3D models straightly from a single photo.
Digital perspective restitution can restitute even the furthest vanishing points; absolute orientation is calculated in 3D space; 3D models can be built using interpretation lines and planes; the correspondence between 3D reconstructions and their photographic image can be visually checked posing a virtual camera on the point of view.
Perspective restitution, like any photogrammetric technique, cannot restitute measures, but only angles and proportions; in order to build measurable 3D models, it is mandatory to scale the perspective model; to this purpose it is enough the measure of a segment displayed in the image.
Such information can be extracted when existing and surveyable elements are displayed in the photo; if such elements are surveyed with laser scanning or SfM photogrammetric tools, the quality of the intrinsic and absolute orientation of the image can be checked by the comparison between the point cloud or the mesh model of the object and its photographic image.

Fig. 5. Interior orientation of the photo of the niche.

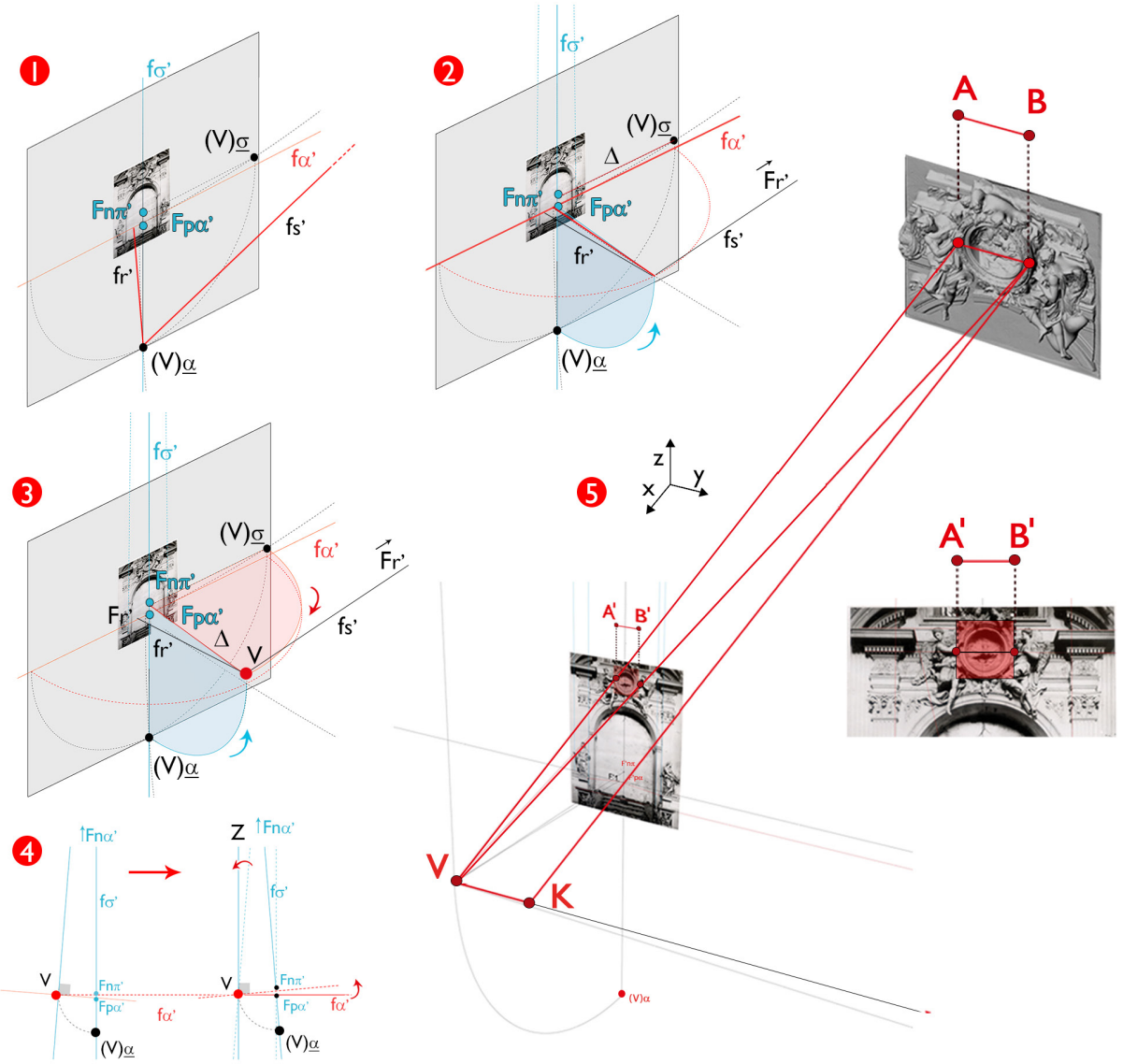


When no extant building appears in the image, period maps can provide angular information for intrinsic orientation and dimensional data for absolute orientation.
In this study both methods have been used.

The restitution process

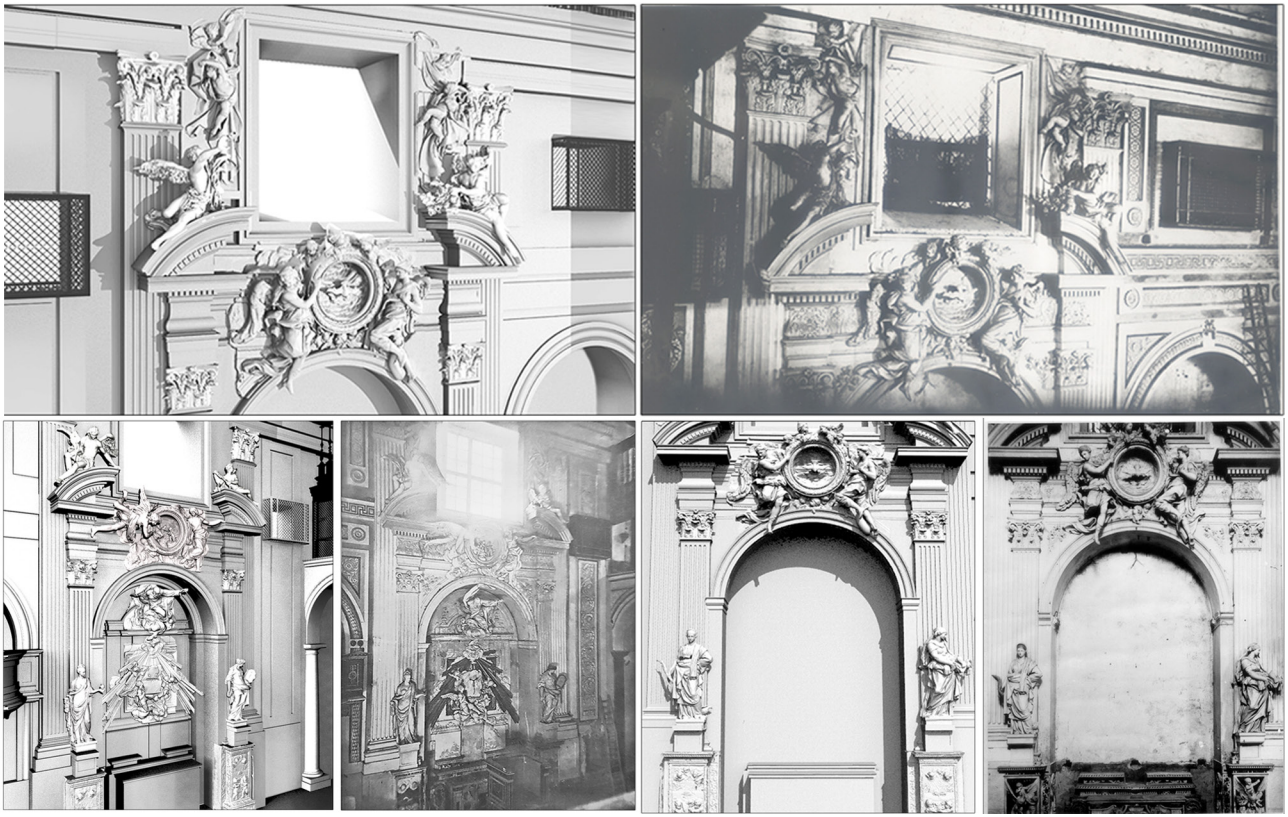
The process aiming at the relocation of Serpotta's stuccoes in their original arrangement inside the church of the Stimmate started with the laser scanning survey of the statues in their present location at the oratory of the Bianchi (fig. 4) and ended, through perspective restitution, with the construction of a hybrid model that combines NURBS surfaces of architectural elements and meshes of the statues.
The second step aimed at the reconstruction of the church façade and of its surroundings, up to Maqueda gate; in this step perspective restitution was compared with metric information extracted from the plan of Basile.
In this study stuccoes are the only 'measurable' parts of the demolished church and therefore perspective restitution assumed these models as reference elements; mesh models were all rotated around z-axis, to make their backwards parallel to xz or -xz planes in the digital scene; this way x-axis acted as the longitudinal axis of symmetry of the reconstructed church [1].
It is well known that the orientation of a photo is split into intrinsic and absolute orientation.
Intrinsic orientation calculates the position of the point of view V through the graphic construction of the principal point and the principal distance; when the image displays elements of a 3D scene linked by mutual constraints, intrinsic orientation refers the direction of the 'principal' ray to the perspective restitution framework.
Absolute orientation refers the point of view and the direction of the principal ray to a 3D context documented in surveyed data or maps; furthermore, it scales the perspective model and thus allows the restitution of measurable geometric features.
The first step in intrinsic orientation usually aims at detecting two vanishing points of horizontal lines and at drawing the horizon line through them. The vanishing point of vertical lines eases the intrinsic orientation solution [2].
In perspective restitution from photos the horizon line fα' is never horizontal and the VP of vertical lines Fnα' is never at infinite. These conditions, usual in drawn perspectives, would occur in photographic image if both the shooting axe and the base of the camera were perfectly horizontal; no need to say that these conditions never occur.
As a consequence, the principal point Fnπ' of a photographic image never belongs to the horizon line fα' [3].
Since photographers in the period from the second half of the XIX to the first half of the XX century aimed at keeping the lens axis almost horizontal, or used mechanical devices to reduce aberrations, in old photos Fnα' is often very far from the image frame.
The restitution process started with the photo of the niche on the left side of the nave; the intrinsic orientation of this image can be summarized as follows: the VPs Fr' and Fs' are detected at the intersection of horizontal edges respectively parallel (Fs') and perpendicular (Fr') to the back of the niche; the line through Fr' and Fs' is the horizon line fα' (fig. 5.1); the photographic image and the lines are rotated to make fα' horizontal (fig. 5.2).
Fnα' is drawn at the intersection of the lines that extend the vertical edges of the pillars flanking the niche; the vertical line perpendicular to fα' that passes through Fnα' is fσ', i.e. the intersection between π and σ, the interpretation plane parallel to σ; Fpα' is the intersection between f'α and fσ' (fig. 5.3).
Lines that vanish in Fr' and Fs' intersect at right angle; the point of view V will therefore belong to the half-circle through Fr' and Fs', that belongs to $\underline{\alpha}$. If we consider the revolution that moves $\underline{\alpha}$ to π, the point (V)$\underline{\alpha}$, i.e. the point of view V revolved onto π by $\underline{\alpha}$, will be on the picture plane at the intersection between the half-circle through Fr' and Fs' and the line fσ'.
Since lines that vanish in Fpα' and Fnα' are perpendicular, V belongs to the half-circle through Fpα' and Fnα'; this circle belongs to $\underline{\sigma}$. If we consider the revolution that moves $\underline{\sigma}$ to π, the point (V)$\underline{\sigma}$, i.e. the point of view V revolved onto π by $\underline{\sigma}$, will be on the picture plane on the half-circle through Fpα' and Fnα'.
The arc of the circle centered in Fpα' through (V)$\underline{\alpha}$ intersects this half-circle in (V)$\underline{\sigma}$.
The horizontal line through (V)$\underline{\sigma}$, i.e. the revolution of the principal ray onto π, intersects fσ' at right angle in the principal point Fnπ'; the segment (V)$\underline{\sigma}$-Fnπ' measures the principal distance (fig. 5.4).
The angle delimited by the principal ray and the line from (V)$\underline{\sigma}$ to Fpα' measures the inclination of the axis of the lens of the camera.

Fig. 6. Absolute orientation of the photo of the niche.



The point of view V is finally drawn in 3D on the principal ray at the principal distance. The lines through V, Fr', Fs' and Fnα' are finally drawn (fig. 6.1, 6.2, 6.3).
The intrinsic orientation is thus processed.
It is worth noting that, if the entire image is available, the principal point Fnπ' is at the intersection of the diagonals of the frame. When the image is taken from a book, or when it could be supposed that particular devices to reduce aberration were used, the position of the principal point should be calculated.
The absolute orientation has been developed in three steps: the first step is the rotation of the entire perspective model around a line through V that is parallel to fα'; the rotation angle makes the line through V and Fnα' parallel to z-axis; as a consequence, the rotation makes α horizontal (6.4).
The second step is the rotation of the perspective model around z-axis, to make the horizontal line through V and Fs' parallel to x-axis (6.5); it is worth remembering that the mesh model of the sculptures had been rotated to make the backward plane parallel to xz.
The third step scales the perspective model with reference to a known dimension. The diameter parallel to x-axis of the tondo portrayed in the image is drawn on the mesh model; its ends are named A and B; a segment VK=AB is finally drawn on the line from V to Fs' (6.5).

Fig. 7. Visual evaluation of the correspondence between the photographic image of sculptures and their 3D mesh model.



Points A' and B' are marked on the image at the ends of the diameter of the tondo that vanishes in Fs' and the interpretation lines through A' and B' are drawn; a line through K that is parallel to the interpretation line through A' intersects in B the interpretation line through B'; the line parallel to x axis through B intersects in A the interpretation line through A'; the entire perspective model is finally moved to match the restituted segment AB to the segment AB in the mesh model.
The quality of orientation has been visually evaluated by posing on V a virtual camera with focal length equal to the principle distance. The possibility to manage the opacity of the picture plane allows the verification of the match between the photographic image of sculptures and their 3D mesh mode (fig. 7).
The image is now fully oriented and perspective restitution can be started.
The 3D restitution of a vertical edge on the wall of the nave provides a good example to illustrate the method that led to the reconstruction of all 3D models presented in this paper: a vertical plane corresponding at the back of the mesh has been modeled; an interpretation plane through the vertical line from V to Fnα' and the image of a point C' on the vertical edge g' is modeled as well; the 3D restitution of the edge, i.e. the line g, is the intersection between these planes; the intersection between the interpretation plane and the image plane has to match g'.
Perspective restitution can be developed in line, using dimensions and directions restituted from a photo, for the orientation of other photos where the same features are entirely or partially displayed; the restitution of the higher part of the niche was completed through the restitution of a photo taken from an elevate position, that displays the higher part of the nave with one of the windows that enlightened the church.
The two photos were referred by the horizontal line at the base of the window, visible in both images (fig. 8).
The facing niche, displayed in the third image of the interior, was reconstructed by symmetry, arguing the invariancy of the dimensions of the niche.

Fig. 8. The photos of the niche are oriented by means of an element that is visible in both images.

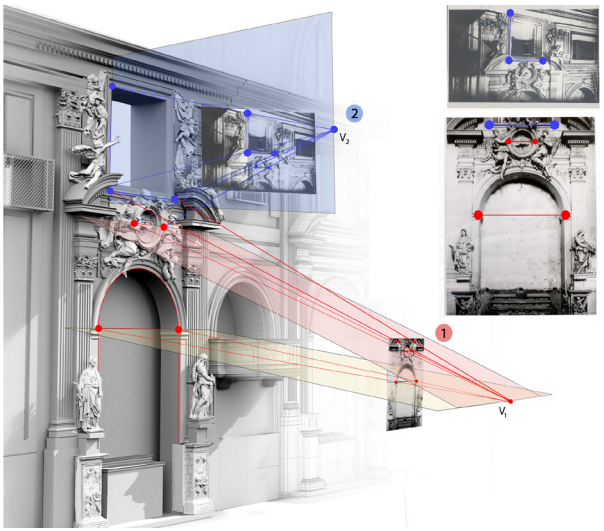
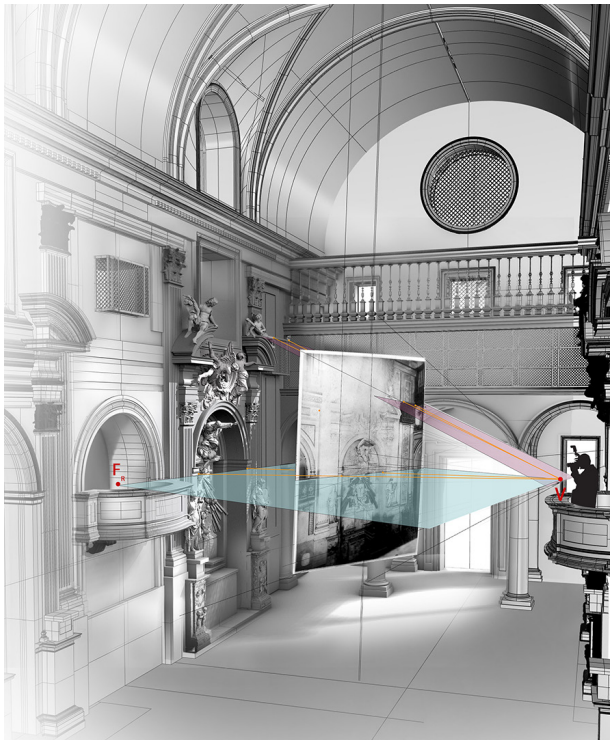


Fig. 9. The orientation of the image is verified by the position of V in the reconstruction model.



A final check, made possible by the 3D approach to perspective restitution, focuses the position of the camera inside the reconstruction scene; if that position proves incongruent, e.g. if V results below the floor or outside the church, the orientation should be reconsidered. The orientation of the third image, that portrays the niche on the right side of the nave from an elevated position, restituted point V on one of the chancels inside the church (fig. 9).

Fig. 10. The niches in the nave.

The conjectural reconstruction of the nave was developed with reference to the overall dimensions provided by the piano of Basile and to the dimensional and proportional comparison with coeval similar churches in Palermo (fig. 10).
The third part of the restitution process aimed at the reconstruction of the façade of the church, with the annexed monastery, and of the Maqueda gate.
The reconstruction of the front of the church started from a photo that displays Maqueda gate with the barricades erected during the protests of 1860, portrayed by Eugène Sevaistre from outside the walls; the photo displays, behind Maqueda gate, the front of the monastery foreshortened. The column of a palace that survived the demolitions of the area supported the absolute orientation of the image and the reconstruction of Maqueda gate and of a part of the front of the monastery. The same front, partly ruined, appears in a photo that documents the demolition of the monastery; at the left edge of the photo the front of the church is partly displayed and highly foreshortened. The shared part of the front of the monastery allowed to link these photos and thus start the reconstruction of the façade of the church and its urban context; the comparison between the outputs of perspective restitution and the piano of Basile allowed a more accurate control and proved an adequate correspondence, with discrepancies close to 10 cm.
The last step of the research aimed at the alignment of equirectangular images taken on site, with the corresponding images digitally extracted from the reconstruction model.
The alignment allows the synchronous visualization of the extant layout of a site and the reconstruction of a previous layout, thus making the understanding of the urban transformations accessible to a wide audience.
The alignment demands: the accurate calculation of the pose of images and the alignment between the reconstructive model and the site.
This alignment has been supported by the superimposition of the piano of Basile and the map dated 1984.
The position of equirectangular images of the site [4] was calculated with SfM photogrammetric tools, through the implementation of a photogrammetric model that aligns standard 35 mm and fish-eye photos.
At the same time the area was partially surveyed with a laser scan and the registered clouds were referred to the 1984 map.

The coordinates of the points, extracted from laser scans, allowed to scale and refer the photogrammetric model to the 1984 map and, consequently, to the piano of Basile. In the reconstruction model, the equirectangular images were used to texture spheres centered in the points extracted from the oriented photogrammetric model.
A virtual camera placed in the center of a sphere allows to navigate the equirectangular image of the site; if the opacity of the sphere is reduced, the reconstruction model appears, thus allowing a direct visual comparison between the current state of the site and its past arrangement (fig. 11).

Conclusions

The study led to the reconstruction of buildings and an urban site that no longer exists, by means of old photographic images. Intrinsic orientation was calculated according to the principles of descriptive geometry, whereas the absolute orientation was calculated with the aid of historic maps and of digital surveys of elements displayed in the images. The reconstructive model of two niches of the church of the Stimmate, displayed in photographic images, allowed to reposition the sculptures that escaped the demolition of the church and are today exhibited in a museum. The reconstructive model at urban scale supports the understanding of the urban transformations.
Perspective restitution is obviously an approximate process, but the study showed that digital tools can significantly reduce the errors of pre-digital restitutions and allow a visual check of the correspondence between the photo and the reconstructed model.
The final part of the research work focused the use of equirectangular images for the visualization of virtual reconstructions of buildings and sites that no longer exist; the alignment between equirectangular images of the site and the corresponding projections of the reconstruction model, was calculated with SfM photogrammetric tools.
Further researches should be oriented at the development of a tool that allows the comparison between equirectangular images on portable devices (smartphone or tablets) and to experiment the visualization of the church of Stimmate in the visiting tour inside inside the hall of the oratory of the Bianchi, where the sculptures are exhibited.

Fig. 11. Reconstruction of the façades and of the urban site.

Acknowledgements

Authors thank: Prof. Ettore Sessa for having followed all the steps of the research with interest and for having provided fundamental guidelines for the analysis of the historical events that led to the construction of the Massimo theater; Dr. Evelina De Castro, director of the regional gallery of Palazzo Abatellis, for having facilitated the surveying sessions at the oratory of the Bianchi; Dr. Gabriele Guadagna for having supported the archivistic research and the transcription of documents related to the monastery of the Stimmate.

Notes

[1] Scans have been taken with a shift-based laser scanner Leica HDS7000 and have been registered with Autodesk Recap Pro. Perspective restitution, 3D modeling and texturing have been processed with McNeel Rhinoceros 6.0. Further point cloud processing (sampling, rotation, normal computation, mesh extraction) has been developed with the free software CloudCompare.

[2] When the vanishing points of two horizontal lines at right angles and the vanishing point of vertical lines are available on the picture plane, the principal point is the orthocenter of the triangle formed by these three VPs. The position of V in 3D space can be calculated at the intersection of three spheres; each sphere is centered on the middle point of one side of the triangle and its diameter is equal to the length of that side.

[3] In this study the following notation will be used: V is the point of view; π is the picture plane; α is the horizontal reference plane; tα is the 'ground line', i.e. the intersection between α and π; Fnπ' is the principal point, i.e. the VP of lines that are perpendicular (normal) to the picture plane π; $\underline{\alpha}$ is the interpretation plane parallel to α; fα' is the horizon line, i.e. the intersection between π and α; Fnα' is the VP of vertical lines, perpendicular (normal) to α; σ is a plane that is orthogonal to tα and fα'; $\underline{\sigma}$ is the interpretation plane parallel to σ; fσ', the intersection between π and $\underline{\sigma}$ passes through Fnα' and is perpendicular to fα'; Fpα', the intersection of fσ' and fα', is the VP of lines generated by the intersection of planes parallel to σ and α. The proposed notation refers to the illuminating lessons on perspective held by prof. Michele Inzerillo at the University of Palermo up to 2015.

[4] Equirectangular images were generated with PtGUI from 7 photo sets taken with a reflex camera mounting fish-eye lens, fixed to a Nodal Ninja arm.

Authors

Fabrizio Agnello, Department of Architecture, University of Palermo, fabrizio.agnello@unipa.it
Laura Barrale, architect, lbarrale@libero.it

Reference List

Arslan, O. (2014). 3D Object Reconstruction from a single Image. In *International Journal of Environment and Geoinformatics*, n. 1, pp. 21-28.

Docci, M., Maestri D. (1994). *Manuale di rilevamento architettonico e urbano*. Bari: Laterza.

Dzwierzynska, J. (2017). Establishing Base Elements of Perspective in Order to Reconstruct Architectural Buildings from Photographs. In *WMESS 2017. Atti del World Multidisciplinary Earth Sciences Symposium 2017*. Prague, Czech Republic, 11-15 september, vol. 95, pp. 1-7. <https://iopscience.iop.org/article/10.1088/1755-1315/95/3/032022/pdf> (accessed 2021, May 12).

Fallavolita, F., Migliari, R., Salvatore M. (2013). Monge e il problema del vertice di piramide: una applicazione alla restituzione di quote e volumi da una fotografia del 1892. In *DisegnareCon*, vol. 6, n. 12, pp. IX/1-9.

Fano G. (1979). *La restituzione prospettica da prospettiva razionale*. Bari: Dedalo.

Paris, L. (2000). *Il problema inverso della prospettiva*. Roma: Kappa.

Ramon-Constanti, A., Gomez, A. (2020). Perspective restitution from a photograph, In *EGA*, n. 146, pp. 146-156.

Van den Heuvel, F.A. (1998). 3D reconstruction from a single image using geometric constraints. In *ISPRS Journal of Photogrammetry and Remote sensing*, n. 53, pp. 354-368.

Hermes. The Story of Places and Things

Storytelling, Visuality, New Media

Armed Architectures/Weapons of Architecture

Alessandra Cirafici

"I am very curious about the notion of a subversive architect,
one who uses architectural design to play with the system,
to circumvent certain political constraints,
or to help recalibrate in some way the urban environment
that currently operates at a level of injustice […]
I am interested in how architects could use their skills and the value
of the project as a political art,
as a space for urban negotiation with power"
[Lambert 2012, p. 48] [1].

The need to 'connect' appears, today, stronger the more pervasively the tendency to 'separate' and build barriers manifests itself. And it is exactly those physical and/or virtual barriers, in a broad sense, which are the places where the conflict between peoples and cultures are manifested, the background of a narrative horizon that will be tentatively explored, renouncing first of all the consideration of architecture as a neutral protagonist of this story, but declaring, instead, right from the start, the impossibility of its 'innocence'.
The following reflections develop, therefore, testing the tools of representation and design of architecture, as areas of possible critical interpretation of the living space. A space in continuous evolution, understood as a space of relations and connections, of interferences and conflicts, which opens a critical horizon in which representation cannot be limited to an exclusively descriptive role of the real, but it can and must instead assume that of a

This article was written upon invitation to frame the topic, not submitted to anonymous review, published under the editorial director's responsability.

Fig. 1. Gordon Matta-Klark, Conical Intersect. Paris 1975. In the context of the Paris Biennale of that year, Gordon Matta-Klark, an artist of imaginative and revolutionary power, conceived one of his most famous building cuts: a disembowelment-joining of two adjoining twin 18th-century buildings that were being demolished to make way for the then nascent Centre Pompidou. Thanks to the conical section of the cuts, at a glance the viewer could see the vision of "historical" Paris and the new, modern metropolis.

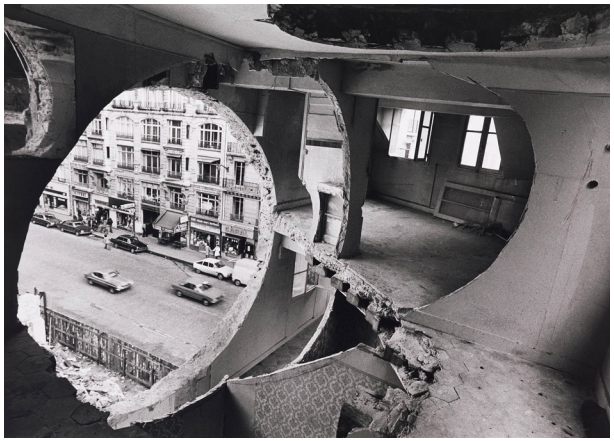
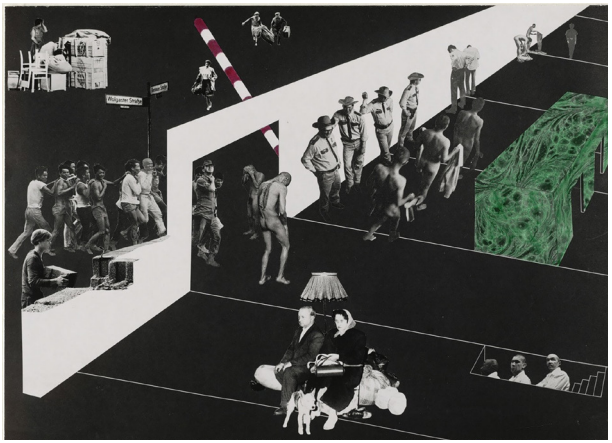


Fig. 2. Rem Koolhaas, Madelon Vriesendorp, Elia Zenghelis, Zoe Zenghelis, Exodus, or the Voluntary Prisoners of Architecture. 1972 |The Museum of Modern Art, Architecture and Design Collection | © 2007 Artists Rights Society (ARS), New York / BEELDRECHT, Hoofddorp, NL.



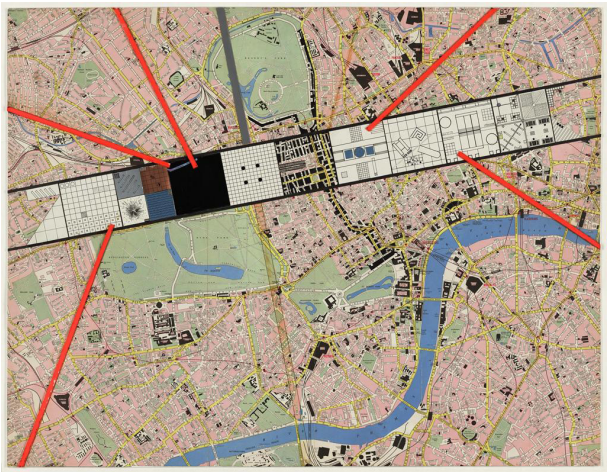
powerful narrator of its complexity and therefore as an activator of imagination and critical thinking, working in perfect harmony with the logic of the 'project' of which it is revealed to be an integral part.
The metaphor around which the reflections will develop is that of the wall, intended as a protection, but also as a barrier, a border, a barricade, a line of demarcation, a limit, as an impenetrable element and yet as an element whose evocative force is all enclosed in its permeability and, therefore, in the possibility of crossing it. A possible interpretation will be given of the 'walls' that scatter the contemporary scene and the reasons why we erect them, certainly a partial and not exhaustive one, but however useful to catch a glimpse of the ways in which the architectural narrative often intervenes in the dynamics put in place, to build or break them down, with the power of its creative gesture. And not without responsibility!

The temptation of the wall

Until a few months ago, before we were overwhelmed by the pandemic outbreak, the political scene was occupied by the great problem of immigration, the need to regulate its flows and rethink the complex theme of integration with foreigners. The 'wall', with all its symbolic significance, appeared as an effective response to the intruder's looming threat. Without doubt a sovereignist response, in which, however, as Massimo Recalcati so well emphasizes, the militarization of borders, the closing of borders, the radicalization of securitarian drives, not only reflect a political temptation, but a deep and rooted inclination of the human being who has always drawn boundaries and rejected the risk of the open, just as much as he was seduced by the idea of freedom, the adventure of contamination, the desire to explore, by wandering, sometimes seen as an aesthetic practice [2].
It must be said, however, that in recent history humanity seems to have experienced new forms of barbarization of social life, in which "the neoliberal degradation of hypermodern individualism and the transfiguration of the border in the wall, fortress bastion are two faces of the same medal that define the incivility of our time" [Recalcati 2020, p. 17]. The loss of the symbolic dimension of the border as a place of transit and its metamorphosis into a barrier are the most obvious consequences. "These are the two ways that characterize the fracture

of the 'anthropological proportion' between the urgent necessity of the border and the equally urgent necessity of its transcendence" [Recalcati 2020, p. 26].
Borders, buffer zones, control systems, protected zones… the space around us is rippled everywhere by borders. Our everyday life is marked by an alternation of badges, passwords, entry and identification codes. Borders are the other side of globalization, they proliferate in order to define and defend privileges and customs, they serve to control portions of space or territory, they help us to negotiate and filter exchanges of cultures and languages. The temptation of the wall is always lurking and with it the rooted idea, to quote Sigmund Freud, the 'outside' coincides with the hostile. A latent temptation, dramatically rekindled by the recent experience of the pandemic and by the so-called 'terrorist' nature of the virus that upsets any established distinction between friend and enemy, between known and unknown between familiar and stranger and that in the obligation of social distance has unexpectedly rehabilitated the idea of the strengthening of the closure and the tightening of the borders. There has been no lack of those who, like Giorgio Agamben, stressing that every social phenomenon can have political implications, looked with suspicion at the introduction in the political lexicon of the West of the term 'social distance' and did not fail to point out that it is a sort of euphemism compared to the crudeness of the term 'confinement' which probably reflects much better the present condition [Agamben 2021, p. 43].
There is no doubt that the experience we are living is significantly modifying the fundamental arrangements of our living together and is forcing us to rethink the very idea of border, the meaning of which, in the articulation of interpersonal relationships, changes perhaps irreversibly, assimilating an idea of 'barrier' in which the new concepts of mask (a further layer between us and the surrounding world) and screen (a surface that allows us to stay in contact, but separate) enter [Casetti 2020]. Protective filters that are re-mediating our spatial coordinates, concepts that if, on the one hand, push us to reflect on new forms of proximity and experience an unprecedented concept of distance, on the other they feed and nourish on the delirium of 'contamination' which risks degenerating into a new form of ideological fundamentalism and reinforces the idea borders, limits, frontiers. Borders and frontiers are once again proliferating in our world. In their pervasiveness, the vast process of cultural and social fragmentation that crosses the contemporary world, is deepened. "There are borders that, like funnels, convey to a point –along a coast or a frontier– disorderly displacement of objects and individuals, as in the case of boats that transport immigrants from one part to the other of the Mediterranean. Others that look like impenetrable pipes, like the fast-flowing roads that cross Israel and Palestine. Borders that arise from the pockets between two territories in conflict, such as the desert strip that cuts Nicosia in half, but also the borders that –like sponges– attract populations and investments, creating new communities. And boundaries that like a ghost limb continue to work even when they no longer exist. And above all, everywhere in the world, there are fences: made from barbed wire and concrete" [3].
Boundaries are sensors of the dynamics of the contemporary world, and as dynamic devices they vibrate energy and resistances which –for better or for worse– move the present history.
The term 'device' is not chosen by chance here, but it perfectly reflects the meaning Michael Foucault gave, intending as device "an absolutely heterogeneous set involving speeches, institutions, architectural structures, regulatory

Fig. 3. Rem Koolhass, Exodus or the Voluntary Prisoners of Architecture, London, 1972. Rem Exhausted Fugitives Led to Reception Exodus, or the Voluntary Prisoners of Architecture, 1972.



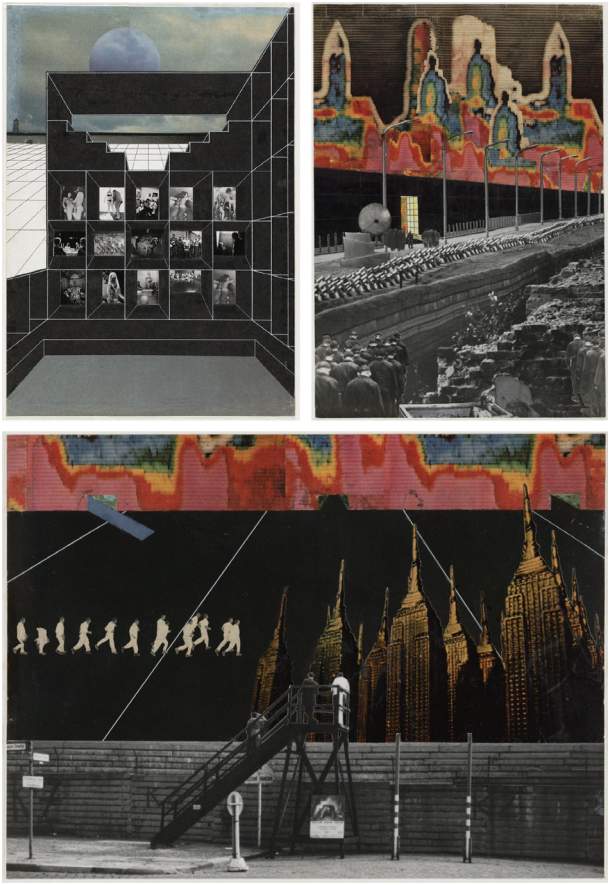


Fig. 4. Rem Koolhaas, and Elia Zenghelis, with Madelon Vriesendorp, and Zoe Zenghelis Exodus, or the Voluntary Prisoners of Architecture. Project for the competition The City as Significant Environment, 1972.

decisions, laws, administrative measures, scientific statements, philosophical propositions, moral and philanthropic […] the device is the network that is established between these elements2" [4]. In short, by device we can intend –by extension of Foucault's thought– a set of actions that at a certain historical moment has had, as its essential function, to respond to an urgency. A device therefore has an eminently strategic function. But if it is true, as it is true, that "terminology is the poetic moment of thought" [Agamben 2006, p. 5], the interpretation of the term 'device' opens to an additional use of the term in our discourse. Declined, in fact, in the specific field of the architecture of power and in particular in the field of architecture used for border control, the concept of device ends up being perfectly fitting to describe the extended idea of the 'wall', intended in its "dominant strategic function […] of manipulating force relations, and rational and concerted intervention in these forces relations" [Foucault 1977, pp. 299, 300]. But it is also true that the device, always inscribed in a game of power, is infused with a "set of strategies of power relations that condition certain types of knowledge and are conditioned by it". And it is in this sense that the project of architecture, as a device of knowledge that is that of spatial thought, and the complexity of the relationships that are triggered in it, enters into our thought!

Walls/Side-effects

> "What does it mean that architecture is a political weapon?
> To answer this question, we need to see how architecture,
> at first, is a weapon (that is, how architecture
> has a propensity for violence)
> and then, how this propensity is necessarily
> exploited by one or several political agendas."
> [Lambert 2012, p. 59]

In his *Weaponized architecture* Léopold Lambert denounces the impossibility of the innocence of architecture with respect to the strategies of power [Lambert 2012]. He does it with an intense and provocative writing that certainly can be imagined as a political act, going so far as to suggest a project as an act of "architectural disobedience" intended as a possible path of resistance against an establishment that uses architecture as a weapon, with all the political implications that this entails. Interviewed by Lambert, Bryan Finoki, an American inde-

pendent intellectual attentive to contemporary geopolitical systems, declares himself "interested in how architects can perhaps use their skills and the value of architecture as a political art, as an urban negotiating space with institutional power, to make spatial changes on their own, to force new balances of power, to establish, in effect, dialogues with power through the medium of the project that can challenge the institution in some way" [Lambert 2012, p. 55].
Starting from these considerations, the notes that follow and the cases described wish to provide an opportunity to reflect on the way often used by architectural narrative –in its dimension as a powerful communicative act linked to design thinking– to shown itself to be an effective conceptual device capable of going beyond the force of provocation, simple rational thinking and denounce the condition of an often sore humanity, hypothesizing solutions and visions of possible worlds.
Testing the tools of the architectural gesture and its graphic narration as areas of possible critical interpretation of the living space means opening a horizon of reflection that sees the project –and its synthesis in images– as a critical instrument of interpretation, of discretization, of arbitrary –but conscious– reduction of contemporary complexity, in the elements of a visual synthesis that is in itself a design act, the result of which is first of all to decode the syntax of the elements of what exists. And it means to do this by proposing a new syntax, which is able to take into account the reasons and tensions of an urban space intended as a 'living space' in which it is possible to try and project new attributions of meaning. A work of 'unveiling' reality which interprets the truest meaning of the act of 'representing'. In this sense, the theme of the 'wall' has always been a fertile ground for reflection, experimentation and amplification of the processes of signification. The power of the gesture that breaks down the function of separation between internal/external, inside/outside, private/public, has suggested design actions, be they metaphorical or real, of enormous political and social significance.
Just think of Gordon Matta-Clark's 'building cut'. Actions in which the anarchist and provocative American architect cut the walls of entire buildings, deconstructed houses and factories, realizing his personal visual and visionary utopia, revolutionizing the world of architecture without erecting even a wall. His an-architecture was a work of vivisection, which worked by cutting walls and at the same

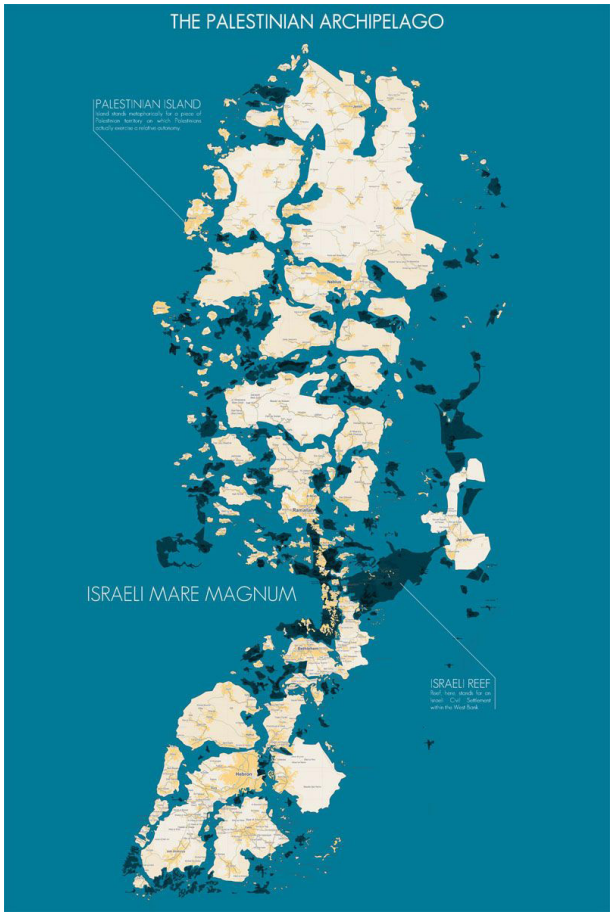


Fig. 5. Léopold Lambert, Representation of the distribution of Palestinian territories occupied by Israel. In Weaponized Architecture. The Impossible of Innocence, 2012.

Fig. 6. Léopold Lambert, A 'disobedient architecture' for two Palestinian populations. In Weaponized Architecture. The Impossible of Innocence, 2012.

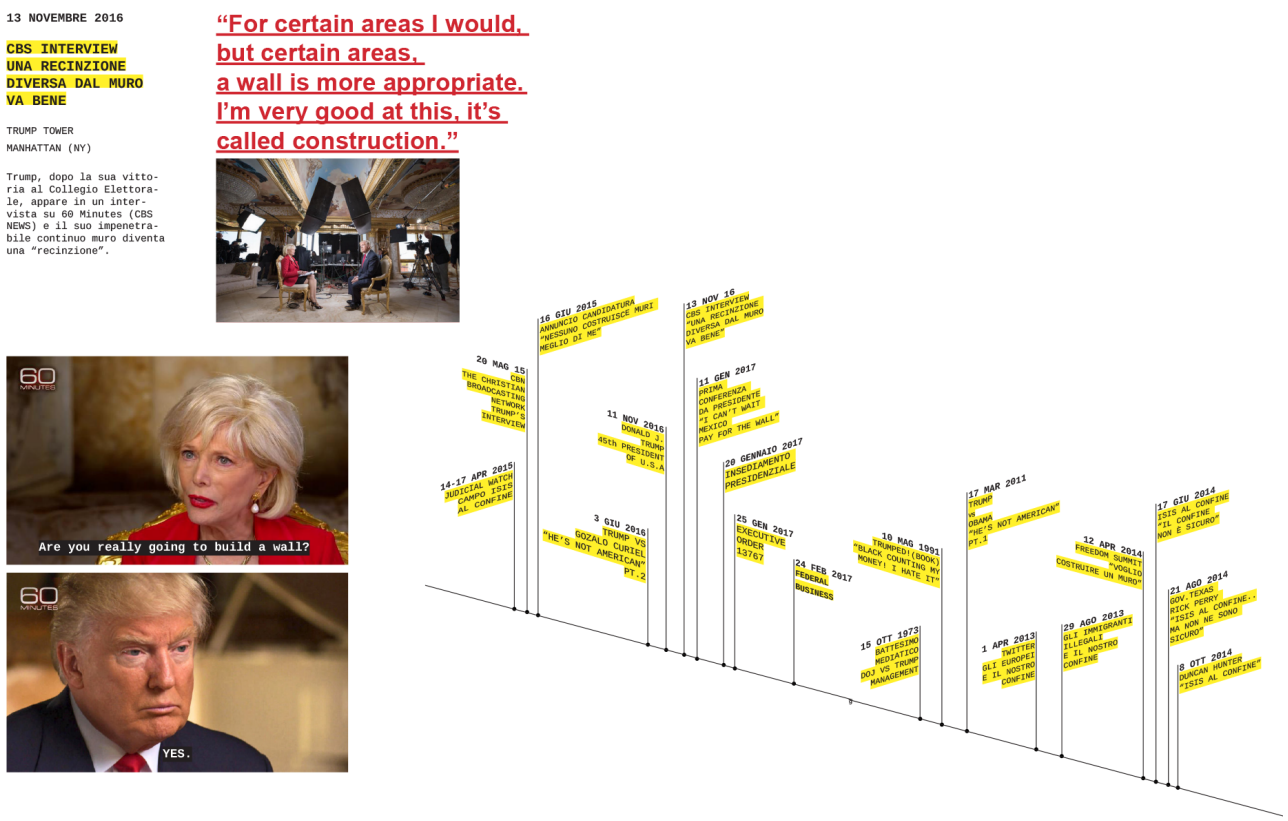
time opening deep lacerations in consciences. And in this way he suggested hypotheses of alternative reading of the city and of dwelling, denounced the failure of the architecture of the seventies, questioning the very meaning of dwelling and in particular the idea of 'private' (fig. 1). Those were years of mobilization and militancy and often the project was made 'manifest', as exasperation of selected aspects of reality, brought to extreme consequences in prefigurations of possible worlds, desirable or terrible, present *in nuce* in the world we inhabit.

Surprisingly, something of that provocative gesture, albeit with a completely different meaning, has recently returned in the *La Ferita* opened on the facade of Palazzo Strozzi, site specific work with which JR, the French 'urban artivista' –as he likes to define himself– wanted in some way to reinterpret the building, symbol of the Italian Renaissance, slicing the fifth wall, opening a wound on it, revealing the precious interior space and thus directing the attention of the community, to reflect on the inaccessibility of places of culture at the time of the pandemic and on the interrupted relationship with art that has characterized this long year of social distancing. A theme which has been particularly felt in these months in which the border, as said before, has become a metaphor of our existential condition, assuming new and unusual meanings.

In the same years in which Gordon Matta-Clark was opening holes in the walls with artistic gesture, another architect debuted on the international scene with a project in which the representation of the wall proved to be an unexpected protagonist. It was Rem Koolhaas who, in 1972, with his *Exodus or the voluntary prisoners of architecture* (figs. 2-4) offered the world his powerful idea of the role of architecture in the visionary interpretation of reality and in the prefiguration of possible worlds. As is often the case in Koolhaas' work, the project is intended as a story to be told, as the result of programming, as a possible scenario, much more then as an architectural object itself [5]. With a clear reference to Cold War Berlin, the project called for the construction of an ideal city structure in the heart of London. The suggestion proposed was to create a void within the city, enclosed by two walls, archetypal structures of architecture, which Koolhaas himself ironically defines "beautiful" in his relation to the project. An idea of a wall in which the element is interpreted, not as a simple supporting structure but as a symbol able to express at the highest level the meaning of separation while staging its negation. The gap between

the two walls is in fact transformed into a new ideal city that reuses the element of the wall for its symbolic and psychological character. The wall thus becomes a positive force, able not only to overlap the existing urban structure, but also to impose a new model of metropolis able to generate in turn a new lifestyle, marked by moments of almost mystical retreat and participation in social activities. So, in the metaphor of the project and its narration, the inhabitants end up gradually choosing to leave the city to move into that 'strip' thus becoming 'volunteer prisoners of architecture'. "Suddenly, –as one can read in the project report– a strip of intense metropolitan desirability runs through central London. This strip is like an airstrip for the new architecture of collective monuments. Two walls enclose and protect this area to maintain its integrity and to prevent any contamination of its surface by the cancerous organism that threatens to swallow it. Soon, the first prisoners beg to be admitted. Their number quickly swells into an unstoppable stream. We witness the exodus of London" [MOMA 1999 p. 294]. The

Fig. 7. Summary history of the genesis and communication of the idea of the US-Mexico wall from the first declarations until the publication of the call in February 2017.



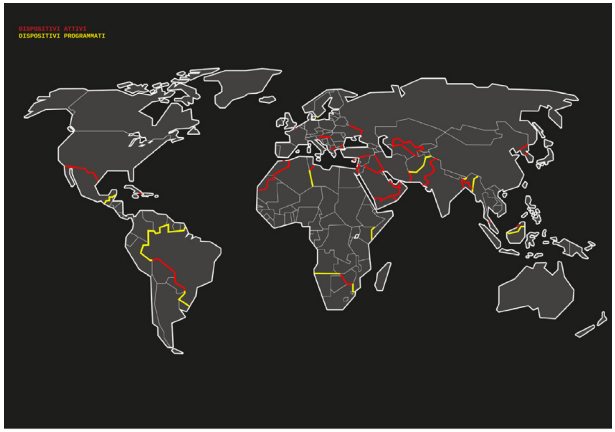


Fig. 8. Census of active, realized or planned physical control and separation devices in the world geopolitical system as of 2017.

project consists of 18 magnificent drawings, kept today at the MOMA in New York, realized in watercolors and collages to which Koolhaas entrusted the disturbing and desecrating message of his walled city, whose main idea is to use the 'intense and destructive force' of architecture, metaphorically represented by that idea of the wall that was and always is 'instrument and source of desperation'. And certainly a source and instrument of despair are the walls built along the physical, material and/or immaterial 'boundaries' that dot our world, a hot topic where conflict becomes real and where it seems more urgent to use design thinking and its representation as a powerful detonator of political and social denunciation through that refined intellectual work, all played out on the border between action and provocation, between design and communication, which inspires many architects, intellectuals and collectives of militant designers. Among others, the same Léopold Lambert with whom we started and his *Weaponized architecture*. Lambert's architectural narrative focuses on exemplary cases of barriers, borders, walls, designed or even planned that dot what he himself defines and draws as the archipelago of the Palestinian territories in the Magnum Sea of Israel (fig. 5). The metaphor is as powerful as the words of the Palestinian architect Nurhan Abujidi in his *Urbicide in Palestine. Spaces of Oppression and Resilience* describe the state of occupation and siege experienced by Palestinians residing in the West Bank and Gaza as a condition of physical constraint within 'lines' [Abujid 2019]. And it is precisely the power of the line understood as a sign and therefore design of architecture that is the starting point of Lambert's research, the inspiration from which his idea of a "durable architecture" was born, better than an architectural disobedience that takes shape in a project of great sensitivity than with different and interesting references to underground architecture, abandoned structures near Ramallah and the textile language of the architecture of the Bedouin culture, proposes the project of a *Qasr*, a temporary residence, intended as a place of possible negotiation between two peoples very different from each other, the Bedouins and Palestinian farmers, who share only the daily suffering caused by Israeli colonization. The building is imagined as a large underground structure, hidden from the early stages of its construction by a system of tents and veils that camouflage its presence and that can be used by Palestinians as an agricultural platform and temporary dwelling, but of which the Bedouins can appropriate as caravanserai for their animals and for themselves during

the stops of their continuous wandering between the islands of the Palestinian archipelago (fig. 6). What is striking about the Lambert project, and that emerges clearly from his reflections, as of the graphic novel *Lost in the Line* that closes his writing, is the ideal of a subversive architect, who uses the architectural project, even just imagined and designed, to play with the system, to circumvent certain political constraints, or to try to somehow recalibrate the urban environment that so often lives in a dimension of illogical injustice.
Others set themselves the same goal through an architectural narrative to which they entrust the task of denouncing the state of fact. Proof of this is the intense activity of the collective Multiplicity, a research agency for the territory that with its dense series of projects, installations, workshops has placed itself as a watchful sentinel of some of the most dramatic criticalities of the contemporary geopolitical context. Just think of the intense Solid See project conducted on the current geopolitical order of the Mediterranean Sea and the drama of migratory flows, but above all the *Border Device(s)* project, an investigation that reveals how, looking parallel to the global flows (of people, goods and ideas) and territorial restrictions, it is possible to reveal how individual and collective identities are defined, in all of their complexity, exactly in the act of crossing borders.

Fig. 9. Estudio Teddy Cruz + Fonna Forman, Border fence. Living at the border_ MOMA Small Scale, Big Change: New Architectures of Social Engagement San Diego-Tijuana border illustration, 2001.

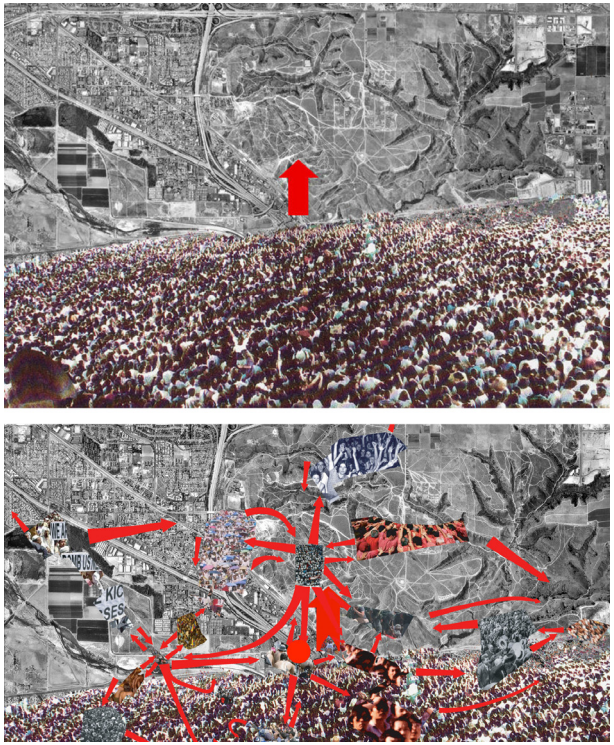


Fig. 10. Estudio Teddy Cruz+Forman, Border fence. Living at the border- , 11 Venice Biennale, United States Pavilion 2008. Photographic reproduction of the US-Mexico border (photo by Lisbet Arboe).

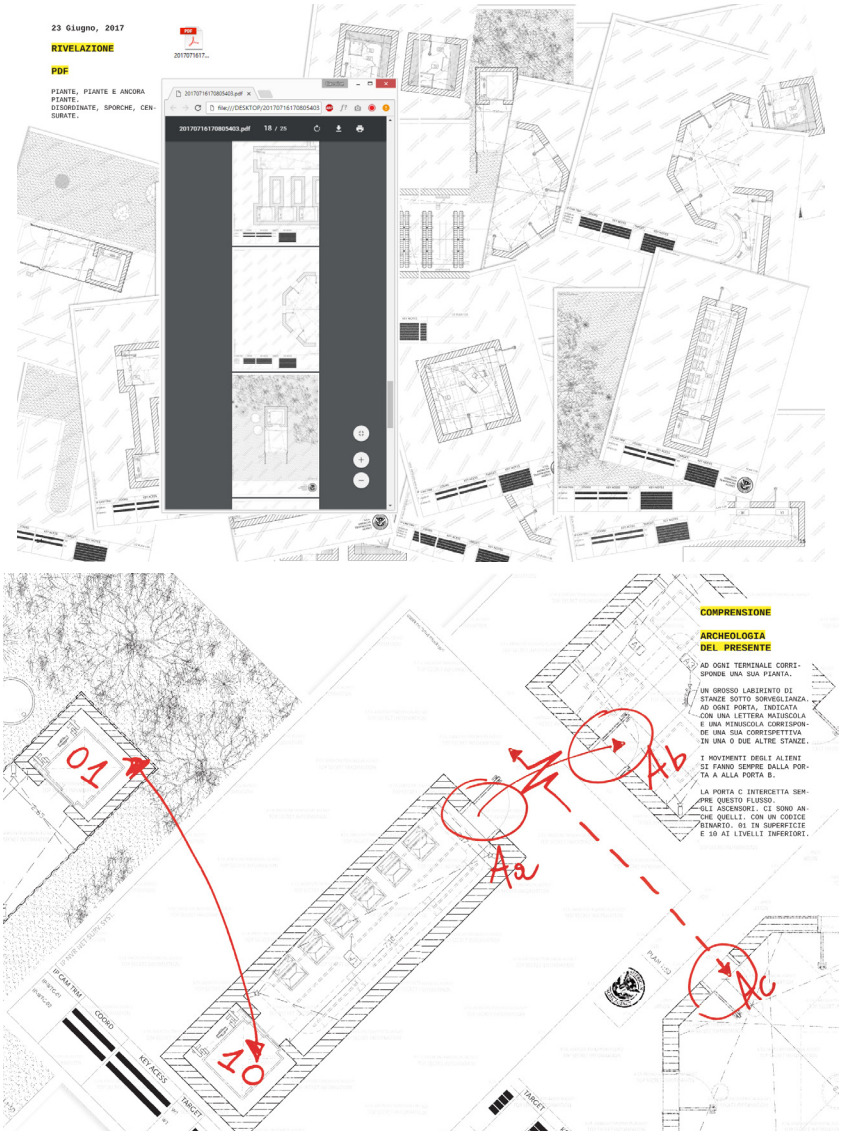
Living on the edge

> "The symbolic function of the border is not
> only to delimit our identity (collective or individual),
> but also to ensure exchange, transition,
> communication with the foreigner.
> Each border, in fact, defines an identity
> only by relating it to a difference.
> In the virtue of the 'porosity'
> is the fundamental attribute of the border".
> [Recalcati 2020, p. 28]

"*En una linea el mundo se une. Con una linea el mundo se separa. Dibujare es hermoso y tremendo*" [6]. Short and intense, this poem by the Basque sculptor Eduardo Chillida expresses with icastic effectiveness the tremendous power of design and its materialization of what we call architecture. A simple line has, in fact, the ability to divide an environment into two impermeable environments, as we are reminded by the obvious geopolitical examples of the border walls that dot our world and regarding which we have talked so far. One of the others has, for some years, taken on a special symbolic value: that which, in the intentions of the President of the United States of the time, Donald Trump, was to be erected along the border between the United States and Mexico.
Exactly on that wall a few years ago a brilliant and visionary student – one of those in whose intense gaze you sometimes find the sense and the reasons why you took this trip – suggested a really singular theme for his thesis on architecture: he wanted to participate in the *Solicitatio Number 2017-JC-RT-001*, with which on February 24, 2017 the Office U.S. Customs and Border protection of the Department of Homeland Security requested: "Design and build of several prototype wall structure in the vicinatory of the United States border with Mexico"[7].
In short, Carmine, that's my student's name, asked me seriously to participate in the Trump administration's electronic request to propose ideas and prototypes for the design and construction of various protective structures near the Mexican border. The contract, conducted in two phases, required to present, in the first phase, a 'conceptual' document by 10 March 2017. A little over two weeks for a project that was supposed to occupy a portion of territory of about 3000 kilometers. It took me a moment to understand the extent of the provocation and I accepted the challenge. I first asked Carmine to construct a detailed documentation on the narrative with which the idea of the wall had been formalized in the mind of Trump (and in that of a large part of that of his supporters!) and was then conveyed to the American public opinion (fig. 7). The result was a document of extraordinary interest in which the representation of the idea of the wall of Trump and its media translation were the background to a much more articulated narrative on the theme of 'physical control devices' and 'active separation devices' that were present worldwide well beyond the single episode in question.
The census of the borders controlled by more or less active devices had given surprising results. The list of those borders realized or even just programmed was incredibly long and the synoptic representation of their precise location on the globe, disturbing (fig. 8). It was no longer a question of reasoning on 'a wall', but of understanding separation devices as an inescapable conceptual category in order to understand the contemporary world. The opinion movement around Trump's project has been intense for years. Just think of the precious work Leaving on the Edge (fig. 9) with which Estudio Teddy Cruz + Fonna Forman have denounced and intensely fought since the early 2000s against the idea still dominant in political discourse, so the border between the United States and Mexico is a place of criminalisation [8]. With actions from below, Teddy Cruz and Fonna Forman managed to transform that boundary into a place of widespread creativity, through projects with high emotional potential all played on the thread of media provocation and metaphorical force of images.
A powerful work of representation that finds its strongest expression in 2008 at the 11th Venice Architecture Biennale, with the beautiful installation *Border Fence*. A provocative life-size photographic reproduction of the border fence between the USA and Mexico concealed the United States Pavilion of America at the Gardens and forced, with a strong metaphorical connotation, anyone who wanted to access the pavilion itself, at the physical act of the crossing, breaking the surface, and defeating the sense of impassable limit (fig. 10).
In the power of the images made by Teddy Cruz in the widespread use of collage and in the precise will to use the subversive force of representation, understood as provocation, there is the distinct echo of that intense season of the designed architecture that has been a source of inspiration for the approach that Carmine wanted to give to his project entitled American Transracial Agency. Architecture of conflict [9].

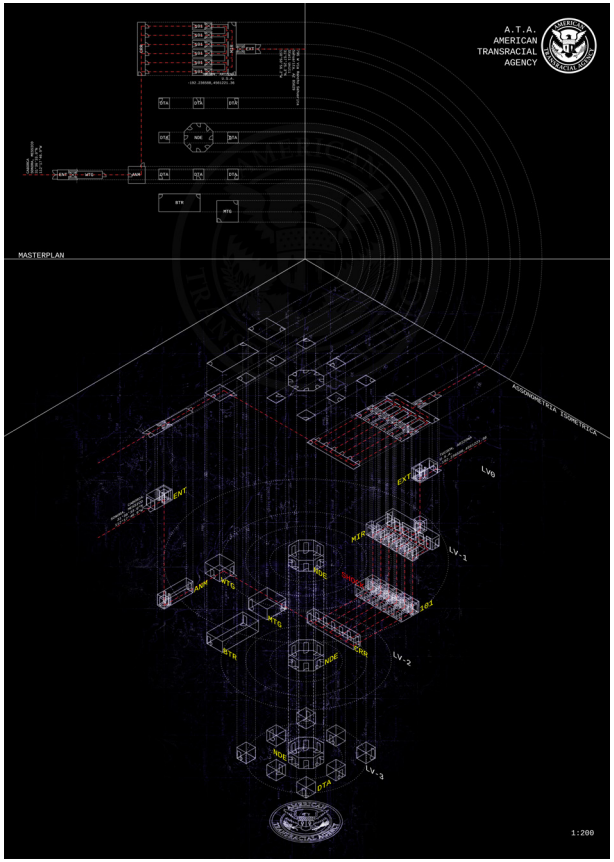
Fig. 11. American Transracial Agency. Architecture of conflict Collateral effects. Thesis in Architecture, by Carmine Errico a.y. 2016/2017, Department of Architecture and Industrial Design. The digital invasion of information about the American Transracial Agency.

Fig. 12. American Transracial Agency. Architecture of conflict. Side effects. Thesis in Architecture, by Carmine Errico a.y. 2016/2017 Department of Architecture and Industrial Design. An excerpt of the spatial sequence through which the process of 'racial mutation' takes place.



With an analogous attitude to understand the concept of wall –and its representation– not only as a barrier, but as a real spatial device and therefore this is a complex place where things happen, the project of the American Transracial Agency moves within a totally imaginary and surreal dimension proposing to create a 'space' intended as a sequence of places/happenings and therefore this process is first conceptual and then physical. A space made up of relational devices that in the thickness of the conceptual wall are able –through a subtle game of the absurd– to neutralize the causes of the effect of separation and exclusion that it generates and underlies. In fact, all of the 'side effects' of the presence of the wall are enclosed in the project of a complex underground architecture located near the border between the USA and Mexico and it consists of access areas, waiting areas, control spaces, rooms with neuronal activators, elevators, entry routes and exit areas beyond the wall. Elements of a path capable of modifying, at the request of the interested party, in real time –and in both directions!–, the"race' (provocative extension of the concept of nationality) of the person in transit and thus render ineffective the barrier created by the wall. All of this is described through a concise narrative, a sort of graphic novel that provides, through drawings of architecture in all likelihood, a punctual description of the places and actions. The process starts from the sudden appearance on the narrator's PC, of the documents of the 'archivio' 404': a rain of documents, maps, itineraries, conceptual maps, aerial photos... , documents that should have remained secret and that instead because of a 'bug' in the internet spread virally, reveal the process in progress and make it clear to the world (fig. 11).

Fig. 13. American Transracial Agency. Architecture of conflict. Collateral effects. Exploded view of the hypogeal structure and identification of the spatial articulation.



The more the narration pushes on the limit of the absurd and of the science fiction, the more the representation of the places is probable and precise (fig. 12). The more absurd the state of conflict created by the wall, the more effective and definitive the surreal solution proposed and described with the force of design provocation. A provocation that finds resonance in the representative choices in which the description of the project assumes the power evoking a declaration of intent, thanks to the communicative capacity of the image and its staging in the visual presentation of the project that through the representation becomes a story (fig. 13).

"Almost at the beginning of each project there is […]
a definition in words –a text– a concept, an ambition,
or a theme that is put into words,
and only when it is put into words
can one begin to proceed, to think about architecture;
Words trigger the project.
All our projects, or our best projects,
are first defined in literary terms,
which then suggest an entire architectural program […]
architecture is an intellectual discipline,
Writing is the privileged communication
of our intellectual disciplines".
[Koolhaas 1978, p. 42]

Notes

[1] The passage is taken from an interview made in 2010 by Leopold Lambert to Brayan Finoki, an independent American writer, attentive observer of the militarized spaces and their geopolitical consequences in 2010 by Leopold Lambert and available on page <https://thefunambulist.net/architecture/interview-bryan-finoki-for-weaponized-architectur> (accessed 2021, May 28). The interview was then published Lambert 2012, pp. 48-61.

[2] The way in which wandering has represented a primary act of transformation of the environment and has proved to be an aesthetic instrument of knowledge and significance of space is investigated in the beautiful book: Careri 2006. In this regard, see also Solnit 2002, where the Author addresses the issue of leaving the enclosed space and therefore overcoming barriers and limits by investigating the relationship between the history of walking and the history of thought.

[3] The excerpt is taken from the presentation text of the exhibition *Border Device(s)/Dispositivi di confin*, –a project elaborated by Multiplicity– set up in 2004 at the conclusion of a multi-year research on the 'policies and mythologies of borders', by the Fondazione Collegio San Carlo di Modena. The sensitive work of Multiplicity, a research agency on the territory coordinated by Stefano Boeri, collected the results of a long research path on the fragmentation of contemporary space.

[4] The concept of device is one of the most powerful contemporary concepts, brought on the philosophical scene in the mid-seventies of the past century by Michel Foucault. It is a decisive technical term in the strategy of his thought, of which Foucault does not give a precise definition, but nevertheless, as Agamben points out, he approaches in an interview in 1977, from which the quotes are taken. The interview was then published in the collection of writings *Dits et ecrits* for the types of Gallimard. Two contemporary authors very significant for contemporaneity, Gilles Deleuze and Giorgio Agamben, have both dedicated to the theme two short essays, –both entitled *Che cosa è un Dispositivo?*– offering ideas for updating a concept that finds enormous scope for application in the horizon of contemporary culture and its media devices.

[5] The iconoclastic dimension of Koolhaas manifested itself from the beginning. His final design at the Architectural Association School of Architecture in London was a series of 18 drawings, watercolors and collages called *Exodus, or the Voluntary Prisoners of Architecture'*, which echoed the inspiration of James Ballard's tales and his surrealist novels. In this project, Koolhaas and his collaborators (Madelon Vriesendorp, Elia Zenghelis, Zoe Zenghelis), mocked the modernist utopias of their predecessors, sarcastically describing the Berlin Wall as a "design masterpiece" and suggesting a walled city inside London as a way to create a new urban culture, which would have led the inhabitants to leave the rest of the city in ruin. About the project see: Koolhas, Zenghelis 1972, pp. 42-45.

[6] Eduardo Chillida, a Basque sculptor with intense spatial poetics, wrote these five verses in 1983 in one of the numerous sketches in which he depicted the closed palm of a hand, with which he investigated the concept of delimiting a portion of space and its relationship with the rest of the way.

[7] This is the notice published on 24 February 2017 by which the U.S. Customs and Border protection office of the Department of Homeland Department of Homeland Security, followed up on the intentions of the United States government presided over by Donald Trump to build a wall on the border between USA-MEXICO <https://www.cbp.gov/frontline/border-wall-prototype-designs> (accessed 2021, June 23).

[8] Teddy Cruz, urban architect and lecturer in Public Culture and Urbanism at the Visual Arts Department of the University of California, San Diego, is internationally known for his urban and architectural research on the border between Tijuana and San Diego. Area where his work is aimed at interpreting the neighborhoods of border immigrants, as places of cultural production, from which to rethink urban policy, affordable housing and civic infrastructure. His investigation of this 'geography of conflict' inspired a design practice and a project production pedagogy rich in suggestions. On his work and on that of Estudio Teddy Cruz + Forman see among others, Misra 2007.

[9] The thesis in Architecture with the title *American Transracial Agency. Architecture of conflict. Effetti collaterali*, was discussed by Carmine Errico, with praise and dignity of the press in July 2017 at the Department of Architecture and Industrial Design of the University of Campania Luigi Vanvitelli (supervisor prof. A. Cirafici, co-rapporteur prof. F. Ippolito).

Author

Alessandra Cirafici, Department of Architecture and Industrial Design, Università degli Studi della Campania "Luigi Vanvitelli", alessandra.cirafici@unicampania.it

Reference List

Abujidi, N. (2014). *Urbicide in Palestine Spaces of Oppression and Resilience*. London: Routledge.

Agamben, G. (2020). *A che punto siamo? L'epidemia come politica*. Macerata: Quodlibet.

Agamben, G. (2006). *Che cosa è un dispositivo?* Milano: Nottetempo.

Careri, F. (2006). Walkscapes. *Camminare come pratica estetica*. Torino: Einaudi editore.

Casetti, F. (2020). Close-up-ness. Masks, Screens, and Cells. In M. Treleani, F. Zucconi (a cura di). *Remediating distances. IMG journal Interdisciplinary journal on image, imagery and imagination*, Issue 03. Bologna: Publicapress, pp. 104-117.

Chillida, E. (2003). *Open-Air Sculptures*. Barcelona: Poligrafa.

Deleuze, J. (1989). Qu'est-ce qu'un dispositif?. In M. Foucault. *Rencontre internationale*. Paris-11 janvier 1988. Paris: Le Seuil. [Trad. it. *Che cos'è un dispositivo?* Napoli: Cronopio 2002].

Foucault, M. (2001). *Dits et écrits III, 1976-1988*. Paris: Gallimard.

Koolhaas, R., Zenghelis, E. (1972). Exodus. In *Casabella*, n. 378, pp. 42-45.

Koolhaas, R. (1978). Dalì and Le Corbusier: The Paranoid-Critical Method. In *Architectural Design*, n. 48, pp.152-164.

Koolhaas, R. (2001). *Delirious New York*. Milano: Electa. [Prima ed. 1978].

Lambert, L. (2012). *Weaponized Architecture: The Impossibility of Innocence*. Barcelona: dpr-barcelona.

Misra, T. (2017). *The Border Is a Way of Reinforcing Antagonism That Doesn't Exist. CityLab* <http://www.citylab.com/housing/2017/01/the-urban-laboratory-on-the-san-diego-tijuana-border-teddy-cruz-fonna-forman/512222> (accessed 2021, May 10).

Recalcati, M. (2020). *La tentazione del muro. Lezioni brevi per un lessico civile*. Milano: Feltrinelli.

Solnit, R. (2002). *Storia del camminare*. Milano: Mondadori. [Ed. orig. *Wonderlust. A History of Walking*, 2002].

Representations of the City. The Diffuse Museum *The Esquilino Tales*

Elena Ippoliti, Andrea Casale

Abstract

Various experiments in cultural heritage enhancement and education have been directed at defining new paradigms of experience, bringing actions and interactions of and between subjects back to the centre. This has led to renewed interest in experiences capable of integrating education and fun, because the emotional environment of playing and the method of "learn by doing" facilitates learning processes.
In this context, we present The Esquilino Tales, conducted in the Master in Communication of Cultural Goods at the Sapienza University of Rome, which aims to enhance the varied, even identity-building complexity of the Esquilino area, the XV Rione of Rome. Since this is a place where both the whole and its individual parts are recognizable first as "figures", the project began with the conviction that an effective proposal could only start with the specific signs of the places. The experimentation therefore investigated the practices of representation, innovating with them through the techniques of storytelling, gamification, and storydoing to develop a communication strategy using a wide range of graphical/visual languages. In this strategy, active means of exploration such as initial actions of enhancement and urban regeneration are proposed for activation between the visitors/citizens and Esquilino/city to begin to rescue our city.

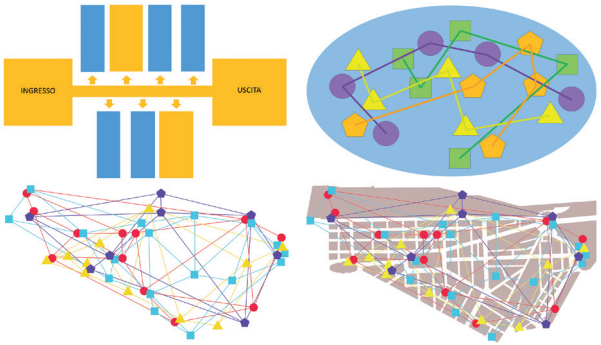
Keywords: graphical languages, communication, enhancement, gamification, storytelling.

Italian Cultural Heritage and the diffuse museum

What makes the Italian cultural heritage truly unique is that «continuum between monuments, cities, and citizens» because, according to an interpretation by Salvatore Settis, it is precisely in that extraordinary continuum between monuments and the cities' connective fabric housing them that «our most precious cultural good» is found [Settis 2002, p. 10].
This is such an authentic awareness about Italy that, since the definition cultural goods was set out, the heritage –material and intangible– has been considered a systemic good, that is, an expression of the set of qualitative and quantitative connections among individual goods and between these and the context of reference. This idea of systemic heritage also gave rise to a culture of enhancement «in which the value of each individual monument or object of art results not from its isolation, but from its insertion within a vital context» [Settis 2002, p. 15].
In recent years in particular, this active awareness of profound renewal has regarded the mission of museums [MiBACT 2014] and the role that they can play in promoting education and scientific progress, cultural and natural diversity, sustainable development, and intercultural dialogue [UNESCO 2015]. This renewal has regarded both "objects" in the collection [Desvallées, Mairesse 2010, p. 26] and museum spaces themselves, expanding the former and dilating the latter for new understand about the practices and knowledge, cultural places connected to them, and the communities that are recognized in that cultural heritage [UNESCO 2003].

Fig. 1. Top: Comparison between the different fruitions in a traditional museum and in a diffuse museum. Bottom: The points of interest in the diffuse museum The Esquilino Tales.

Fig. 2. The Esquilino Tales in its analog version. Packaging tests (graphic elaboration by Giulia D'Alia, Giulia Flenghi, Francesca Troiani).



The view of the museum therefore projects outside, re-evaluating the cultural heritage in cities and the communities that live there, particularly through the "diffuse museum", a particular type of museum that embraces various concepts of the ideal museum, reaching the concept of Italy as a large outdoor museum to realize the «dream of recomposing knowledge: historical, artistic, architectural, scientific, material» [Mottola Molfino 2007]. In this particular type of diffuse museum, it is even more imperative to work on the system and the connections to design «paths of meaning that are well focused on specific territorial areas such that […] it does not simply summarize a series of works of art or monuments, but is translated into a historically and culturally consistent path, or many parallel paths» [Bray 2013].

The strategy

The reflections made thus far frame the communication project *The Esquilino Tales* [1], which, while referring to a particular case study, is proposed as a customizable model which can therefore be replicated in other parts of Italian cities due to the recurrence of the same types of objects. More in general, in its organization and general lines, the experience is proposed as a possible version of a diffuse museum in the city with the specific objective of becoming an active practice in the culture of the city in question, reflecting the attitudes of a particular public –teenagers between 13 and 18– who are naturally excited by curiosity and socializing and are ready to play.
At this 'museum', play, creativity, and participation for emotional involvement, interaction, and also the repetitive schemes underlying each game allow the cultural knowledge to become more easily impressed, bringing teenagers/citizens to the inestimable heritage of the city, even «on the face of the image and the enhancement of the country» [Settis 2002, p. 10].
For the effectiveness of the educational experience, the theoretical support used to set up the communication project refers to Harold Dwight Lasswell's "model of communication", which, while subject to criticism, adaptation, and integration, has remained the basis of comparison for later theories of communication.
In 1948, Lasswell, a political scientist, sociologist, theorist of political science, and pioneer in mass media studies, defined in a concise, cogent sentence the principal ques-

tions implied by each act of communication, synthetically formulating the principles of his model. A «convenient way to describe an act of communication is to answer the following question: Who says what in which channel to whom with what effect?» [Lasswell 1948, p. 37].
It is clear that the model is especially adapted to asymmetric communicational processes –an active emitter that produces a signal and receivers that passively react to the signal– and it is particularly suited to describing the traditional system of communication instilled between an institution and the public, even though increasing numbers of institutions have recently tried to break out of and overcome such unidirectionality. On closer inspection, though, with possible updates congruent with the needs of modern communication, the questions posed by this model are still valid.
For this reason and due to its indisputable linearity –or better yet, simplicity– Lasswell's model was proposed to the students as an outline to follow when analysing and defining the communication strategy on which the project was established. The model is therefore followed in tracing the description of the experience.

Who communicates?

In the case of the museum, the communicator is the museum as an institution. In a diffuse museum, instead, it consists of institutions, organizations, associations, etc., that is, the different subjects that may be a key part of the community of reference. Each of these subjects has its own individuality, and is differentiated by a particular cultural and social role in the community of reference.
To be able to communicate, however, these individualities should nevertheless be organized according to a single "voice", that is, they should be coordinated by a subject responsible for communication which therefore plays the role of "who". This figure should have, or develop for the purpose, its own characteristic identity that will be revealed through the action of communication, an unveiling that is a necessary attribute and qualitative element of the communication.
In the case study adopted, a careful analysis of the different subjects operating in the area was made and the Palazzo Merulana [2] museum was chosen as the "one responsible for communication" because it has always been dedicated to cultural participation as a factor of social inclusion and welfare and is therefore already significantly integrated in the surrounding urban context. This was a strategic choice for the project because it would guarantee the necessary stability and continuity and also the necessary visibility to favour broad participation.
More in general, the choice represents a method for enhancing the city by reinforcing the relationships between the various "cultural places". The method aims to initiate a profitable interweaving between city, citizens, and museums, attributing to the latter a central role in understanding the cultural heritage, stimulating the participation and creativity of citizens, enhancing the memory of the past, and feeding the awareness of historical, civic, and symbolic values that permeate the heritage.
It is an opportunity for museums to expand their range of action beyond the good practice already shared today of "before, during, and after", which temporarily extended museum visits well beyond the strictly necessary stay (during), leading the visitor through a more complex and detailed experience, preparing visitors (before) and accompanying them (after).
This serves as an opportunity for museums to expand their range of action in space as well, working on the relationship between "inside" and "outside". This is a new role for cultural places, which can become hubs of culture and creativity, places for inclusion and democratic prac-

Fig. 3. The card, the fulcrum of the project The Esquilino Tales. The front is created by Giulia D'Alia. The back is created by Simone Amarante.

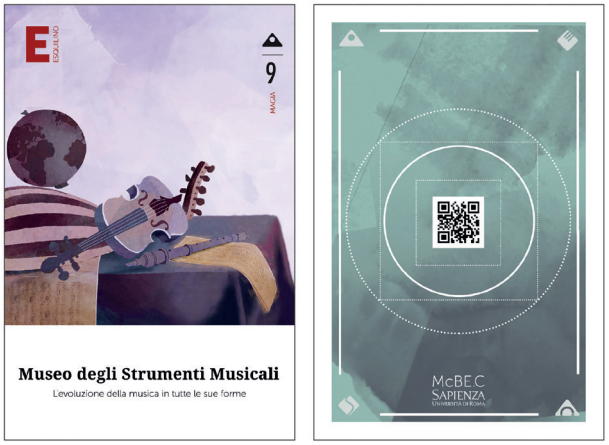


Fig. 4. Some representative cards of the Magic perspective (the number 4 created by Giulia Flenghi; the number 7 created by Francesca Troiani) and the Memory perspective (the number 1 created by Federica Giannoni; the number 10 created by created by Simone Amarante).

tice, and interacting with citizens through the territory, entertaining stable relationships with schools, universities, and companies. In doing so, they incarnate «the role of laboratories of knowledge and widespread accelerators of ideas, through and within which they not only generate mechanisms of cultural and creative fertilization, but also, as a direct results, personal and collective growth» [Asproni 2018].

To whom?

Assessments of possible answers to this apparently simple question start with the theories and practices of Audience Development, which, included in Europe Creative financing programmes since 2014, aim to identify areas of possible development to expand and diversify the cultural public.
In fact, despite important policies, even economic ones, implemented in the last twenty years, the rate of participation in cultural production in Europe and even more so in Italy is still low and the public reached has been mostly the same for more than 50 years: «white, cultured, well-off, middle aged» [Gariboldi 2017].
The different markets that can potentially be developed through cultural production include those under 18 years of age (which represent more than 17% of the population in Italy, with 12-18 year olds equal to about 6%). The world of culture has been particularly attentive to this sector of the public in recent years with a varied range of dedicated activities. More in general, there is growing awareness of the role that culture plays in the growth of a person as a whole, which has even led to an extensive interpretation of the notion of "human capital" in economic studies [Cingano, Cipollone 2009] [3].
Despite this renewed attention, the numbers for Italy in the field of educational instruction are not comforting, with a rate of dispersion that is still very high: more than 14% compared to 10% as the European average, growing from the north to the south and greater where less culture is presented.
Finally, with more specific regard to relationships between youths and the city, some interesting experiences in participatory planning show how the involvement of teenagers creates positive effects well beyond the specific topic. The experience of sharing reignites the motivation to design one's own future and participate in the all-round education of conscious, responsible citizens [Corbisiero, Berritto 2017].

These considerations therefore motivated the choice to direct the project *The Esquilino Tales* not to the public as a whole, but to its younger members, particularly secondary school students, accompanied by their families and in the context of education/school and culture/museum. The goal is for them to rebuild their role in their relationship with the city, that is, the space where they live and determine their future.

With what effects?

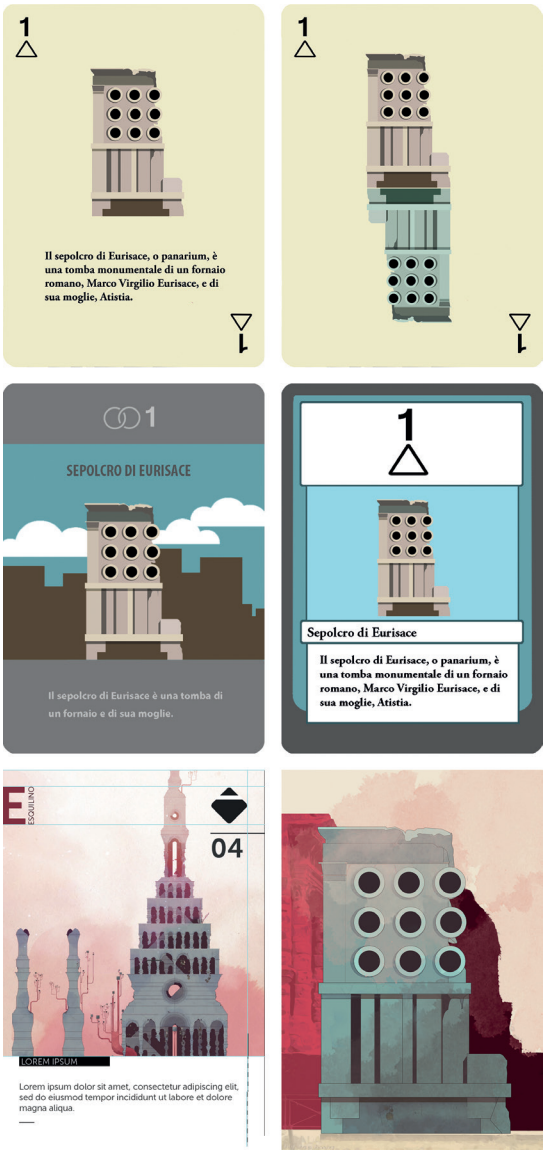
The expected results are obviously also consistent with and integrated into the set of choices above.Bringing younger citizens closer to their cities' heritage has the general scope of raising awareness about their active relationship with society, which is «one with our language, music, and literature, our culture». Due to the capillary spread through the territory of the «model of Italy», we 'also find it «without wanting to or without thinking about it in the streets of our cities, the buildings where our homes, schools, offices are, in churches open for worship» [Settis 2002, p. 10].
This heritage covers an inestimable number of items, but especially inestimable vitality of the values that they hold. It may be a possible key to an opportunity for growth and participation for young people, and therefore a flywheel to bridge the educational gap and cognitive poverty, favouring greater inclusion in culture and a broader range of resources to develop our territories and society.

To say what? Esquilino

The motives for experimenting with the diffuse museum in the Esquilino quarter include tracing 150 years of history of Rome as the capital of Italy. It was here, in fact, that building began in 1870 to create an entire neighbourhood in order to adapt the city, which then had little more than 200,000 residents, to its role as the capital of a country. This was an impressive urban renewal project, with the construction of representative buildings, palaces, and residences for public workers and white-collar workers in the new administration, along with broad avenues and squares, with a focus on Piazza Vittorio Emanuele II, where more than a kilometre of imposing porticos surrounds the spacious botanical garden created around

Fig. 5. Some representative cards of the Transition perspective (the number 1 created by Federica Giannoni; the number 6 created by Angela Moschetti) and the Fusion perspective (the number 1 created by Simone Amarante; the number 2 created by created by Margherita Stisi).

Fig. 6. The various initial tests and references: Neapolitan and French playing cards (above), collectible Magic: The Gathering cards, (middle), the gaming platform Gris (bottom) also applied to the tomb of Eurisace.

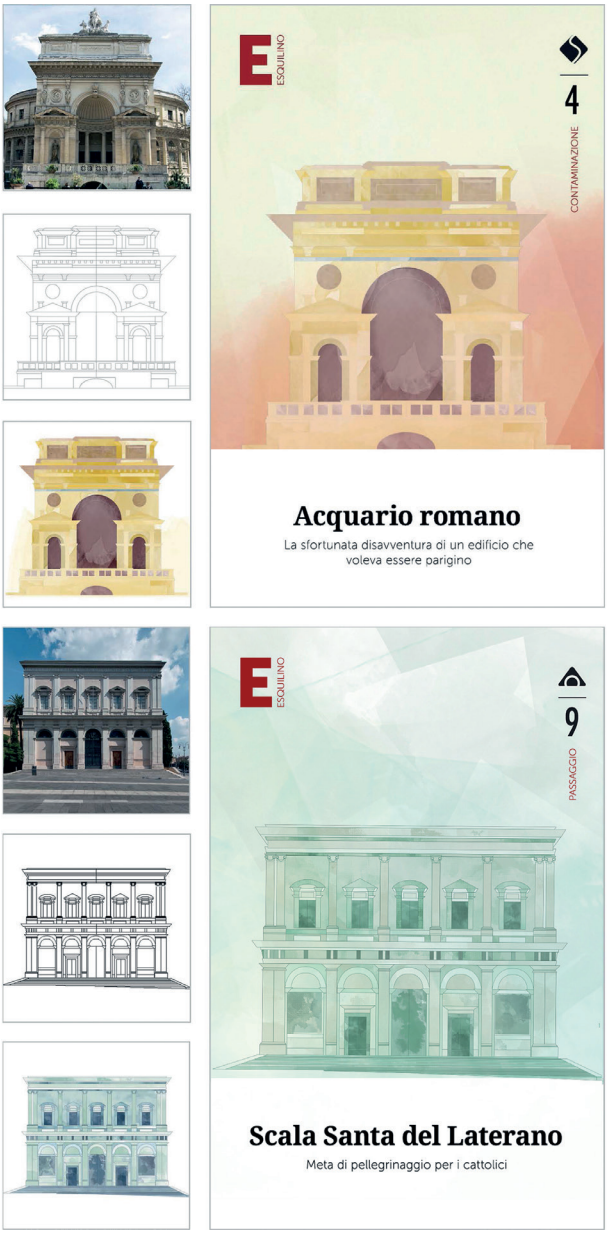


the ruins of the Nymphaeum of Alexander monumental fountain.
This is the starting point to explore an entire neighbourhood that, while at the centre of Rome, is mostly unknown, not only by tourists, but also by residents of Rome. It is a sort of enclave that houses important historical remains from the thousand-year-old history of the 'Eternal City' and the more recent history of modern Italy. Of Republican Rome, when the Esquilino hill, the highest in Rome, was a suburb only partially falling within the Servian Wall, while outside lay the crowded, dangerous Suburra. Of Augustinian Rome when it was annexed to the city and public structures and villas were built for rich patricians. Of Christian Rome, with the churches of San Pietro in Vincoli, Santa Pudenziana, Santa Maria Maggiore, Santa Prassede, and San Martino ai Monti. Of Sistine Rome when Santa Maria Maggiore became the focus of the new city design based on a network of churches, roadways, and obelisks. Of the capital of Italy after 1870: Rome under Umberto I, Rome in the 1920s, Rome after the Second World War, and modern Rome.
This is a complex urban situation where important Roman remains with great archaeological and aesthetic interest coexist with newer architecture from the unity of Italy; where the squares, the expression of the geometric rigour of the Savoys, host places for the most diverse ethnicities to come together and meet; where the strategic railway nodes for the entire city and beyond still interweave with the ancient gates that separated Imperial Rome from the outer world; where the buildings are an indelible testimony of Fascist brutality, but also the fight of the resistance for the liberation of Rome; where novels and films of post-war and contemporary Italy echo in the streets.
This is a layered reality that has known how to reconfigure itself throughout history to adapt to growth and physical transformation and to subsequent migration and globalization, denoted by a variety of both built space and the people living there: a multitude of cities rather than just one city.
The Esquilino neighbourhood therefore holds a special heritage well adapted to the diffuse museum. In contrast to a 'traditional' museum where goods are acquired, collected, ordered stored, and displayed to the public, each day in the quarter presents a living reality whose individual parts continuously interact with the places and artefacts, reciprocally modifying each other.

To be promoted, this special heritage requires working on the possible connections with a mechanism that is at heart very similar to guides, which, starting in the first half of the 1800s, freed the larger public, allowing them to individually and independently plan their trips. These are particular devices in which, without an author, the places presented to the reader/traveller through possible itineraries come to the fore [Ragonese 2010] and where the plot woven between places and the traveller builds an attitude about the travel experience, whether real or virtual [Mangani 2007]. Such guides did not invent this mechanism; rather, it derived from the different implementation of the inhabited space –atlases, maps, itineraries etc.– which were more recently renewed by cinema [4].
Nevertheless, the focus of each type of museum and therefore also diffuse museums, is always its collection, that is, an 'ordered' collection of 'objects' of the same type, thereby forming a relatively coherent, meaningful set [Desvallées, Mairesse 2010, p. 26] (fig. 1).

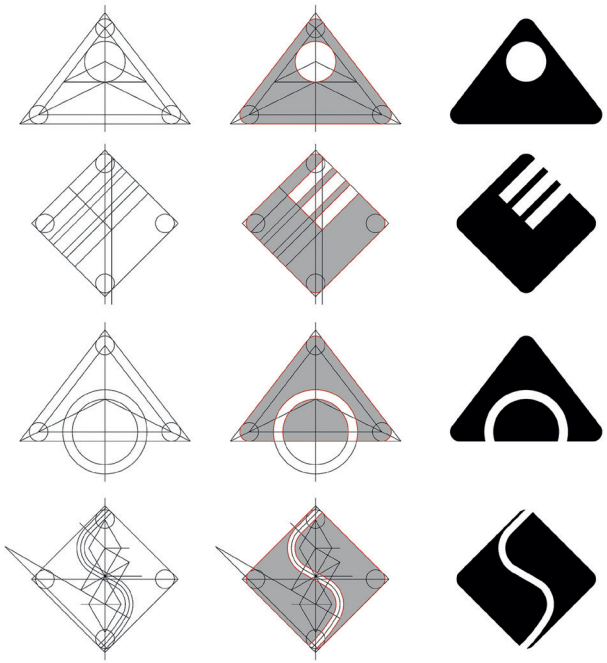
Fig. 7. The four backgrounds corresponding to the four narrative perspectives, each characterized by a prevalent chromatic tones: violet/blue for Magic, grey for Memory, green/teal for Transition, orange/ochre for Fusion (created by Simone Amarante).

Fig. 8. The procedure: construction of the 'figure' –starting from the photographic documentation through retracing and some particular brushstrokes'– followed by insertion in the background of the visual (by James Douch).



In parallel to the expansion of the heritage –from material to intangible– the types of objects in museum collections first expanded –no longer just physical objects, but also related practices, expressions, knowledge, and cultural spaces that communities recognize as an integral part of their cultural heritage [UNESCO 2003]– and then the museum space shifted from a closed space, a container of objects, to include the outdoors.
Despite these transformations, a museum is always characterized by a collection of "objects" –material and nonmaterial– that are essentially "sensory" objects, that is, interpreted and understood with the senses and "ordered", or at least connected to create a system with the overriding goal of being «exhibited for public viewing» [Pomian 1987, p. 18].

Fig. 9. The 'suits': construction of the ideograms representing the four families, that is, the four narrative perspectives.



In this framework and in the case of the Esquilino neighbourhood, but for urban spaces in general, the goods fall under the extended definition of "architecture", where both the whole and its individual parts are therefore recognizable primarily as "figures". The project therefore began with the conviction that a proposal for its effective use could only start with the specific signs of the places, that is, its possible representations. This gave rise to the concept of the communication project that describes each urban reality through a set of 40 cards (fig. 2), which acts like the museum collection, organized into four families (10 numbered cards) referring to a particular themed narrative (itinerary).

In which channels? The structure of *The Esquilino Tales*

Museums are, by definition, «systems of communication» [Lugli 1993, p. 80] based on the use of a "sensory" language analogous to the objects in the collection, which are "sensory" objects, that is, they can be interpreted and understood with the senses. A museum's capacity for communication therefore depends mostly «on the non-verbal language of the objects and observable phenomena» [Cameron 1968, p. 34], that is, visual language.
This supposes, however, that for the communication to be effective, the public shares the set of codes used in the communication. Communicating means "placing in common", i.e. the only way to make someone else participate in the content. Each act of communication, or any type of "text" in general, also implies rules to be shared, which also applies to the empty spaces left by the author to the interpretational, and therefore cooperative, initiative of the reader [Eco 1991].
Therefore, in the Esquilino communication project, the students/authors/curators built the communication as a combination of iconic constructs accompanied by textual and acoustic attributes. This means of communication was designed starting with the figurative imagery of the chosen public (teenagers between 13 and 18) such that they may possess the codes necessary for deciphering and comprehension.
The communication project is also built by relying on that «lazy mechanism» that Umberto Eco traces in each text «that lives on the added value of sense introduced by the target» [Eco 1991, p. 52]. Therefore, both the complexity and non-uniformity of the Esquilino area, which

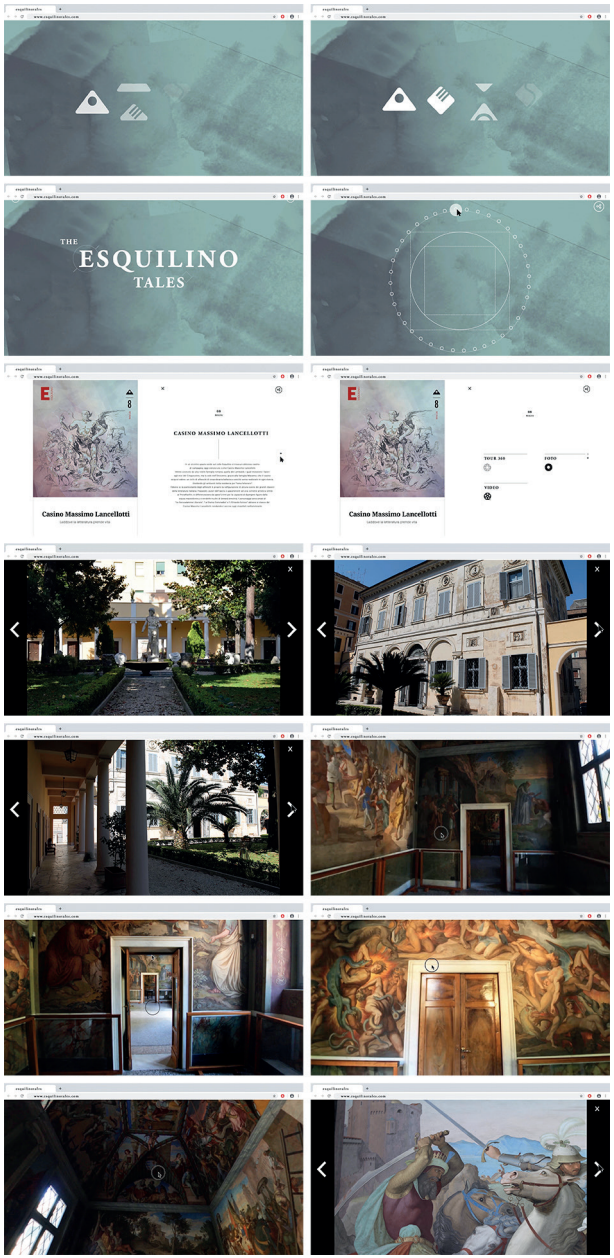
are impossible to describe from only one point of view, and the need for synthetic, involved communication that induces the public/visitor to participate actively, led to the technique of gamification as the anchor for the communication project.
In fact, theories of learning show that the "action/response" cycle underlying each game activates motivated involvement, transforming "simple" seeing or listening into "creating" an experience, and even storytelling into story-doing [Viola, Idone Cassone 2017], with no distinction between narrator and listener, spectator and actor.
The scientific interest in play is not related to an abstract system of rules, but rather the concrete behaviour that is realized in the act of playing itself, i.e. play or performance commonly associated with the concept of pleasure [Eco 1973]. The interest lies in fun activities as a subjective state, as has recently been shown in cognitive science studies. The particular disposition of the subjects involved in the interaction, who interpret the situation as a game, allows investigators to understand the «circumstances in which people say they are "playing" or "being playful" while involved in activities that are objectively not games» [Paglieri 2002, p. 376].
Some recent experiences in the communication of cultural goods have also shown how play can be an effective way to bring users to the heritage [Albisinni, Ippoliti 2016; Lampis 2018; Luigini, Panciroli 2018; Pescarin 2020].
Indeed, by activating an interactive relationship, the emotional environment of the game facilitates learning processes because «Play is a very serious matter […] It is an expression of our creativity; and creativity is at the very root of our ability to learn, to cope, and to become whatever we may be» (Rogers, Sharapan 1994). As educators know well, nothing is more serious than play, which is indispensable for individuals and also the community «by reason of the meaning it contains, its significance, its expressive value, its spiritual and associations, in short, as a culture function» [Huizinga 1949, p. 9].
Having discarded video games for various reasons [5], after an analysis of the most common table games [6], the choice fell on collectible game cards [7] for the experience of the Esquilino neighbourhood. As recently demonstrated, these combine the methods of play with the passion for collection, a particular connection that lends a capacity to spread virally, that is, to self-promote itself.
The system of representation proposed for the Esquilino quarter therefore starts with a deck of 40 cards divided into four families (10 numbered cards), intended as a set of "open communication" where the public's contribution, while entailing a "simple" game, requires particular dedication.
As mentioned above, while only experimenting with the Esquilino area, the concept of the project is designed to be suitably customized and replicated for different urban areas with recognizable characteristics, a condition that also favours the spread of the game through the

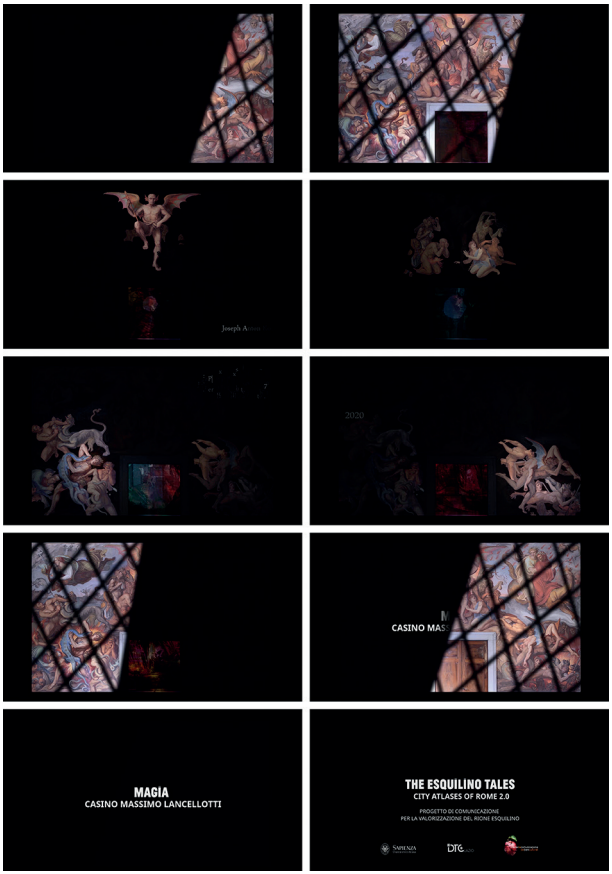
Fig. 10. Tests to define the layout, particularly the front of the card (experimentation by James Douch and Simone Amarante).

proliferation of decks of cards. This simple structure and its related connections –card/family/deck/decks– transforms the cards into collector objects that, with their easy spread and competition between players underlying any game, is a further push for interaction due to the need for exchange.
To favour the experience of visiting the cultural heritage housed in cities, the rules of the game require the player to increase the power of their cards when they interact with a cultural element, entailing progressive increases in power according to the different means of access and actions: at a distance (QR code, app, or website), directly through a tour, completing an itinerary from among those proposed, etc.
Once the objective has been fixed, players can thereby implement different strategies to earn power individually or as a team through interaction with the cultural good. The rules of the game require players to personalize each round, setting out variations in the deck to complete or modifying the default composition by replacing individual cards while keeping the number and families fixed.
With this simple game, *The Esquilino Tale*s diffuse museum responds at heart to the mission of every museum, that is, favouring learning by performing its educational function.

In which channels? *The Esquilino Tales* system of representation

While the fulcrum of the project lies in the individual card, (analogous in its digital variations with the role of interface to access the cultural content, fig. 3), the game is structured so that one would preferably discover the Esquilino district following the cards in a family, that is, via one of the four particular visuals proposed in each deck. Each visual creates a connection between the individual points of interest (places and histories that they summarize) described on each card, thereby composing a specific tour. Therefore, after careful analysis of the tangible and intangible heritage of the Esquilino area, the four visuals according to which the points of interest are grouped are: Magic, Memory, Transition, and Blend/Fusion/Influence (figs. 4, 5). As can be easily understood, these visuals represent categories and qualities with a level of generalization such that they may be used effectively to describe other urban areas. More than being related to a particular object, they refer to a particular experience that can be had by crossing urban places: an unexpected view, the dreamlike aspect of a story, the fascination of a show or concert, aesthetic enjoyment of a work of art, the memory of old history, the evocation of recent history, the transition between one era and another made physically by crossing a city, the connection between apparently different places, the evidence of modern multiculturalism, the stratification that condenses an urban space, the perennial co-existence between sacred and secular etc. Once the structure of the game and principal rules had been defined, the graphical elements were designed –figures, colours, backgrounds, symbols, characters, layouts– such that they worked together to orient players starting out on a trip through *The Esquilino Tale*s. Therefore, each place and its associated history is represented by a figure, while the visual narrative (Magic, Memory, Transition, Fusion) is entrusted both to the colour palette and a symbol (suit).
For the figures, the goal was to define a recognizable style. After various tests [8] (fig. 6), it was decided that these figures should be borderless and emerge from the juxtaposition of mostly regular geometric shapes. Only flat colour tones, selected from within the same chromatic tonality would be used, simulating the use of watercolour with different brush sizes in the digital environment. The next step was to associate a prominent chromatic tone with each of the narrative visuals (violet/blue for Magic, grey for Memory, green/teal for Transition, orange/ochre for Fusion), followed by development of the four corresponding backgrounds (fig. 7), these characterized by soft, sinuous forms that, except for minor modifications, were adopted for all cards pertaining to the same family (fig. 8). The next step was to design the graphics of the different suits (fig. 9). An ideogrammatic stylization was chosen to express the four visuals, each characterized by iconographic uniformity with respect to the shape (triangle, square, circle, and rounded corners) and colour (black). Following this, to avoid disorienting the player, the layout was defined for the arrangement of the graphical elements in the compositional space of the cards, which measure 8 cm x 12 cm (fig. 10). On the front, the upper left contains the "E" and the text "Esquilino", which are balanced on the right by the suit, the card number, and the name of the visual. Vertically, the space of the card is divided into two parts: the top contains the figure situated on the background, while below, there is a white band that contains the name of the place, centred (bold serif





Figs. 11, 12. The experience The Esquilino Tales offered by the website. After animation similar to a slot machine, one can access a dedicated page in the footer, in which the data and information are summarized, or begin the experience. The exploration of the Casino Massimo Lancellotti: in fig. 11 the virtual tour and the photographic slide show (created by Simone Amarante, James Douch, and Federica Giannoni); in fig. 12 the video (created by Simone Amarante).

font of a size designed to be read easily), along with a subtitle that hints at the history (sans serif characters of a notably smaller size).
For the back of the cards, the graphical choices were consistent with those described above. The four suits are situated at the corners of the card, but in grey, on a background similar to the one on the front, but with a non-interfering colour tone. Finally, a combination of circles and squares circumscribes the space containing the QR code (fig. 3) for access to multimedia content available in the form of text or images – iconography, photographs, panoramas to be navigated, brief videos (figs. 11, 12). The different types of content are assigned different roles in the narration. Videos introduce the history and create an empathic relationship with players in order to capture them in the game. Spherical panoramas offer a partially immersive and interactive tour via hot spots. The iconography and photographic images summarize the main features of the places, and the texts underline the characteristics and relate facts and events. The structure of links through the QR code allows interest in play to be maintained through constant, continuous updating of the content, implemented by expert curators and editorial staff.

Fig. 13. The experience The Esquilino Tales as first action for enhancement and urban regeneration of Rome city.

A summary representation of *The Esquilino Tales* is found on the home page, the interface for the curators and editorial staff, where an animated graphic similar a slot machine is built in analogy with the front of the cards. The 4 suits of families/visuals appear, ending with the field *The Esquilino Tales*, which lies at the centre. At the end of the animation, the visitor/player is presented with 40 small circles that rotate on the path of a larger circle. By clicking on one of the small circles, the player randomly accesses an individual card. After the textual presentation of the experience, the player can then move on to different content (360° tour, photographic slide show, video) by selecting the corresponding icon. (figs. 11, 12).

Conclusion

This experimentation investigated the practices of representation, innovating with them through the techniques of storytelling, gamification, and storydoing, with the aim of developing a communication strategy within a wide range of graphical/visual languages. In this strategy, active means of exploration such as initial actions for enhancement and urban regeneration are proposed for initiation between the visitors/citizens and the Esquilino district/city to begin to rescue our city [9] (fig. 13).
With The Esquilino Tales the challenge was to hold physical and virtual places together through the interfaces/representations imagined as new agorae where connections can be made between visitors, experts, and cultural goods. This system of representations is a start to exploring the Esquilino district, mixing past and present, monumental memories and recent history, life in Rome and multiculturalism, local and global, inclusion and exclusion, architectural style and spatial indeterminacy.
In our opinion, this experience falls entirely under the more general area of "city representations", a particular family of representations with an extremely wide range of types and variations spanning the entire array of representational conventions –from figures to signs, from concept to plausibility– all of which are similar since they are emotional devices. This emotional capacity to suggest histories and interpretations is still present in city representations, albeit with forms that have changed and undergone innovation due to new media. The representations encompass different registers of figures (static images, graphics and photographs, and moving images) organized like an atlas, where the atlas acts as a tool

for deconstructing reality, reconfiguring it and communicating it as the juxtaposition of fragments of memories.
*The Esquilino Tale*s is therefore a "machine for thinking" due to that imaginative mechanism that is activated by recognizing an undefinable proximity and affinity in a series of representations, that is, that certain «air of family» [Settis, 2017, p. 97]. While it seems impossible to reconcile single and multiple, identity and community in certain years, this "machine for thinking" offers a set of possible views of the Esquilino district to reconstruct the topography of an imaginable but tangible city that holds together memory and future.

Notes

[1] The experience was carried out with students in the Master in Communication of Cultural Goods at the Sapienza University of Rome, started by the Department of History, Design and Restoration of Architecture and the School of Architecture. Collaborating in the experience were Leonardo Paris, Cristian Farinella, Lorena Greco, and Stefano Volante.

[2] The multipurpose space of Palazzo Merulana, the site of the Fondazione Elena e Claudio Cerasi with a collection of works from the Roman school and the Italian twentieth century, opened in 2018 following restoration of the former Esquilino Ufficio di Igiene.

[3] Of particular interest is a study by Federico Cingano and Piero Cipollone published in Questioni di economia e finanza edited by the Bank of Italy, to measure the economic effects of investments in education. Indeed, these are higher than what can be obtained from financial or infrastructure investments and generally suggest that overall, profits from the community point of view would be even higher.

[4] The reflection was widely expressed by Bruno 2006. According to the author, emotional attitudes towards virtual tours is cultivated and developed over time by different forms of the inhabited space. This emotional capacity is present in cartography even in the modern age, while having changed into other forms such as in cinema. For Bruno, cinema is therefore the new geography, that is, the favoured medium for evoking emotion by observing the landscape, the city, and its architecture, which are represented through that wandering incorporated in cinema itself.

[5] Various reasons include the economic resources necessary to create a video game with a setting that could produce emotional involvement and compete with what is currently on the market, as shown, for example, by the editions of Rome Video Game Lab held annually since 2018. More in general, we are convinced by what Alessandro Baricco says, 'Game is a most difficult habit, one that offers intensity in exchange for insecurity, generates inequalities, and is not appropriate for many people' «*il Game è un habitat molto difficile, che offre intensità in cambio di insicurezza, genera disuguaglianze e non è adatto a un sacco di gente*» [Baricco 2018, p. 196].

[6] Among the different types of table games analysed, we mention only the main, best-known ones, including, 'path' games – snakes and ladders, Taboo etc. – luck and statistics – Risk, Monopoly, etc. – abstract – chess, checkers, backgammon, etc.

[7] One of the reasons for choosing collectable cards is also the very strong iconographic relationships that tie these cards to art history, as shown by Lampis 2018, pp. 270, 271.

[8] Different references range from Neapolitan and French playing cards to collectible Magic: The Gathering cards, as well as the gaming platform Gris (developed by Nomada Studio and directed by Conrad Roset) and the 2D side-scrolling game Father and Son (created by Ludovico Solima at the Luigi Vanvitelli University of Campania for the National Archaeological Museum of Naples, with scientific supervision by director Paolo Giulierini and development by Tuo Museo by the game designer Fabio Viola).

[9] The experience was presented at one of the laboratory encounters organized within the project/show *Riscatti di Città. La rigenerazione urbana a Roma* [Rescuing the City. Urban Regeneration in Rome], Palazzo Merulana, held between 18 January and 17 February 2020.

Authors

Elena Ilppoliti, Department of History, Representation and Restoration of Architecture, Sapienza University of Rome, elena.ippoliti@uniroma1.it
Andrea Casale, Department of History, Representation and Restoration of Architecture, Sapienza University of Rome, andrea.casale@uniroma1.it

Reference List

Albisinni, P., Ippoliti, E. (a cura di). (2016). Virtual Museums of Architecture and City. DisegnareCon, 9(17)

Asproni, P. (2018). *Musei: trasformazioni e prospettive. In Il Giornale delle Fondazioni. Museo Quo Vadis?*. <http://www.ilgiornaledellefondazioni.com/content/musei-trasformazioni-e-prospettive> (accessed 2021, March 10).

Baricco, A. (2018). *The Game*. Torino: Einaudi.

Bray, M. (2013). *Il turismo e l'incontro tra beni culturali e territorio*. <http://www.massimobray.it/il-turismo-e-lincontro-tra-beni-culturali-e-territorio/> (accessed 2021, March 10).

Bruno, G. (2006). *Atlante delle emozioni: in viaggio tra arte architettura e cinema*. Milano: Bruno Mondadori.

Cameron, D. F. (1968). A viewpoint: The Museum as a communication system and implications for museum education. In *Curator. The Museum Journal*, 11(1), pp. 33-40.

Cingano, F., Cipollone, P. (2009). *I rendimenti dell'istruzione (The private and social return to schooling in Italy)*. (Occasional Papers), 53, pp. 1-27. <https://www.bancaditalia.it/pubblicazioni/qef/2009-0053/index.html> (accessed 2021, March 10).

Corbisiero, F., Berritto A. (2017). I bambini inventano la città: partecipare per progettare. In *La città creativa. Spazi pubblici e luoghi della quotidianità*. CNAPPC Consiglio Nazionale Architetti Pianificatori Paesaggisti e Conservatori, pp. 263-270. <http://www.cittacreative.eu/wp-content/uploads/2017/04/La_citt%C3%A0_creativa_2017.pdf> (accessed 2021, March 10).

Desvallées, A., Mairesse, F. (a cura di). (2016). *Concetti chiave di museologia*. Parigi: A. Colin. International Council of Museums.

Eco, U. (1973). Homo Ludens Oggi. In J. Huizinga. *Homo Ludens*, pp. VI-I-XXVII. Torino: Einaudi.

Eco, U. (1991). *Lector in fabula: la cooperazione interpretativa nei testi narrativi*. Milano: Bompiani.

Gariboldi, A. (2017). La rivoluzione copernicana dei pubblici. In *Il Giornale delle Fondazioni. Studi e ricerche* <http://www.ilgiornaledellefondazioni.com/content/la-rivoluzione-copernicana-dei-pubblici> (accessed 2021, March 10).

Huizinga, J. (1949). *Homo Ludens. A study of the Play-Element in Culture*. London: Routledge and Kegan Paul Ltd.

Lampis, A. (2018). I videogiochi per conoscere arte e cultura. In *Economia della Cultura, Rivista trimestrale dell'Associazione per l'Economia della Cultura*. 3/2018, pp. 269-274.

Lasswell, H. D. (1948). The structure and function of communication in society. In L. Bryson (ed.). *The communication of ideas*, pp. 37-52. New York: Institute for Religious and Social Studies, Harper & Brothers.

Lugli, A. (1993). Museologia. In A. Conti, R. Cassanelli (a cura di). *L'arte. Critica e conservazione*, pp. 75-100. Milano: Jaca book.

Luigini, A., Panciroli, C. (a cura di). (2018). *Ambienti digitali per l'educazione all'arte e al patrimonio*. Milano: FrancoAngeli.

Mangani, G. (2007). Introduzione alla riedizione del Teatro del mondo di Abramo Ortelio (Venezia 1724). In *L'Universo*, a. LXXXVII, n. 6, 2007, supplemento <http://nuke.giorgiomangani.it/Portals/0/GiorgioMangani/downloads/Introduzione%20a%20Teatro%20del%20mondo%202007.pdf> (accessed 2021, March 10).

MiBACT (2014). *Organizzazione e funzionamento dei musei statali*, Decreto 23 dicembre 2014 (Decreto Musei). <http://musei.beniculturali.it/wp-content/uploads/2018/04/Decreto-Ministeriale-23-12-2014-agg.-02-2018-ECA.pdf> (accessed 2021, March 10).

Mottola Molfino, A. (2007). *Museo* (lemma). In Treccani, Enciclopedia Italiana. VII Appendice <http://www.treccani.it/enciclopedia/museo_res-81d75601-9bc2-11e2-9d1b-00271042e8d9_(Enciclopedia-Italiana)/> (accessed 2021, March 10).

Paglieri, F. (2002). Credendo di giocare. Verso un'interpretazione cognitivista dei processi ludici. In *Sistemi intelligenti*, 14 (3), pp. 371-415.

Pescarin, S. (a cura di). (2020). *Videogames, Ricerca, Patrimonio Culturale*. Milano: FrancoAngeli.

Pomian, K. (1987). *Collectionneurs, amateurs et curieux. Paris, Venise: XVIe-XVIIe siècle*. Paris: Gallimard.

Ragonese, R. (2010). Guide turistiche: un'introduzione. In *E|C Serie Speciale. Journal online of AISS - Associazione Italiana di Studi Semiotici*, anno IV, n. 6, pp. 5-18.

Rogers, F., Sharapan H. B., (1994). How children use play. In *Education Digest*, 59(8), pp. 13-16.

Settis, S. (2002). *Italia S.p.A. L'assalto al patrimonio culturale*. Torino: Einaudi.

Settis, S. (2017). Un confronto tra Geburtstagsatlas e Mnemosyne Atlas: Tavola 7*. In Settis S., Pedersoli A., Culotta S., *Esercizi di confronto tra le Tavole 7, 30, 37 del Geburtstagsatlas di Gombrich e le corrispondenti del Mnemosyne Atlas, La Rivista di Engramma,* 151/2017, pp. 96-100.

UNESCO (2003). *Convention for the Safeguarding of the Intangible Cultural Heritage* <https://ich.unesco.org/en/convention> (accessed 2021, March 10).

UNESCO (2015). *Recommendation concerning the Protection and Promotion of Museums and Collections, their Diversity and their Role in Society* <http://umac.icom.museum/wp-content/uploads/2018/08/246331m.pdf> (accessed 2021, March 10).

Viola, F., Idone Cassone, V. (2017). *L'arte del coinvolgimento. Emozioni e stimoli per cambiare il mondo*. Milano: Hoepli.

Aspects and Criticalities of the Fruition in Subjective of the Digital Space: the 'First Person View'

Graziano Mario Valenti, Alessandro Martinelli

Abstract

The research illustrated here stems from a critical reflection on the theme of 'first person view', as defined in the context of interactive virtual digital three-dimensional representations. A reflection arising from the perceptive, communicative, illusory and narrative wonder typical of seventeenth-century architectural perspectives, in contrast with the more slender –compared to the forces at play– suggestive efficacy of the typical scenarios of today's digital immersive perspective enjoyment. Through an analytical phase of observation of the natural experience of seeing and moving in the space of the real world, an attempt was made to identify some macroscopic critical issues and functional gaps, now deliberately or individually neglected in the implementation of the use of digitally simulated three-dimensional space. In this way, three macro areas of potential intervention have been identified and described in their salient features and, for each of them, some emerging qualitative factors have been focused, the care of which can perfect the experience of three-dimensional fruition and, consequently, the cognitive activity of the digital virtual space, as well as of the information contained therein. The final goal of the research is in fact to perfect and personalize the virtual fruition of digital museum spaces.

Keywords: first person view, perspective, perception, real-time 3D, virtual museums

Introduction

The museum installations and the cognitive paths designed within the cultural heritage present, with increasing frequency, spaces intended for the fruition of digital models by means of headsets, which drop the viewer in virtual, augmented or mixed reality.
Despite the extraordinary innovation and technological evolution that can be found both in the production of headsets and in the representation of digital models, the direct experience of real space is so complex, and sometimes even personal, that each digital simulation that aims to effectively reproduce the sensorial impact and the innate cognitive goal, results in an 'other', different experience. For this reason, it is frequent to resort to alternative solutions, which avoid facing the simulation of reality in its total complexity. In the context of videogames, for example, it is usual to drop the visitor into a virtual space with an unreal character, at times imaginative if not even 'cartoon', where the experience itself is worth: an immersion in a large digital playground, whose nature is never to be associated, much less to be compared, with the experience in the real world [Schwartz 2006] (fig. 1).
This experiential-communicative paradigm is the foundation of the information aids produced in the field of gamification which, in general, seem to prefer motor perceptual learning, rather than a symbolic reconstructive one [Antinucci 1998].
The narrative emphasis that derives from this approach is certainly consistent with the development of a video

game. However, it leaves some perplexity when it is extended as an optimal and universal solution for any other information activity. The digital use of museums, for example, carried out mostly in an undifferentiated form for the target user, is among the activities most at risk of this applicative singularity [Modena 2019].
Since the early 1990s, with the birth of the World Wide Web and the subsequent opening of the Internet to the vast public, the methods of sharing digital information relating to cultural heritage have taken on different forms, naturally of increasing complexity: from the most simple hypertextual/hypermedial product, to the 360-degree photographic sequence of the exhibition space, up to the most advanced interactive navigation experiences in virtual three-dimensional spaces, where the user is equipped with haptic and stereoscopic interfaces.
However, by observing and above all experiencing the state of the art directly, the reduced pervasiveness of information communication in a three-dimensional context appears to remain, a mode frequented more out of curiosity about technology than for actual communicative surplus value. There may be many interpretative keys aimed at identifying the reasons for the recurrent oscillation, between enthusiasm and disappointment, which characterizes the interest in three-dimensional digital operations. Reasons that in substance are all attributable to the consideration that in digital simulations it is possible to focus and 'increase' only some aspect of experience and communication, which however manifests itself in a sensorial context that is still too poor compared to that determined by real experience and with which it inevitably ends up confronting itself. The digital experience therefore remains, even today, an integrative activity and is far from being a replacement.
In analyzing what were the sensory gaps that still make the two experiences incomparable [Paes 2017] and seeing if there was space to provide a useful research contribution to fill them, the areas of study appeared numerous and mostly affordable only in an interdisciplinary way, requiring to put in system skills in geometry, optics, computer science, anatomy, neurology, psychology, and so on. Within this scenario, our attention was therefore focused on a central aspect of the problem and precisely of research in the field of drawing. A qualitative factor of three-dimensional fruition that, compared to the role it covers, appeared all too neglected: the knowledge of the digital space and the information contained in it in the mode defined as 'first-person view' (fig. 2). A first substantial survey was therefore initiated on this qualitative factor, followed by an analytical reflection, aimed at identifying criticalities and potentialities: operational, perceptive and cognitive.

Fig. 1. The 'cartoon' representation of reality in Fortnite and Minecraft.

The 'first person view'

The 'first person view' is a conceptual model of representation: a relationship between observed reality and observer, where the latter has an active participation, as the protagonist of the scene and not as a mere spectator. It is also a spatial relationship understood in a geometric sense, proportional and kinematic between the elements making up the representation, since, in becoming the protagonist of the scene, the observer must assume the same presence and behavior of the subject he identifies. Not surprisingly, the first person view is otherwise known in cinematographic language with the name of 'subjective'.
By drawing on the extensive discussion that history and film criticism has dedicated to this particular way of shooting the scene, two families of influencing factors can be deduced that perfect the narrative effectiveness of the first person view. Representative families of factors, one exogenous and the other endogenous compared to the observer. We can consider exogenous factors those expedients external to the visual phenomenon adopted to communicate and reinforce the idea that the image being enjoyed is the product of a first person view. At the origins of cinema, when there was still no technology and in part even the theoretical knowledge to faithfully reproduce a subjective shot, the illusion of the viewer was emphasized through the visual narration associated with the use of mattes [Eugeni 2020].
For example, initially the protagonist of the scene was filmed in the act of positioning a telescope on the eye and in the following images what he saw in 'subjective' through it was simulated, cutting out the frame with a circular matte (fig. 3). Over time, the visual narrative has been very refined, emphasizing the illusion of subjective sight through the careful framing of parts of the subject's body, in which the viewer had to identify himself (fig. 3). These exogenous factors, to which the appropriate use of sound must certainly also be added –e.g. heartbeat and footsteps during a labored run– are of considerable interest also in the digital virtual environment, but, in the part of the research described here, the attention was based on endogenous factors, which strictly depend on the physiology and behavior of the human body, albeit investigated and reproduced with a reasonable margin of approximation. Within this family of factors, we distinguish three prevalent areas of possible intervention: geometric-projective, physiological-perceptive, kinematic.

Fig. 2. Rigging of the camera to obtain the first person view (FPV). Unreal 5.

Geometric-projective field

The representation of digital three-dimensional space, like the analog one, originated from the geometric simplification of the visual phenomenon. A simplification that is stronger the more the elements making up the scene are numerous and complex and the more the image must be formed rapidly in real time. The starting point of this simplification are the principles of *perspectiva artificialis*, which describe with sufficient approximation the projective phenomenon characteristic of a photographic apparatus and which the human being, with a consistent operation of mental interpretation, is now accustomed to associate identical to his own vision.
Of this simplified model we cite, by way of example, some aspects of the approximation: the eye is considered in the abstract form of a point; it is often unique and has a homogeneous sensitivity; therefore, there are neither perspective aberrations, nor peripheral areas of lesser detail; the surface on which the light rays are projected is flat. It should also be remembered that the image that is formed in the mind as a consequence of direct observation of the real world is constructed with the contribution of the complex phenomena of visual perception [Amoruso 2020], while, in the use of a digital image, perception takes over from the constructed image: it therefore collaborates in a minor form, to its definition and to those processes of attenuation-emphasis produced by the cultural and subjective interpretation of the observed space. Processes that could significantly change the color, size, orientation, geometry of what we observe.
We do not want to refer here specifically to the explored question of cultural interpretation of perspective, raised by Panofsky and Gioseffi, which would open a field of

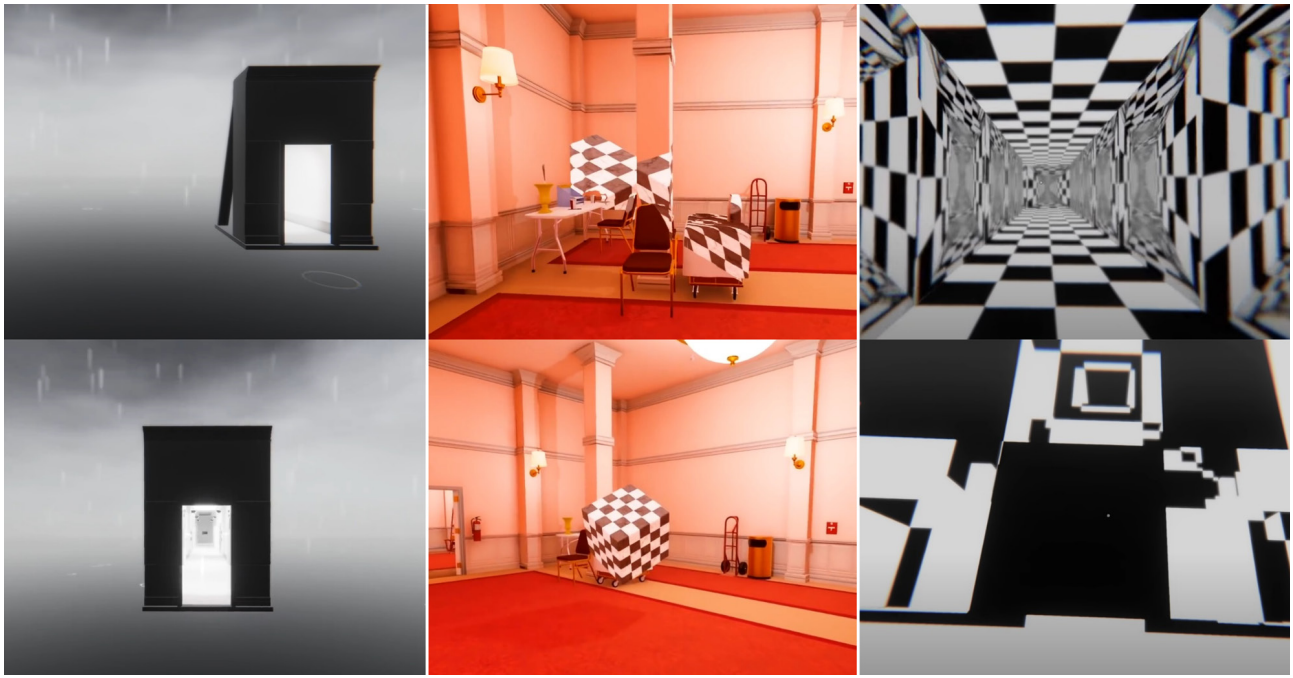
Fig. 3. Use of the circular matte in Ce que l'on voit de mon sixième (F. Zecca 1901); blurred vision of hair in the wind in Notorius (A. Hitchcock 1946) ; from murder to suicide in Spellbound (A. Hitchcock 1945).

conceptual treatment closer to aspects related to visual perception than to geometry; instead, we allude to the ability and habit of the mind to normalize the observed space, as happens for example in the face of small fluctuations in the point of view. Attenuations of the projective alterations of space, which are typical of the natural vision process and which are generally not present in the digital dynamic perspective image, because there are no devices suitable for their control or simply because it has been chosen to neglect them. Consider, for example, how little evident it is, without tracing the thought back to the principles of perspective, to perceive live and on a small scale the possible convergence in vanishing line of the vertical lines, consequent to a consistent zenith rotation of the head upward or downward, and how vice versa this convergence appears instead evident in a two-dimensional image, a digital projection of the same space. Think again of the stability-straightening of the vertical and horizontal orientation of the image perceived in the face of small rotations of the head, compared to what would happen by rotating the camera of a digital representation or even more simply by observing a perspective drawn on a sheet arranged with orientation random in front of us.

The more we manage to immerse the viewer in virtual space, the more the mind is deceived and stimulated to behave as in real space.

Binocular vision, obtainable by wearing modern stereoscopic headsets, attenuates the presence of some of the phenomena described. However, the attention dedicated to the development of this technology and the care in its rigorous use do not seem to be proportional to the significant contribution they could offer in favor of the implementation quality of virtual three-dimensional fruition systems.

Fig. 4. Perspective illusions and multidimensional spaces in Superliminal. The solution of the alterations and perspective, illusions guide the player through the virtual space.



The attention and commitment of the creative operators in the sector of communication of cultural heritage is mostly biased towards the project of information content, while with regard to the tools –specifically in the choice of the methods of use– are often used standard procedures which, except for a few cases of technological experimentation, they are often very simplified simulations of the real phenomenon they want to allude to.
With Vitruvian etymological inspiration from the term 'scenography', but with a precise reference to the geometries that make up the space observed, to this geometric-projective field belong the scenic factors too, which can affect and in particular direct the exploratory path of digital space. In the cognitive appropriation of space achieved through the vision of a film product, the viewer is bound to the movements of the camera, along paths that have been designed by the director and specially characterized by the set designer. In the theatrical field, even if there is no interposition of the shooting equipment between the observer and the observed space, the position of the spectator is generally fixed and, once again, the director and set designer determine what must and can be seen. In interactive digital three-dimensional fruition, on the other hand, the observer can move freely and is able to potentially explore every corner of the scene. In the construction of a virtual museum experience, therefore, the design of the environment cannot be limited to the definition of the exhibition equipment useful for emphasizing the knowledge of the objects on display. Rather, it will be necessary to pay particular attention to the introduction of scenic precautions, which have both limiting and attractive value, in order to contain and direct the user's path in the virtual space [Nielsen 2016] (fig. 4).
With specific reference to the seventeenth-century architectural perspectives, which initiated the reflection on the theme of first-person view, think, for example, of the mastery in the use of anamorphosis, visible in the work attributed to Jean François Niceron (1613-1646), present in the convent of Trinità dei Monti in Rome and concerning Saint John the Evangelist on the island of Pathmos while writing the Apocalypse. A work where the user is encouraged to move from perspective expedients to reach knowledge and make the narrated message their own [Trevisan 2015].
To prevent the user from getting lost or lingering in the digital space, some videogames have used so-called cutscenes, during which the user loses or reduces the autonomy of control of the virtual space navigation and proceeds 'automatically' to a new place of the scene. While helping to keep the pace and dynamics of the game high, the judgments on their use are very discordant: since the more these tricks are present, the more we move away from the quality and benefits of personal experience.

Physiological-perceptive field

The eye is a complex sensory organ with heterogeneous performance in humans. Its digital form, we have said to be mostly simplified, but various physiological factors, should instead be considered with great attention, since they significantly contribute to modifying the projective geometric rigor and communicative pervasiveness of the image. Sev-

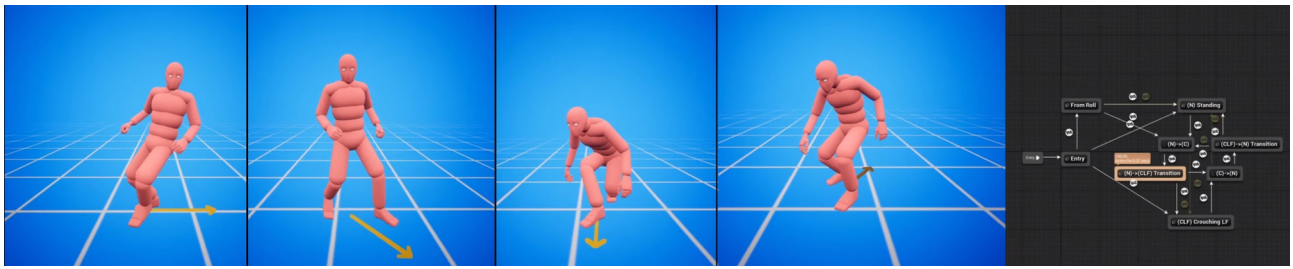
Fig. 5. Examples of images captured in photomode. Polygon: <https://www.youtube.com/watch?v=PZ4jY0LOPVg> (consultato il 12 maggio 2021).

eral of these physiological factors, characteristic of the human eye, also belong to inorganic photographic equipment, perhaps also for this reason they have found greater attention in digital implementation: focus, width and depth of field, blur, sharpness, brightness, contrast. In recent years, the most advanced videogames have begun to offer a particular mode of use called *photomode* (fig. 5). When the player enters this mode, he turns into a virtual photographer and the scene is arrested in an instant. It is not a simple capture of what is projected on the screen, but a real exploration of the immobilized virtual space, with the possibility of controlling the virtual photographic set as if it were a real set. More than a game within a game, this operational opportunity is assuming the important role of vector and training aid in the dissemination of the culture of the image and its communicative power. Thus, a new profession of digital scenery photographer has emerged, which creates another bridge, perhaps closing the circle, between three worlds of digital photography, characterized by shots produced in real life, in a deferred rendering environment and finally in real-time virtual rendering scenarios. If this is the trend that is emerging –as a need– in the field of videogames, it is natural to think that even in the virtual museum fruition we will soon proceed in this direction. The photographic shot of the cultural asset is now already widely desired in the real world and recently mostly granted, given the benefit it brings in the role of promotional image when shared on social networks. It is therefore a question of making the project of fruition of the virtual museum and the possibility of seeing of the user even more complex, studying in detail also this emerging mode of interaction.
Referring to the qualitative factors deriving from considerations on visual perception, the research has identified several of them, during the recognition phase. The theme, as expected, turned out to be very wide [Casale 2016] and untraceable in this context. However, there is an aspect that cannot be avoided and that concerns inclusiveness: one of the key challenges of the current research European 'Culture, creativity and inclusive society'. The role of visual perception, understood as a physiological and cultural media, is the tool to be explored, to create personalized digital environments on the heterogeneity of users. Inclusive virtual spaces, where different skills, different cultures, different generations can also access and understand information.

Kinematic field

The third macro area identified concerns kinematics, that is the geometric description of the motion of the organs of vision. The solutions prevalent today use excessive simplifications or complex descriptions of the movement which, however, are customized on particular dynamic activities of the game. In still other cases, there is a tendency to reproduce the camera movements which, although familiar, belong to the expressive repertoire of the cinematographic image and are therefore not characteristic of the personal visual experience. In this type of digital experience, camera movements such as panning, tracking shots, zooming are frequently mixed continuously, undoubtedly making the aesthetic experience of digital use rich but, at the same time, distancing it from reality.
A correct kinematics of the first person view should be based on the study of a motion that necessarily passes through the analysis of the chain of independent move-

Fig. 6. Unreal Advanced Locomotion System V. 4: visual programming of the avatar's movements.



ments that defines the absolute orientation of the visual organs compared to the observed space [Boletsis 2019] (Fig. 6). With reference to the natural movement of the human being, who proceeds by walking in real space observing what surrounds him, the corresponding avatar designed for the virtual space should have a pair of points of view –perspective projection centers– placed in correspondence with the eyes. Their orientation will be determined respectively: by the movement of the eyes, by the orientation of the head and, finally, by the posture of the body that supports the head.

Eyes

The eyes orient themselves in space through movements of various kinds, both voluntary and involuntary. Some are almost imperceptible and have little influence on the representation, others, conversely, are more consistent and not negligible. In the context of involuntary movements, the vestibular-ocular and optokinetic reflexes must certainly be included, both of which are useful for keeping the point collimated by compensating for any movements of the head and body. Instead, belong to voluntary movements those called vergence, which allow the two eyes to collimate a single point, even if moving away (divergence) and approaching (convergence) to our face. For our evaluations, the voluntary saccadic movement plays a fundamental role, which aims to rotate the eyeball, bringing the observed objects to collimate with the central region of the retina, of maximum visual acuity [Sun 2018]. This movement, which would allow an excursion of about 90 degrees, is actually normally used within 20 degrees –for example, about two degrees when walking through the lines of a text–, beyond which one instinctively tends to bring into play the head rotation. On a perceptual level, as can be learned by rotating the eyeballs in a constrained view situation, the changes to the projective product are minimal. It is therefore difficult to perceive projective differences between the saccadic movement carried out in front of a real space compared to the same movement obtained by observing a two-dimensional projection of the same space made on a screen/headset.

Head

The movements of the head, in the digital environment, are generally translated as rotation of the main direction of the perspective view, applied precisely in correspondence with the center of projection. This completely eliminates the phenomenon of parallax, which instead is perceived

Fig. 7. Death Stranding (2019): one of the most advanced digital simulations of the anatomical and motor dynamics of the avatar.

in natural rotation, as it is impossible for us to rotate our head while keeping still what we perceive to be our center of projection. It should also be said that the movements in the digital environment are mostly linear, as are the panoramas, but in reality, when we move the head, the saccadic movement takes its liberties: it pauses and accelerates according to need, transforming the perception of the space in a decidedly different experience than the one tried digitally.

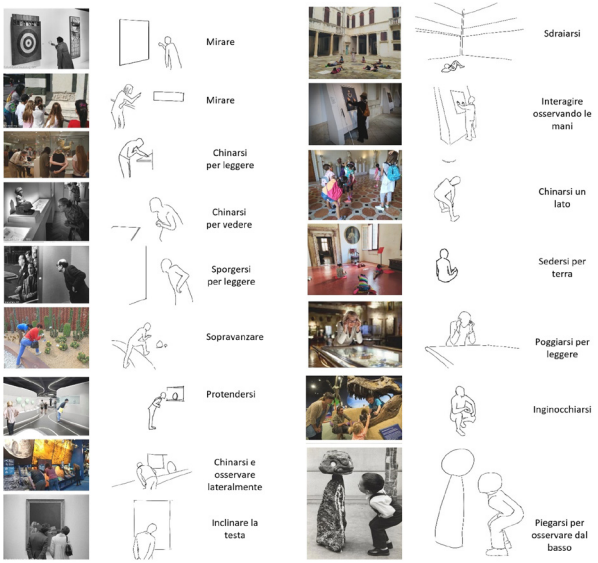
Body

Over time, from the origins of digital three-dimensional use until today, there have been significant improvements in the simulation of postures that have described the movements of the avatar in the virtual environment. If originally the movement was translated as a simple translation from the point of origin to that of destination, today –in the most refined models– it is instead the product of a complex kinematic sequence that affects all the organs of movement in which the body of the avatar is discretized. End of this chain, in the case of binocular vision, is a pair of vision centers located in correspondence with the eyes. The cinematic sequences are identified and reproduced thanks to the study and normalization of data collected through motion capture techniques. Recently, automatic recognition technologies have also spread, conducted with the aid of machine learning procedures, today widely used for face swapping [Nirkin 2019] or physic character control activities [Bergamin 2019]. If, on the one hand, in the panorama of Virtual Reality applications, there are vast motion-capture databases dedicated to the most extreme and demanding physical activities that can be assigned to the avatar (sports, fights, dance etc.), (fig. 7), much less material is available to fully describe and reproduce the slower, more reflective movements characteristic of normality. Only in the field of animation cinema, where the need to best characterize the characters with expressions and emotions of considerable realism has arisen, a greater attention was paid to the detail of normality.
A Part of the research was therefore dedicated to detecting a first group (fig. 8) of movements and postures that people assume when visiting an exhibition space. Movements that, in a subsequent phase, will be digitally implemented and tested.

Conclusions

The analysis of the three thematic macro areas and the related qualitative factors through which it is possible to perfection the experience of use and knowledge of the digital three-dimensional space, clearly shows the need to pursue the search for a new goal of equilibrium, where technological advancement on the one hand and the narrative project on the other find integration at a higher level of complexity. From the analysis of the state of the art, these operational scenarios today appear weakly linked: on the one hand, the technology useful for the use of three-dimensional digital space appears too influenced by a development oriented –obviously– to respond to the demands of the great demand, now from the world of videogames; on the other hand, the designers of the narrative paths useful for accessing the knowledge of three-dimensional space and the information it contains end up welcoming technological aids as a 'dogma' and focusing all their critical attention and innovation only on the subject

Fig. 8. Exemplary extract, in the form of an abacus, of the postures and movements to be digitized, identified by observing the activity of use of real exhibition spaces.



of the narrative. Already the first results of this research show, instead, how vast is the space of intervention between these two operational scenarios and how much it is necessary to strengthen interdisciplinary collaborations in order to increase and consolidate their links. In the geometric-projective field, for example, the relationship between derogation and rule in perspective representation should be further investigated, fueling the experimentation with knowledge from studies on visual perception. In the physiological-perceptive field, the coherence and narrative efficacy of the physiological aspects of human vision should be clarified, codified and tested, and on a strictly perceptive level, investigated the attractive and dissuasive potential of the space useful for directing the visitor's path. Finally, in the cinematic field, if on one front it is necessary to continue to develop the immersive technologies necessary to access the digital space, so that they can offer the recording and control of multiple parameters of human behavior, on the other hand it is appropriate that these parameters are adequately regulated by the designers of the narration, so that digital information can be accessed in ways similar to natural ones. Parameters that more than enumerated, valued and counted, must be mapped as Laura Marcolini suggests [Amoruso 2020].

Authors

Graziano Mario Valenti, Department of History, Representation and Restoration of Architecture, Sapienza University of Roma, grazianomario.valenti@uniroma1.it
Alessandro Martinelli, Department of History, Representation and Restoration of Achitecture, Sapienza University of Roma, alessandro.martinelli@uniroma1.it

Reference List

Amoruso, G. (2020). disegnare con… Laura Marcolini. In *DisegnareCon*, vol. 13, n. 25.

Antinucci, F. (1998). Musei e nuove tecnologie: dov'è il problema? In *Sistemi intelligenti*, vol. X, n. 2, pp. 281-306.

Bergamin, K., Clavet, S., Holden, D., Forbes, J. R. (2019). DReCon: data-driven responsive control of physics-based characters. In *ACM Trans. Graph.*, vol. 38, n. 6, Article 206.

Boletsis, C., Cedergren, J. E. (2019). VR locomotion in the new era of virtual reality: an empirical comparison of prevalent techniques. In *Advances in Human-Computer Interaction*, vol. 2019. <https://doi.org/10.1155/2019/7420781> (accessed 2021, May 12).

Casale, A. (2018). *Forme della percezione: dal pensiero all'immagine*. Roma: Franco Angeli.

Eugeni, R., Guerra, M. (2020). Far sentire la macchina. Appunti sulla soggettiva cinematografica e la teoria dell'enunciazione. In *E/C*, anno XIV, n. 29, pp. 134-144.

Modena, E. (2019). Musei nei videogiochi| Videogiochi nei musei. In *Piano B Arti e culture visive*, n. 4, pp. 83-105.

Nielsen, L. T., et al. (2016). Missing the point: an exploration of how to guide users' attention during cinematic virtual reality, In S. N. Spencer (ed.). *VRST 2016. Atti del 22nd ACM Conference on Virtual Reality Software and Technology*, Monaco, Germania, 2-4 novembre, pp. 229-232. New York: Association for Computing Machinery Inc.

Nirkin, Y., Keller, Y., Hassner, T. (2019). FSGAN: Subject Agnostic Face Swapping and Reenactment, In *IEEE/CVF 2019*. Proceedings International Conference on Computer Vision, Seul, Corea, 27 ottobre-2 novembre, pp. 7184-7193: <https://openaccess.thecvf.com/content_ICCV_2019/papers/Nirkin_FSGAN_Subject_Agnostic_Face_Swapping_and_Reenactment_ICCV_2019_paper.pdf> (accessed 2021, May 12).

Paes, D., Arantes, E., Irizarry, J. (2017). Immersive environment for improving the understanding of architectural 3D models: Comparing user spatial perception between immersive and traditional virtual reality systems. In *Automation in Construction*, n. 84, pp. 292-303.

Schwartz, L. (2006). Fantasy, realism, and the other in recent video games, In *Space and culture*, n. 9, pp. 313-325.

Sun, Q., et al. (2018). Towards Virtual Reality Infinite Walking: Dynamic Saccadic Redirection. In *ACM Trans. Graph.*, vol. 37, n. 4. <https://doi.org/10.1145/3197517.3201294> accessed 2021, May 12).

Trevisan, E. (2015). Il san Giovanni Evangelista di Jean François Niceron: la scoperta di un'apocalisse dell'Ottica. In G. M. Valenti (a cura di), *Prospettive Architettoniche*, pp. 365-374 Roma: Sapienza Edizioni.

From the Representation of Urban Vulnerability: the Drawing of Graphic Abacuses for the Project

Giorgio Garzino, Maurizio Marco Bocconcino,
Mariapaola Vozzola, Giada Mazzone

Abstract

The contribution is part of more extended research, aimed at defining analysis tools and languages based on representation codes capable of describing quality and well-being in cities, particularly in the context of the current declinations and definitions of the terms vulnerability and resilience. Considerations on urban surveying and the deployment of complex information systems for graphic analysis in particular contexts are described. The concept of resilience applied to the city cannot disregard the specificity of places, a deep knowledge of the urban context, not only in its environmental, microclimatic and structural aspects but also in its morphological and morphogenetic ones. The places of resilience are those places that, in continuous change, allow for rethinking. The contribution shows how the urban survey, besides being an opportunity for the representation of levels of analysis and knowledge of the built environment, can become a scientific tool capable of inducing a second and deeper level of analysis, linked to different levels of knowledge, becoming an efficient cause of a type of derived knowledge. Considering the conditions of resilience and sustainability, we recognise the need for dialogue at different scales of complexity, of actors, of competencies, of disciplines, of intermediaries and of urban policies through common grounds of interchange that we have defined graphic abacuses for the project.

Keywords: city resilience, urban quality and well-being, representation methods, graphic abacuses for the project.

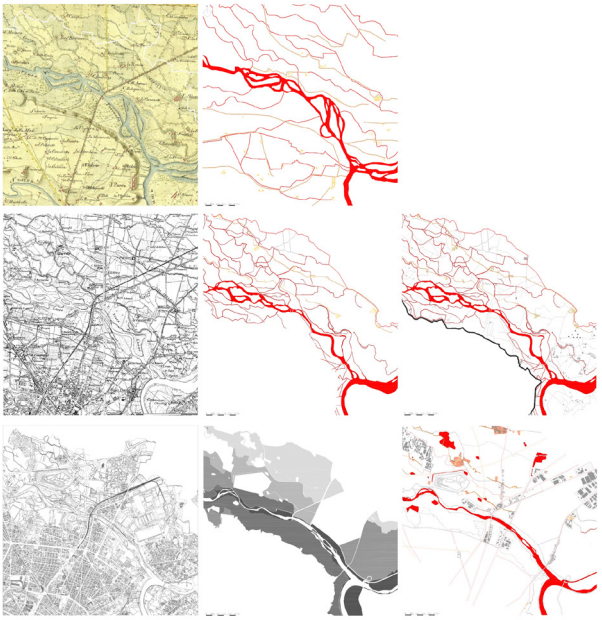
Introduction

The work presented here starts from the studies initiated in the last decade by Professor Giorgio Garzino on the subject of well-being and urban quality and graphic codes to support interpretation and project [Garzino 2010; Garzino et al. 2017b; Garzino et al. 2017c], including overtime the reading of vulnerability [Garzino et al. 2015; Garzino et al. 2016; Garzino et al. 2017] and the definition of new ways to represent the aspects of resilience and regeneration skills of territories and building structures that characterise urban form [Garzino, Novello 2011; Bocconcino et al. 2021], not only about the central and stratified courtly area but also regarding other structuring and characterisations that characterise the peri-urban areas and the neighbouring municipal areas [Garzino et al. 2020a; Garzino et al. 2020b; Garzino et al. 2020c; Garzino et al. 2020d]. In the present contribution, one field of study is the city of Turin, the object of extensive research by the Turin school related to surveying and representation, which sees in the founding teachers both roots –which anchor the methodological aspects to tested and 'traditional' ways of working– and branches leaning towards renewed tools for the future.

The study is part of wider research on new themes of the urban survey, focused on the definition of a language based on a graphic-symbolic codification able to describe different and heterogeneous cognitive levels of interest for the city, an interactive language in dynamic environments of representation. Through the possible declinations of the

term resilience for the urban contexts, the research examines the cultural and disciplinary premises of the urban survey, to arrive, through successive refinements, at the proposal of an updated system of representation integrated with the cognitive and intervention phases.
Considering resilience as one of the dimensions capable of orienting transformations lets us imagine its operational specificity (its own character) that 'in this historical moment' must be reintegrated into the theoretical and practical aspects of the culture of the project. An abacus of solutions/actions for urban regeneration represents a tool that dialogues with scholars and planners, thus being able to move within those realities that would need interventions, maintaining an overall vision. The abacus is composed of mitigation and adaptation actions, two fundamental conditions for the pursue of resilient urban environments, and possible action –solutions– strategies aimed at offering scenarios at the urban scale, oriented towards emergency or programming [Garzino et al. 2018]. We will then illustrate cognitive models with a graphic matrix capable of representing, in synthesis, demanding conceptual elaborations of a logical deductive type, and at the same time making uninterpreted data and analysis tools instantly available. The introduction of indicators representative of the urban and social evolution of an area containing new developments with a mix of functions, including social housing, is one of the starting points for highlighting changes in the form and identity of the place and possibilities for redevelopment or extension. The quality of the settlement is measured through a knowledge matrix, which provides a complete picture of the state of the art and outlines possible scenarios for future improvement. Taking a representative example, the northern suburbs of Turin, affected by complex processes of urban transformation and regeneration articulated in functional mixes that support social regeneration and housing policies together with temporary residential and commercial interventions. Some application developments have been given on two northern districts of Turin, Aurora and Pietralta, some of which are taken up here. (G.G, M.M.B.).

Fig. 1. Integrated reading of some documentary sources on a cartographic basis consisting of the Municipal Technical Map of the City of Turin, original scale 1:1000 (elaboration by G. Mazzone).

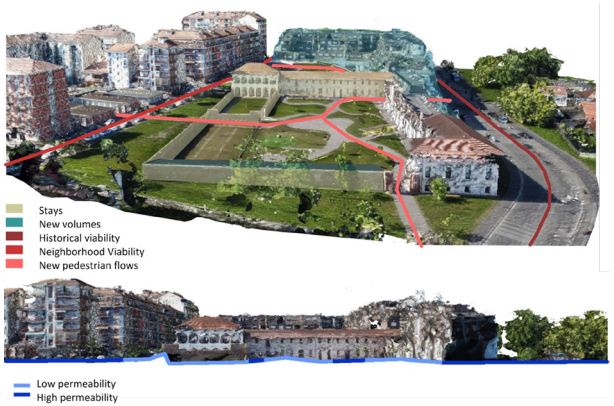


Application to read resilience through urban quality

Today we are faced with a renewed 'need for quality' of the spatial configuration of the places where human activities and life take place; a quality that can be verified through assessment mechanisms able to guarantee the control of outcomes in all those decision-making processes that induce changes in territorial and urban space [Brunetta et al. 2019].
Taking into account the formal outcomes of the actions and interventions on the territory, the aim of the new disciplinary paradigms is the introduction in the decision-making processes of new approaches and behaviours that recognise the importance of specific moments of evaluation and control on the outcomes of the interventions in terms of settlement shape.
The quality of the urban environment is mainly based on a project development that requires, in a first approach, a thorough knowledge of the parameters characterising the area; it is clear that each territorial situation requires a different analysis, as it is characterised by particular and punctual situations and therefore by different indicators: this simple consideration leads to the fact that it is not possible to define only the universal indicator or indicators, but that it is indispensable to examine also the set of indicators relating to the environmental and territorial situation to provide

certain and essential elements for comparison and data cross-referencing, such as to allow plan choices and regulatory indications for the formation of the planning tool.
Indicators are, therefore, the necessary tools to create a technically defined and unique code for the reading and interpretation of the various components of the territorial and environmental system under study.
The two 'fragments' of Turin's territory, the Cascina Fossata and Pietra Alta areas, are now both the object of specific regeneration interventions; these areas have been interpreted in contributions presented on previous occasions (see the authors' bibliography in this regard) by imagining them no longer as points, but as nodes of the different territorial networks of which they are part, reinterpreting a city that is redesigned on the geography and territory starting from what is still visible in the structures that built it (fig. 1).
The testing, aimed at identifying indicators that depend on the historical analysis and transformations of places, investigates in parallel both the representation of the chosen indicators and the visualisation tools. Sometimes the product of the accessibility tools could be numerical and listed in tables, matrixes or data sheets without offering any kind of visual result, at other times it needs accessibility tools and generates a two or three-dimensional visual product [Berkes, Folke 2000, p. 12].
A clear set of indicators focuses on the physical aspects and configuration of space as well as defining the accessibility

Fig. 2. Drone survey and modelling of the Cascina Fossata area. Identification of the road structure and volumes (elaboration by G. Mazzone).



of urban space and topological networks using the transport network as well as other networks based on visual perception.
Spatial accessibility, road connectivity measures and visual connections are some examples of tools that are based greatly on the spatial syntax approach and lead to the identification of a place-reading tool. Among the various tools, both traditionally and experimentally related to the model-

Fig. 3. Extract from abacus. Impact elements and schematisation of interventions (elaborazion by MP. Vozzola).

ling of urban geography, an application, specific to the case of Cascina Fossata, using the technique of drone modelling has been initiated (fig. 2).
Through the description of the context and the reading and interpretation of the indicators, and the integrated vision of the relationships between the different data, it is possible to identify the risk and/or quality elements relevant for the investigated building fabric, and consequently to obtain a picture of the state of the art to define the improvement strategies to be applied. One objective will be to assess the resilience, quality and urban comfort of the investigated context and to document the level of regeneration achieved and achievable by adapting mitigation actions. To realize this goal, the research team identified a matrix of indicators,

Fig. 4. An extract from the database of the 'vulnerability/action' graphic set (elaboration by G. Mazzone).

Fig. 5. Example of a case study diagram, with project information, main data and graphic tables (elaborazion by MP. Vozzola).

Vulnerability	Goal	Target	Action	Sketches
URBAN HEAT ISLAND FORMATION	Decrease of temperatures	Reduction of stored heat/reduction of incident radiation	Designing green corridors	
		Incident radiation reduction	Design shaded areas	
		Turning sensitive heat into latent heat	Realize urban forests	
DIFFICULT WATER RUNOFF	Rainwater management	Flow rate reduction	Designing artificial lakes/water plazas/rolling basins	
		Water separation/reduction of pollutant impact/reuse of water	Create storage tanks Phyto-purification systems	
		Increased permeability of surfaces	Making drains and infiltration trenches Increase surfaces with plant flooring Reduce waterproof surfaces	

listed and described in detail in previous works [Garzino et al. 2020b]. The indicators were selected from a wide range of indicators introduced in national and international studies, which have as their object the analysis of standard evaluations, characterising any urban fabric, and the formulation of new ad hoc indicators, which have made it possible to characterise and represent the typicality of the context investigated. Starting, therefore, from the reading and analysis of the ECI - European Common Indicators –through successive levels of refinement and deepening of the reading– mediating with the indicators of the Province of Turin, the City of Turin and other Italian cities, which have conducted studies on the analysis and representation of resilience and connections with the 'reuse' of the territory (e.g. the study conducted by the City of Cervia, the work carried out by the Emilia Romagna Region, the Reuse project of the Politecnico di Milano with the National Research Council, the European project Nature4Cities), and inserting ad hoc indicators that better represent the cognitive framework of the urban fabric investigated, the definition of different types of indicators has been achieved. Within the indicator categories, there are several parameters that better define and describe the heterogeneity of the urban fabric under investigation. The indicators defined in this way do not only represent data collected directly or from known databases or sources but are sufficiently sensitive to be able to represent and make visible the effects of the changes produced by urban regeneration interventions on the quality and urban comfort perceived by those living in the urban fabric under analysis. To achieve this level of data representation, two aspects have been taken into consideration: the level of spatial definition of the indicator, which must be adequate and appropriate to the scale of representation at which the different analyses are elaborated; the gradient of variation of the indicator, which must allow the entity of the variations to be correctly visualised. (M.P.V., G.M.).

From the analysis of resilient city projects to the archive of adaptation actions

The proposed research starts from an in-depth analysis of numerous projects developed and implemented around the world that have had the main objective of increasing the resilience of the cities in which they have been or will be adopted: the aim is to create a large cognitive framework of the state of the art, albeit not exhaustive and complete,

that allows to catalogue best practices and to identify the most suitable categories of intervention as a response to a given shock or stress.
To create the framework on which to build the database of interventions to be catalogued and the typologies, in a first phase 68 change factors –defined as Shocks and Stresses– were outlined, including actions related to social policies, health, climate change, economic, political and cultural factors. Case studies of national and international relevance were selected to become best practice examples of how and for what purpose they have responded to the emerging needs of modern cities. The projects analysed were divided according to the two scales of intervention: the urban scale and the neighbourhood scale, given the considerable difference in the tools and practices adopted. From the analysis of 125 cities responding to one of the identified Shocks and Stresses [1], several projects were analysed, the result of concluded or ongoing debates, whose response actions represent global trends in international metropolitan cities, shaping the future of resilient cities [Arup 2016] (Tab. 1).
In parallel with the study of resilient cities, some other projects have been analysed that have implemented solutions and actions aimed at containing the impacts on the city territory caused by one or more shocks or stresses. Examples at the national level are the projects promoted by the Metropolitan City of Milan, which has created consultable catalogues for the evaluation of adaptation actions to be implemented to counteract the impacts on the territory caused by climate events. The user can consult three applications to explore the catalogues presenting the adaptation actions:
a) adaptation actions: 10 main actions and 58 sub-actions were identified. For each main action, detailed data sheets were produced where the user can read the advantages and disadvantages of each proposed action, the impact of the action on the UHI and Run-off parameters, the expected effect and the planning tool to be implemented for the implementation of the action;
b) adaptation measures with naturalistic solutions: the most important naturalistic solutions (NBS – Nature-Based Solutions) that can be applied to the city to counteract and contain the effects caused by climate change are described. Three adaptation measures have been identified: water management, technical green in the built environment, urban green on the ground, and for each of them communication sheets have been created where it is possible to find some examples of measures already implemented within the city territory;
c) Nature Solutions Explorer: an interactive tool to explore NBS and the urban challenges that contribute to addressing them.
From the analysis and picture of the state of the art, the project database was constructed as an open working environment that is constantly being implemented. From the first mapping of the projects, it is possible to have an in-depth analysis of which actions have been developed in the territories, through the use of an in-depth table, where all the information relating to the action in response to the change factor to be contained has been catalogued. (M.P.V.).

The abacus and the introduction of graphic codes for the representation of resilience

The extent and performance of urban forms have traditionally been defined to respond to stable environmental conditions over long periods [Ahern 2011]. However, this assumption is no longer appropriate when dealing with unpredictable urban dynamics such as climatic and/or environmental changes and socio-economic transformations [Felson 2005; Ahern 2011; Felson et al. 2013]. There are numerous examples of cases in which the actors involved in the decision-making phases of the design of urban areas have had to abandon consolidated design practices to propose and define new approaches to the management of changes in the city, dictated by events that

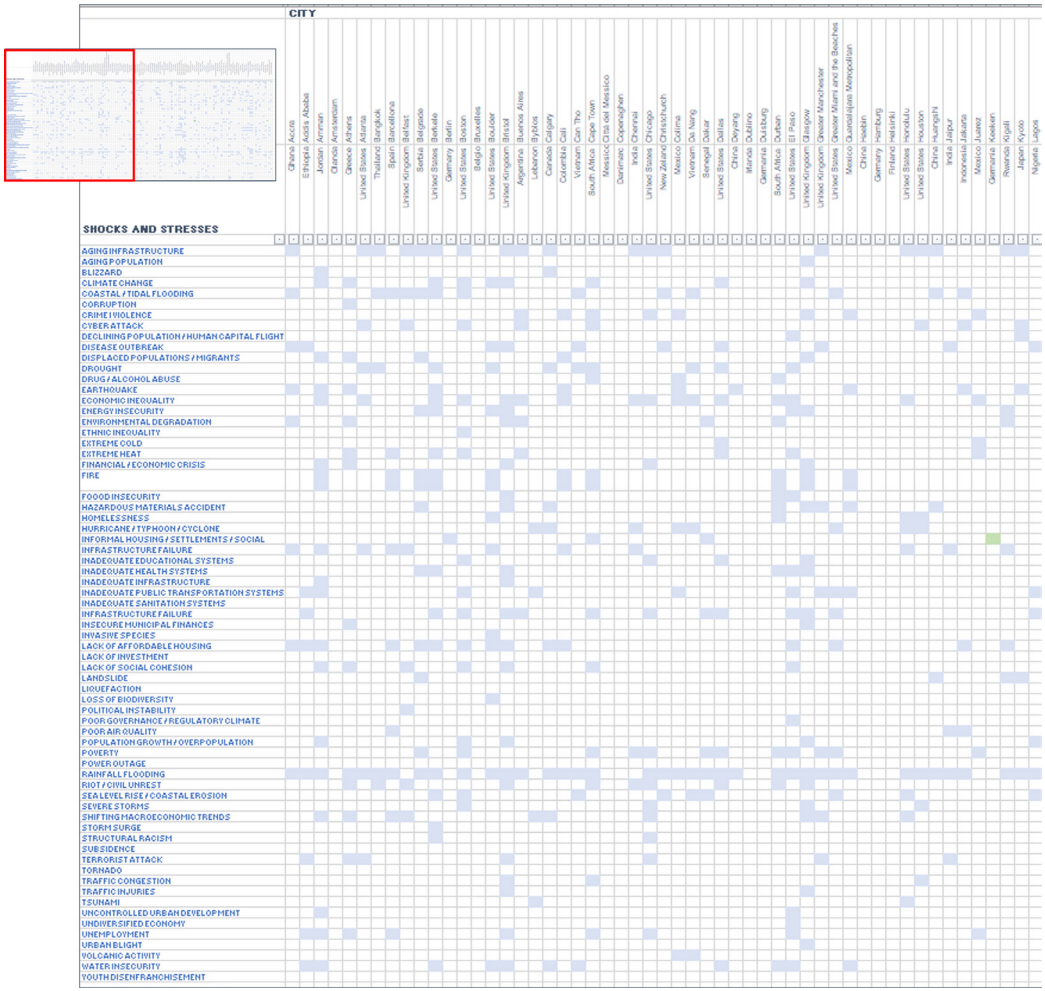
Fig. 6. Dati descrittivi generali associati ai singoli progetti analizzati (elaborazione M.P. Vozzola).

CASE STUDY 01	
Risk	Climate Change
Phenomenon	Climate Change
City	Athens
Country	Greece
Latitude	37° 58' 46 N
Longitude	23° 42' 58 E
Project Code	001_CAMBIAMENTO_CLIMATICO_ATHENS
Project Name	Regeneration of athens city center
Designer	Okra Land Schaps Architecten
Year of realisation	2013 - 2015
Project status	
Type of Representation	Render
File Name	001_CAMBIAMENTO_CLIMATICO_ATHENS_RENDER
Source	http://www.lartu.polito.it/cartografia/digitale/link_a_fogli_d_unione
Graphic scale	-
Notes	-

are not always predictable and to which the city itself is not ready to respond. In recent years, some catastrophic climatic events that occurred in large metropolitan areas have brought back the attention to urban design and 'prevention': new cutting-edge design solutions have been introduced, which enhance and focus urban planning related to the resilience of places at the expense of vulnerability [Palazzo 2019].

The concept of resilience applied to the city cannot disregard the specificities of places, a deep knowledge of the urban context, not only in its environmental, microclimatic and structural aspects but also and above all in its morphological and morphogenetic aspects. The places of resilience are those places that are constantly changing and allow for rethinking. This way of seeing resilience, as one of the dimensions capable of orienting transformations,

Table 1. Extract from the table summarising the projects analysed for the abacus of actions (elaborazion by MP. Vozzola).



lets us imagine an operational specificity (a character) of resilience that "in this historical moment" must be reintegrated into the theoretical and practical aspects of the culture of the project. The project is intended as a cognitive activity that is applied through the techniques of representation, design and drawing [Vozzola 2020].
Resilience, therefore, deals with the characteristics of that specific place; it allows attention to be shifted away from its 'dysfunctions' by orienting individual resources towards an image that recomposes and redesigns the characters in proper functioning.
The introduction of urban vulnerability modelling should therefore be understood not only as a cognitive moment, aimed at the survey, the evaluation of the place and the quantitative assessment of its resilience but above all as a real moment of transformation of the place itself, through the introduction of improving-minimising and resolving solutions to the problems that emerged in the first phases of evaluation. It is, therefore, necessary to go beyond the approach of analysing and monitoring the vulnerability of places, to dialogue with the more operational dimension of resilience through the introduction of responses and proposals for actions aimed at the realisation of scenarios and evolutionary phases of the place (figs. 3-6).
One of the main objectives of the proposed research is to increase the dissemination and accessibility of this information for online consultation of projects aimed at increasing the resilience of modern cities. Such activities are of great importance in order not to disperse a wealth of knowledge that appropriately contextualised, can be usefully transferred to other similar contexts [Novello, Bocconcino 2020].
As part of the research, an in-depth study was undertaken to facilitate the consultation of fragmented and disjointed data, within digital environments that can be implemented and interrogated through different reading keys. An information system was therefore created, on an alphanumeric and geographic basis, which links projects responding to the emerging needs of metropolitan and non-metropolitan cities, and alphanumeric and geographic contents through possible paths of in-depth analysis and customised queries (figs. 7, 8).
An abacus of urban regeneration solutions/actions represents a dynamic tool, able to move within those realities that need mitigation/improvement interventions while maintaining a global systemic view of the application. The objective is to create a framework of possible actions-solutions-strategies aimed at offering scenarios on an urban scale, oriented towards emergency or planning. The abacus thus becomes a consultation and guidance tool for developing resilient design, responding in a targeted way to risk through its application in a specific location. Research has emphasised the role of the design process as a distinctive problem-solving tool to maintain a functional balance between human needs, environmental factors and economic constraints [Felson 2005; Backhaus et al. 2012; Lennon et al. 2014].
Parametric software was used to represent the abacus, to dynamically manage the synthesis and schematisation of possible actions in a BIM environment. From this point of view, the use of digital technologies has made it possible to improve and define the knowledge of the investigated urban environment in an increasingly detailed manner, creating models with an initial level of detail LOD1 and a final level of detail LOD3 (according to the definition of LOD given by the CityGML standard of the Open Geospatial Consortium, OGC, which is valid for spatial and urban level readings), elaborated in successive phases, which have made it possible to carry out various analyses and perform rough quantitative calculations within the model itself (fig. 9). From this point of view, the abacus represents the first necessary step in the relationship between the indicators and the city project. The organisation of potentially disaggregated data in an abacus of codified actions is a way of systematising the surveys carried out, which can be evaluated in their reciprocal interactions, thus becoming an opportunity for in-depth study. (MP.V.).

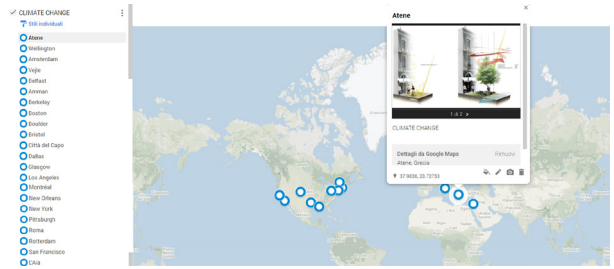
Towards 'smart' territories

The paper presented a state of advancement of a work in progress related to a further and new methodological framework (the one concerning the graphitization through multiscale abacuses), based on several previous study activities presented in different occasions of conferences and publications. At this stage of the research, the graphic abacus is being defined, exemplified in some illustrations and not reported extensively as it is of interest here to highlight the possibility of schematising project environments through the integration of supports such as information modelling associated with parameters and indicators on an urban and building scale. We, therefore, refer to the extensive previous discussions that have dealt with specific aspects from time

to time, in particular related to graphic codes that derive from the approach to the urban survey of the Turin school, assumed at the national level by a specific regulatory framework, extending it in the latest occasions to vulnerability and urban quality [Bocconcino et al. 2021] (fig. 10).
The experience conducted shows how the urban survey, in addition to being an opportunity for the representation of levels of analysis and knowledge of the built environment, can become a scientific tool capable of inducing a second and deeper level of analysis, related to different stages of awareness, and become an efficient cause of a type of derived knowledge. Considering the conditions of resilience and sustainability we recognise the need for dialogue at different scales of complexity, actors, competencies, disciplines, intermediaries and urban policies. Therefore, it is necessary to translate the resilient urban system under analysis and investigation into 'typologies' of intervention through the construction and representation of solutions, classifications

Fig. 7. Customised map in shared environment (elaboration by MP. Vozzola).

Fig. 8. Selection of digital documentary materials, associated with the location and descriptive data of the intervention (climate change), (elaboration by MP. Vozzola).



of actions and case studies. The graphic codes investigated within the abacus are therefore intended to relate the criteria of systemic evaluation with the project at the urban scale through solutions that from specific analyses codify actions with general characters, defined graphic codes that will facilitate the interpretation and reading of the operations of recomposition of the environments.
The study area is represented by the northern area of Turin; the result of this contribution has been the generalisation towards graphic abacuses that must look at three aspects together: a system of indicators of vulnerability and urban quality (for the evaluation and identification of the priority aspects of intervention); parameterized design solutions through the graphic analysis of volumes, vertical surfaces and public areas, punctual and linear elements identified as graphic elements of determining urban values (routes, nodes, emergencies); adoption of information systems on a multiple scales for the management and analysis of case histories from the international to the local level. Considering conditions of resilience and sustainability, the design supports the dialogue of a plurality of actors, skills, disciplines, intermediaries and urban policies at different scales of interpretation. The role of the representation disciplines within the project of defining the vulnerability of an urban environment involves aspects of survey knowledge, the setting up of multi-relational databases for data processing, as well as the interaction with GIS, BIM and DBMS systems through dedicated web platforms (fig. 11).
On the one hand, it is necessary to prepare synthetic frameworks capable of representing demanding conceptual elaborations of a logical deductive type, but at the same time, it is necessary to make uninterpreted data instantly available, as well as tools for analysing the same, capable

Fig. 9. Example of an action plan elaborated in a BIM environment: Floods. The image shows 6 different stages of adaptation of the area for rainwater storage (elaboration by MP. Vozzola).

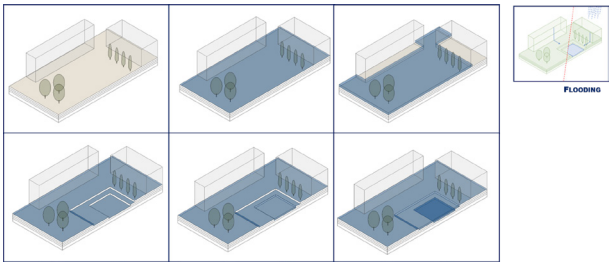


Fig. 10. Representation of indicators related to the study of the urban quality of the Pietra Alta area: Walkability, Green areas, Ground permeability and Public lighting (elaboration by arch. A. Rabbia) [Bocconcino et al. 2021].

Fig. 11. Data analysis pathway and expected results (elaboration by MP. Vozzola and G. Mazzone).

Fig. 12 Prefiguration of interaction with complex information systems through dedicated web platforms and applications based on artificial intelligence (elaboration by MP. Vozzola).

of allowing the various players in the field to carry out analyses that could not have been foreseen in the research project as it was conceived in its initial moment. As can be easily deduced, the extremely complex structure of the city requires an investigation developed for multiple areas and thematic sectors, each linked to a process of deconstruction by parts of the system. This fact can hardly be hypothesised within a single type of investigation, indeed it requires, from time to time and for the specificity of the analyses to be carried out, precise in-depth studies. It is therefore necessary that all the information collected be suitably structured and made congruent through the construction of networks of relations between the data that can also be interrogated subsequently. Hence the need to use information systems where the information collected can be found and correlated. The decay of tools is an unavoidable phenomenon that the support of artificial intelligence aims to counteract through the adoption of tools for the communication of the city and for the mapping of redevelopment interventions that can accompany urban regeneration projects. The same tools could be active support for students and experts in urban psychology as well as for those involved in the conservation and restoration of cultural and environmental heritage.

One of the possible outcomes is the development of an IT tool for planners and public authorities to involve citizens in the design of public space, to educate about sustainability and inclusiveness, and to collect data on needs, wishes and proposals; a flexible tool that can be applied to different neighbourhoods. Citizens who are not specialists, architects or designers, already have tools to design and visualise a proposal for urban space, which are usually very poorly integrated with tools to survey individual and group behaviour and attitudes, and, above all, these tools cannot prefigure a solution starting from specific urban problems and using ad hoc abacuses. Each player could elaborate a semi-automatic configuration of the urban space, composed by an artificial intelligence engine, make corrections or a new project proposal and visualise its impact, receiving a score on the categories of accessibility, economy, productivity, ecology, social interaction. Users can then understand the level of complexity of each decision related to urban space and the different needs related to different functions. The artificial intelligence engine learns from corrections and new design solutions and then proposes a new configuration that takes into account previous changes (fig. 12). (M.M.B.).

Acknowledgements

The authors would like to thank the Fondazione Sviluppo e Crescita CRT (president Cristina Giovando) Urban and Social Regeneration group that financed part of the research (project manager Bianca Viarizzo, project coordinator Anna Rabbia, scientific coordinators Franco Prizzon and Maurizio Marco Bocconcino of the Politecnico di Torino, research collaborators Mariapaola Vozzola and Giada Mazzone).
The research is developed in collaboration with the R3C – Responsible Risk Resilience Centre of the Politecnico di Torino, an interdisciplinary research centre focused on Urban Resilience.
The theme of urban investigation has been at the heart of our department's activities since the first studies on the city of Turin began by Professor Augusto Cavallari Murat and continued by Professor Dino Coppo and Professor Giuseppa (Pina) Novello. The concept of urban resilience has long since become part of our research objectives. Since the establishment in 2017 of the Interdepartmental Research Centre on Risk Resilience, this particular vantage point is central to our activities.
The contribution is part of broader research work on the study and representation of urban and environmental quality and related resilience aspects. The research group is coordinated by Professors Giorgio Garzino and Maurizio Bocconcino and is composed of Ing. Mariapaola Vozzola, Arch. Giada Mazzone, all belonging to the Department of Structural, Building and Geotechnical Engineering of the Politecnico di Torino, and arch. Anna Rabbia of Fondazione Sviluppo e Crescita CRT.
The authors, identified by the initials of their first and last names, have edited the corresponding paragraphs and illustrations: introduction and methodological aspects Giorgio Garzino and Maurizio Marco Bocconcino, the role of urban quality indicators Mariapaola Vozzola and Giada Mazzone, intervention archive and graphic abacus Mariapaola Vozzola, conclusions and possible developments Maurizio Marco Bocconcino.

Notes

[1] See the Resilient Cities Project, <https://resilientcitiesnetwork.org> (accessed 2021, May 10).

Authors

Giorgio Garzino, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, giorgio. garzino@polito.it
Maurizio Marco Bocconcino, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, maurizio.bocconcino@polito.it
Mariapaola Vozzola, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, mariapaola.vozzola@polito.it
Giada Mazzone, Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino, giada.mazzone@polito.it

Reference List

Ahern, J. (2011). From Fail-Safe to Safe-To-Fail: Sustainability and Resilience in the New Urban World. In *Landscape and Urban Planning* n. 100 (4), pp. 341-343.

ARUP (2016). *Cities Alive, Towards a walking word* <https://www.arup.com/perspectives/publications/research/section/cities-alive-towards-a-walking-world> (consultato il 19 gennaio 2021).

Backhaus, A., Dam, T.,Jensen M. B. (2012). Stormwater Management Challenges as Revealed through a Design Experiment with Professional Landscape Architects. In *Urban Water Journal*, n. 9 (1), pp. 29-43.

Berkes, F., Folke, C. (2000). Linking Social and Ecological Systems for Resilience and Sustainability. In F. Berkes, C. Folke. (Eds.). *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*, pp. 1-25. Cambridge: Cambridge University Press.

Bocconcino, M. M. et al. (2021). Intelligent Information Systems for the representation and management of the city. Urban survey and design for resilience. In C. Sposito (a cura di). *Possible and Preferable Scenarios of a Sustainable Future Towards 2030 and Beyond*, pp. 90-107. Palermo: Palermo University Press.

Bocconcino, M. M., Vozzola, M., Rabbia, A. (2021). Quality of Urban Walking Routes: Interaction of Knowledge Systems for Integrated Representations. In M. Del Giudice, A. Osello (Eds.). *Handbook of Research on Developing Smart Cities Based on Digital Twins*, pp. 388-424. Hershey: IGI Global.

Brunetta, G. et al. (Eds.). (2019). *Urban Resilience for Risk and Adaptation Governance: Theory and Practice (Resilient Cities)*. Cham: Springer.

Felson, A. J. (2005). Designed Experiments: New Approaches to Studying Urban Ecosystems. In *Frontiers in Ecology and the Environment*, n. 3 (10), pp. 549-556.

Felson, A. J., Oldfield E., Bradford M. (2013). Involving Ecologists in Shaping Large-Scale Green Infrastructure Projects. In *Bioscience*, n. 63 (11), pp. 882-890.

Garzino, G. (2010). Il rilievo del comfort per gli spazi urbani: prime riflessioni per analisi speditive. In: D. Coppo, C. Boido (a cura di). *Rilievo urbano. Conoscenza e rappresentazione della città consolidata*, pp. 170-185. Firenze: Alinea Editrice.

Garzino, G., Novello G. (2011). Il rilievo ambientale degli spazi urbani. The environmental survey of the urban spaces. In C. Gambardella (a

cura di) *Le vie dei Mercanti.S.A.V.E. Heritage safeguard of architecture, visual, environmental heritage.Atti del 9° Forum Internazionale di Studi*. Aversa-Capri, 9-11 giugno 2011, pp. 201-1-201-11. Napoli: La scuola di Pitagora.

Garzino, G., Chiaia, B., Marchis, E.T. C. (2015). Prime note per una mappatura storca sui centri minori. Some Preliminary Notes On Historical Town Seismic Mapping. In A. Marotta, G. Novello (a cura di). *Disegno & Città. Cultura, Arte, Scienza, Informazione. Drawing & City. Culture, Art, Science, Information. Atti del 37° Convegno Internazionale dei Docenti della Rappresentazione*. Torino, 17-19 settembre 2015, pp. 613-619. Roma: Gangemi editore.

Garzino, G., Marchis, E.T. C. (2016). Survey of buildings, elaboration of urban maps, databases for describing the seismic behaviour of historical sites. In B. G. Jöger (Ed.). *EURAU 2016 European Symposium on Research in Architecture and Urban: In Between Scales*. Atti del Convegno, Bucarest, 28-30 settembre 2016, pp. 561-572. Bucarest: "Ion Mincu" Publishing House.

Garzino, G., Bocconcino, M. M., Donato, V. (2017a). Metodi e codifiche grafiche per il rilievo della vulnerabilita' sismica alla scala architettonica e alla scala urbana. Methods and graphical codes for the seismic vulnerability survey at architectural and urban scale. In S. Bertocci, M. Bini (Eds.). *DisegnareCon*, 10 (18), pp. 3.1-3. 23.

Garzino, G., Bocconcino, M. M., Donato, V. (2017b). Siti del patrimonio costruito culturale: rilievi e tecniche di valutazione speditiva della vulnerabilità sismica alla scala dell'aggregato edilizio ed urbano. Analisi geometrico deduttive. Il caso di studio degli edifici porticati di piazza Santarosa a Savigliano. In: G. Bernardini, E. Di Giuseppe (a cura di). Colloqui. AT.e 2017. *Demolition or Reconstruction?* Atti del Convegno Ar.Tec. Ancona, 28-29 settembre 2017, pp. 819-835. Monfalcone: Edicom Edizioni.

Garzino, G., Bocconcino, M. M., Donato, V. (2017c). Survey of Comfort and Cityscape: Methodological Considerations for the Definition of a Graphic Code and Related Experimental Applications. In: G. Amoruso (Ed.). *Putting Tradition into Practice: Heritage, Place and Design. Atti del 5° convegno internazionale INTBAU*, Milano, 5-6 luglio 2017, pp. 537-550. Cham: Springer International Publishing.

Garzino, G., Novello, G., Bocconcino, M. M. (2018). Handbook of Research on Urban and Territorial Systems and the Intangible Dimension: Survey and Representation. In A. Ippolito, C. Inglese (Eds.). *Conservation, Restoration, and Analysis of Architectural and Archaeological Heritage*, pp. 346-385. Hershey: IGI Global.

Garzino, G. et al. (2020a). Sistemi informativi per l'analisi grafica della resilienza in ambienti urbani in trasformazione – prime applicazioni al caso della periferia nord di Torino. first applications in the case of the northern suburbs of Turin. In T. Empler, A. Caldarone, A. Fusinetti (a cura di). *3D Modeling & BIM. Data modeling and management for AECO industry. Atti del convegno 3D Modeling & BIM*, Roma, 14 maggio 2020, pp. 330- 349. Roma: DEI s.r.l.

Garzino, G. et al. (2020b). From the representation of urban vulnerability to the design of the abacus for the project. Graphic itineraries for the guide to the reading of the territory and the resilience project. In *CHNT 25 | 25th Conference on Cultural Heritage and New Technologies, Atti del Convegno*. Vienna, 4-6 novembre 2020, <https://www.chnt.at/wp-content/uploads/From-the-representation-of-urban-vulnerability-to-the-design-of-the-abacus-for-the-project.pdf > (accessed 2021, May 10).

Garzino, G. et al. (2020c). 'Nuovi' centri urbani: metodi e strumenti grafici per la lettura della qualità e della resilienza in luoghi extra moenia con caratteri storici consolidati. In A. Arena et al. (a cura di). *Connettere. Un disegno per annodare e tessere. Atti del 42° Convegno Internazionale dei Docenti della Rappresentazione*, pp. 3329-3350. Milano: Franco Angeli.

Garzino, G. et al. (2020d). Planning and Then Measuring Resilience in the Urban Periphery: The Case of the Northern Area of Turin in Italy. In: *Space International Conference 2020*, Atti del Convegno, Londra, 25-26 settembre 2020, pp. 109-118. Londra: Space Studies Publications.

Lennon, M., Scott, M., O'Neill, E. (2014). Urban Design and Adapting to Flood Risk: The Role of Green Infrastructure. In *Journal of Urban Design* n. 19 (5), pp. 745-758.

Novello, G., Bocconcino, M. M. (2020). Itinerari digitali tra carte e disegni del patrimonio dell'archivio Porcheddu. Le pratiche delle opere torinesi nel periodo 1894-1927. In S. D'Agostino, F. R. d'Ambrosio Alfano (Eds.). *History of Engineering Storia dell'Ingegneria. 4th International Conference, Atti dell'8° Convegno Nazionale*, Napoli, 11 dicembre 2020, pp. 633-646. Napoli: Cuzzolin.

Palazzo, E. (2019). From water sensitive to floodable: defining adaptive urban design for water resilient cities. In *Journal of Urban Design*, n. 24 (1), pp. 137-157.

Vozzola, M. (2020). The support of graphic representation for the analysis of the distribution and the preparation of temporary works in the post-pandemic period. In *Vitruvio*, n. 5, pp. 39-54.

Websites

<https://territorio.regione.emilia-romagna.it/urbanistica/corsi-formazione/rebus-laboratorio-rigeneraz-urbana-cambiam-climatici> (accessed 2021, January 19).

<http://www.urban-reuse.eu/?pageID=casi_internazionali (Politecnico di Milano e Consiglio Nazionale delle Ricerche> (accessed 2021, January 19).

<https://resilientcitiesnetwork.org/> (accessed 2021, January 19).

<https://www.cittametropolitana.mi.it/Territori_resilienti/adattamento/index.html> (accessed 2021, January 19).

<https://www.cittametropolitana.mi.it/Territori_resilienti/adattamento/index.html> (accessed 2021, January 19).

<www.comunecervia.it/urbanistica/psc-rue-dpque> (accessed 2021, January 19).

<http://www.sinanet.isprambiente.it/gelso/rassegna-degli-strumenti-di-sostenibilita-per-gli-enti-locali/indicatori-comuni-europei-eci-european-common-indicators> (accessed 2021, January 19).

<http://www.a21italy.it/medias/17D4D3426E7C39B4.pdf> (accessed 2021, January 19).

<http://www.urbanisten.nl/wp/?page_id=47> (accessed 2021, January 19).

RUBRICS

Readings/Rereadings

Readings/Rereadings

Remember, You Are an Artist, Not a Scholar. *Six Drawing Lessons* by William Kentridge

Massimiliano Ciammaichella

The extraordinary endeavour of William Kentridge is the testimony of an intense, many years and productive work that relates to the dynamics of a complexity located in the cultural and political context of belonging, so being able to interpret it means being confronted with a visual universe capable of reflecting a precise personal need, in privileging the medium of drawing and in the freedom to hybridize it with cinema and theatre.
The artist was born in Johannesburg in 1955 and his Jewish origins date back to his paternal family. The Kantorowicz, in fact, left Lithuania to escape the racial persecutions of the Russian empire in the late nineteenth century and, once arrived in South Africa, modified the surname adapting it to the English-speaking sounds. But although the progress of the history seems to overturn the social roles of the protagonists, being whites does not mean living the abomination of apartheid as passive spectators. "Moving from the status of a persecuted minority to that of a privileged elite is an ideal condition for demonstrating the arbitrary basis of racism" [Burgio 2014, p. 12] [1]. This is what William Kentridge's parents are proposing to do, as lawyers defending black rights.

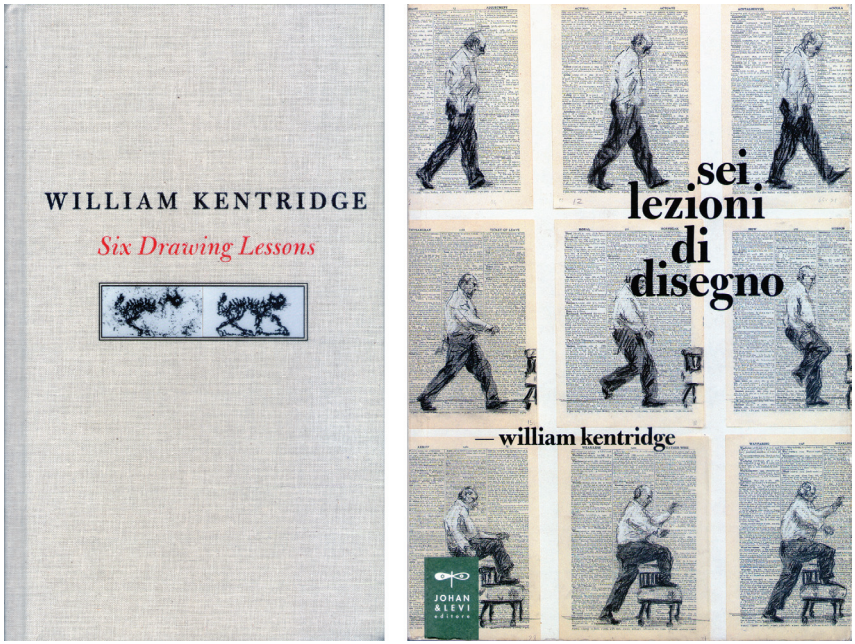


Fig. 1. Cover of the first English edition [Kentridge 2014] and Italian edition [Kentridge 2016].

https://doi.org/10.26375/disegno.8.2021.22

On 21 March 1960, during a peaceful demonstration organised by the PAC [2] in the Sharpeville township –to protest against the government's Urban Areas Act, which required black citizens to show a proof document of their right to enter white-only areas, and for work purposes only [3]– police shot at a crowd of demonstrators, including in the back. 67 people were killed, 186 wounded and 18011 arrested [Pelliccioni 1972, p. 655]. Sydney Kentridge assumed a pivotal role in assisting some of the victims' families and later made headlines for his trial of the Steve Biko's suspected cause of death, founder of the *Black Consciousness* student movement, who had led the Soweto protests against the segregationist government.

The arrest of 18 August 1977 was the last of many: the story ended with the death of the activist, occurred on 12 September of the same year. As for the motives, the prison police stated that they were induced by a hunger strike, but the reality of the facts showed that he was repeatedly tortured, so when lawyer Kentridge questioned Lieutenant-Colonel Pieter J. Goosen, asking him what right he had to keep a man in chains for 48 hours, the debate unfolded in the following dialectical ways: "Goosen: I have the full power to do it. Prisoners could attempt suicide or escape. Kentridge: Let's have an honest answer – where did you get your powers? Goosen: It is my power. Kentridge: Are you people above the law? Goosen: I have full powers to ensure a man's safety. Kentridge: I am asking for the statute. Goosen: We don't work under statutes. Kentridge: Thank you very much. That is what we have always suspected" [Parker, Mokhesi-Parker 1998, p. 56].

In a family context in which his parents assume *super partes* roles in the defence of the person rights –regardless of the ethnic group to which he belongs–, William Kentridge grows up and is formed, recording the traumatic memories of a liberation process decidedly oriented towards a decolonial politics that reflects on the most intimate meaning of the term 'power', questioning its declinations in a direct and crossed relationship between the noun and the verb. The first approach to racism is precocious and decidedly shocking, because it goes back to the time of the Sharpeville massacre, when, at only six years old, curious about a yellow box placed on his father's desk, convinced to find chocolates inside, he furtively opens it and sees photographs of dismembered and headless cadavers [Kentridge 2005, p. 99].

"These documentary images, with their scientific apparatus of notes, diagrams, and arrows, would often return to the artist's imagery. The reference to the document will bring a strong stock of social denunciation" [Burgio 2014, p. 14] [4].

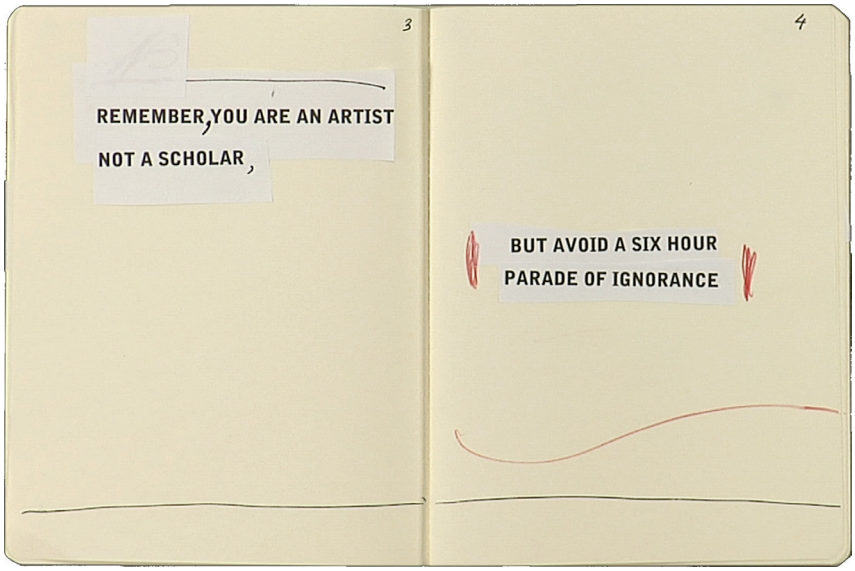
After graduating from the Witwatersrand University in 1976 with a degree in political science, William Kentridge pursued his passion for drawing by enrolling in printmaking and engraving courses at the Johannesburg Art Foundation. In 1981 he decided to attend the École Internationale de Théâtre Jacques Lecoq. His studies led him to work in the cinema and theatre, including as an actor, director and set designer.

One of the most significant and recognised artists in the world, in 2012 he was invited by Harvard University to give a series of conferences, and the contents of the prestigious *Charles Eliot Norton Lectures* were collected, integrated, and published two years later by the same author.

The introduction to the *Six Drawing Lessons* book opens with the enthusiastic announcement made to his father, by telephone, about the invitation and the response received: "do you have anything to say? […] and now you have that honor. You don't have to accept" [Kentridge 2014, p. 3]. The preparatory work is complex and focuses on the specific themes of an artistic practice that problematizes the origins of the available mediums, giving new life to obsolete technologies that are reshaped and updated, in a sort of criticism of the processes of recession and censorship in South Africa in which he was formed. Therefore, the drawing becomes a political manifesto of an anachronistic and involuntary impediment, in being in synchrony with the times of a changing world. It is an act of denunciation that forces one to break down and recompose the text and the image of a falsified media support, on which to write the animated drawing of a credible story that highlights the gaps, inconsistencies, and contradictions of a dilated present, in such a way as to anticipate the trajectories of a possible future, the course of which, since the nineties, has begun to be glimpsed.

A series of sentences summarise the recurrent thoughts of one's existence. They are synthetic notes written in sequence, on a sheet of paper to be cut up and divided into six parts, to compose a collage from which to extrapolate the textual cues necessary to formulate the lessons contents (fig. 2).

The imperative is always the same: focus on the primacy of the image in order to go back to the idea behind it.



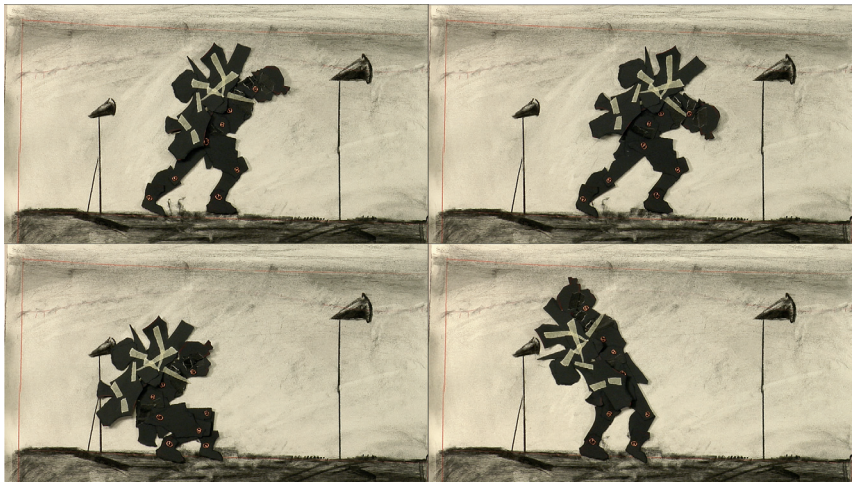


Fig. 2. William Kentridge, notebook collage from the preparatory notes of the six lessons, 2012. © William Kentridge.

Fig. 3. William Kentridge, drawing with paper puppet. First lesson, 2012. © William Kentridge.

For what concern the first lecture, entitled *In Praise of Shadows*, it starts with the projection of a film in the auditorium, made in 1999 for the Istanbul Biennial. It is *Shadow Procession*. Small fragments of black paper portray the articulated shapes of characters and objects connected by iron wires, manually moved in a sort of puppet theatre in which every single pose is meticulously programmed and photographed, to assemble the animated sequences, in stop motion, away from a trip with no destination. Drawing and movement are a practice of thought, but also physical actions that force the artist to move away from his images in order to photograph them and resume work immediately afterwards, in an alternation of continuous movements [Maltz-Leca 2013, pp. 139-140].
Since the image, whether static or in motion, is always the result of an artistic operation, travelling backwards to verify the real adherence of the message conveyed with the idea that originated it means revealing the entire construction process. And so, we start very far back and arrive at Plato's *Republic* of 360 B.C., in the moment when, in the seventh book, the allegory of the cave is faced. Socrates describes the prisoners chained to their feet, and neck that cannot move, forced to look ahead in a process of questioning the truth of existence, made credible by the projections of their shadows [Maltese 2015, pp. 249-251]. In the black ones, of the represented cortège, Kentridge's challenge is to achieve the minimum degree of recognisability of the subjects that produced them: travellers directed no one knows where, "miners carrying a broken city, pensioners carried in a wheelbarrow. An inventory of specific

people seen in newspapers and the news, or on the streets of Johannesburg" [Kentridge 2014, p. 9] (fig. 3).
In a dialogical inversion of the themes of the first lesson, the second lesson intercepts the cultural geographies of a return journey, the salient stages of which are marked by the timing of the memories that pass through the tortuous passage from darkness to light, in piecing together the fragments and interrupted possibilities of a brief history of the colonial uprisings.
The photographic projection and the device that originates it are the main sources of phenomenal interpretation, but also aids in the works project.
It starts with three shots: the first depicts the Baptist church built by Pastor John Chilembwe on the hill of Chiradzulu in Nyasaland [5]; the second abstracts it in a smoky mass that actually documents the act of bombing that blew it up in 1915; the third reveals its ruins and was reproduced in many copies, becoming a popular postcard to be sent throughout the British colonies.
Three black and white images, therefore, summarise the sad story of the Pastor who had sent a letter to the *Nyasaland Times* newspaper immediately after the outbreak of the First World War, in which he asked the government what expectations the Natives would have at the end of a conflict in which they were forced to participate.
Obviously, the letter was not published in the newspaper and Chilembwe organised a revolt that ended with his murder, the hanging of those actively involved and a series of arrests.
Everything that precedes and follows this horrific event remains in the

Fig. 4. William Kentridge, shrinking map. Second lesson, 2012. © William Kentridge.

photographic memory, locked away in a drawer in Kentridge's studio for twenty years, but never forgotten and a harbinger of a contemptuous critique of the cultural movement of the Enlightenment, even when the context exhibited shifts the focus from crude reality to the democratic space of the theatre. So, the scenic space is reinvented: it functions as a camera obscura in which the artist devises strategies for crossing blackness, with the aim to "show the need for the darkness, for shadow, to be present for anything to be visible" [Kentridge 2014, p. 45].
The preparatory drawings for the sets of Mozart's *The Magic Flute* [6], 2005, are to be understood as negatives of a photographic film to be mounted on the scenery of a scaled-down maquette of the theatre, on which to test the projection effects of the animated sequences, following a direction designed to suggest the merciless object value that 'Power' has conferred on visual media in documenting the image of South Africa. Hence the need to treat the medium of drawing as a blackboard, on which to narrate a fiction superimposed on reality.
"The camera and the blackboard both resonate of the themes of power relations and colonial history. The camera was a pivotal instrument of imperial power, used to appropriate the 'virgin lands' and all they included, from landscape to humans and animals; on the other hand, the blackboard is the teacher's instrument and characterizes magician and mentor Sarastro" [Guarracino 2010, p. 273].
The sketchbook, on the other hand, is the medium on which to trace a

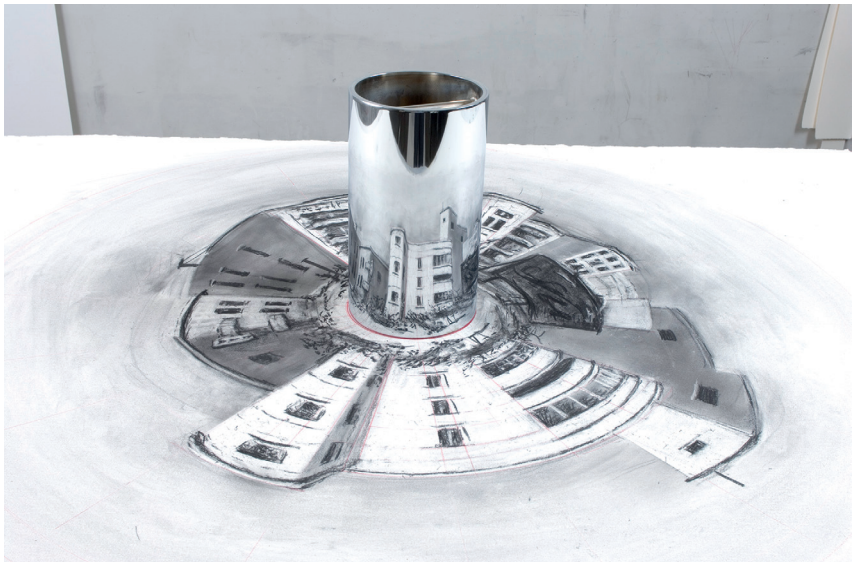


Fig. 5. William Kentridge, cylindrical anamorphosis. Fourth lesson, 2012. © William Kentridge.

social geography dating back to the days of one's youth, when the world was changing shape and distancing itself from South Africa, narrowing the map of modernity to widen that of exclusion (fig. 4).
Then the magnifying glass focuses on the city of Johannesburg, within which the topics of the third lesson orbit. The aim is to reconstruct a sort of memories cartography, metaphorically described in the form of documents collage, photographs and clippings to be brought back to the intimacy of one's own studio, where the long times of design thinking confront the voracity of the moments interrupted by the contradictions experienced.
There is a white sheet of paper, a charcoal pencil, an eraser, and the invention of *Drawings for Projection* –which made the artist famous in the early nineties [7]–, to determine the animations made up of countless snapshots, taken with an old Bolex or Ariflex camera.
The blank sheet is always the same and Kentridge draws, observes, moves away and photographs, then erases, redraws, photographs again, repeating this practice almost maniacally [Krauss 2000, pp. 5-7]. What is really surprising is the hint of the trace that remains after each erasure, in the multiple layering of images in motion that echo a sense of uncertainty in piecing together the inconsistencies of a distant, or personally experienced, historical memory, where time slows down, and one needs to reflect. "Something glimpsed for a second may take a day, or days, to draw. Pleasure, frustration, self-doubt, states evocated by the materials and activity, take the place of the initial impulse. There is still some connection to the first thought; but it is on hold. The impulse is sent to wait outside in an antechamber while the work is being done" [Kentridge 2014, p. 93].
The fourth lesson is entitled P*ractical Epistemology: Life in the Studio*; William Kentridge says he filmed his eight-year-old son holding a paint can, opened it and spilled the paint on a studio wall, then threw the pencils on the floor and tore the sheets of paper into small pieces to scatter around. The film was edited backwards and shown to him. In his eyes? Magic.
It is clear that the stunt of a little pest is actually the result of a planned action. However, once the child has overcome his astonishment, he asks his father if he can do it again, but he is told that everything must be cleaned up first, including the stained wall.
The choice of medium in this case determines the rules of a game that in its, direct and inverse, reiteration alludes to the utopia of a perfect world. If to question oneself on the functioning of the instrument provided is to deeply understand its grammar, one can go back to the origins of precinema, to experiment not so much the limits as the possibilities offered by the phenakistoscope, the praxinoscope or the zootropium.
Continuing the journey backwards one encounters other devices, and it is easy to see how a complicit relationship is always created between action, rule, and knowledge of the medium in the convincing credibility of an illusion (fig. 5).
Regarding the fifth lesson, Kentridge begins by declaring his difficulty in preparing it. *In Praise of Mistranslation*, in fact, seems to want to dismantle the previously postulated assump-

Fig. 6. William Kentridge, linocut. Fifth lesson. © William Kentridge.

tions. There are notes on the table, but while waiting for thoughts and constructs of meaning to find their harmonious coexistence, inspiration comes from the preparation of a series of linocuts [8] printed on the torn pages of an old encyclopaedia (fig. 6). Shortly afterwards, the fragments of an obsolete bestiary left in the notebook's discard list, among the many phrases used in previous lessons, are intertwined with a recurring word whose meaning is not remembered: *asen*. The answer is in a book on the history of African art, which explains that this sort of small memorial altar for the dead is a small iron disc, about thirty centimetres wide, on top of which are placed metal silhouettes representing people, objects and animals that metaphorically recompose the circle and theatre of life. We learn that there are three actors involved in its realisation: the dead person, the donor who takes charge of describing it and the craftsman who must interpret it.

"Between the briefing by the donor and the making of the *asen*, there is a gap. A list of requests from the donor, and a configuration of solutions and responses to these from the craftsman. The *asen* becomes a rebus, a text made up of the words embedded in the images, a private riddle to be read. But then time passes, the donor joins the subject of the *asen* in death; he is not alive to remember his questions, to link the craftsman to the answers" [Kentridge 2014, p. 134], but the artefact remains.

The sixth lesson: *Anti-Entropy*, unlike the others, never refers to the reassuring completeness of the works of the past, but rather shares the questions of an artistic research in progress.

The Refusal of time and *Refuse the hour* [9], are respectively an installation and a performance structured in seven chapters, five of which take part of this latest Norton lecture.
In the first case, the idea of a controlled order, which homogenises the mechanical time of the world, is confronted with the arbitrariness of the artificial boundaries with which African cultures have been fenced, so the arithmetic measure of duration cannot be compared with that of lived experience. Sequences of images are projected on the walls and coexist with the ticking metronomes in video projections that multiply, accelerating or decelerating the rhythms of an inevitable chaos [Huyssen 2017, pp. 88]. *Refuse the hour*, on the other hand, uses drawing and collage in a video montage in which the manipulation of the narrated events reflects precisely on the non-linearity of the time flow [Le Borgne 2013, p. 502] (fig. 7).
Pneumatic time is what conditions us and programmes the succession of our actions, dressing us the instrument that regulates them in a continuous hand-to-hand combat. The geographical clock, on the other hand, measures distances. "The world was covered by a huge dented bird cage of time zones, of lines of agreement of control, all sent out by the clock rooms of Europe" [Kentridge 2014, p. 169], but resistance to colonial rule highlights the fragmentary nature of an entropy that returns only the splinters of a piloted order.
We might as well concentrate on the suspended time, in which we collect the fragments, the lacerations, the scraps, in order to recompose them and draw from them a meaning.
This is what the artist must make.

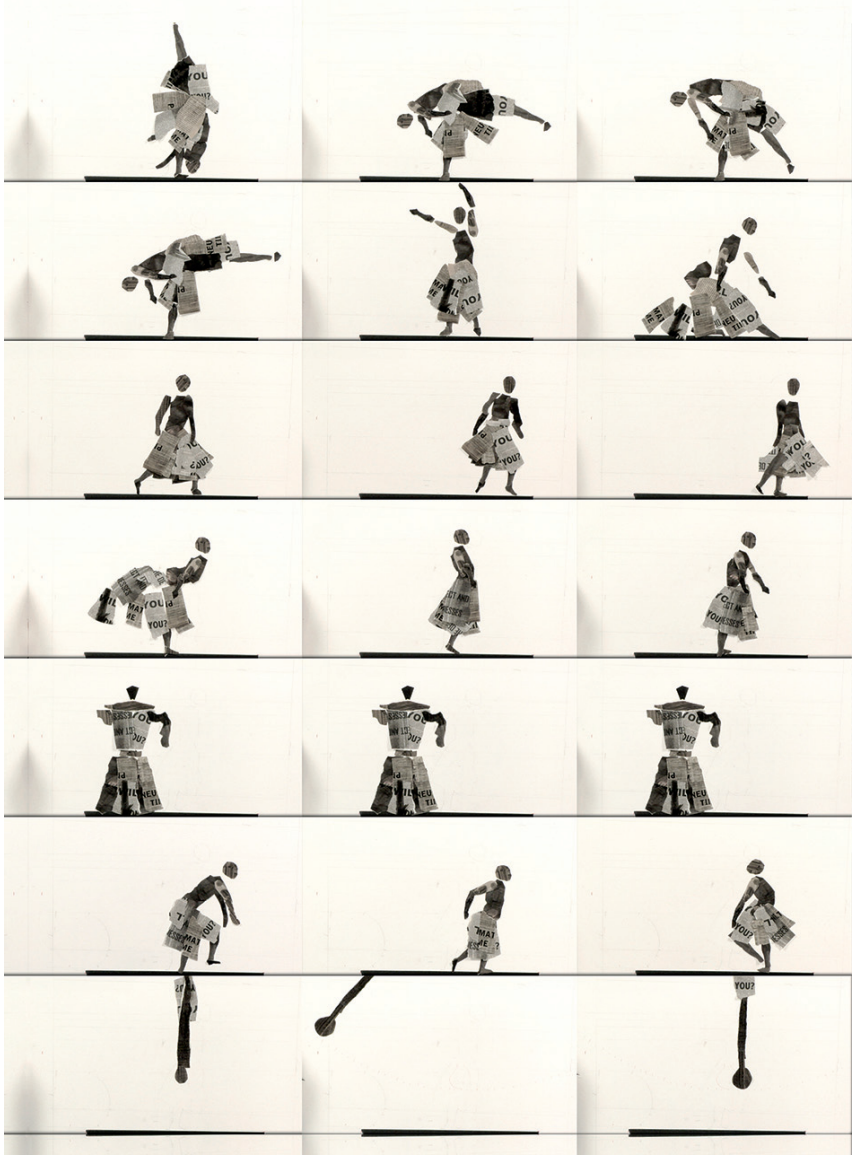


Fig. 7. William Kentridge, drawings, and collages for the video projections of Refuse the hour. Sixth lesson, 2012. © William Kentridge.

Notes

[1] Translation by the author.

[2] PAC: An acronym for Pan Africanist Congress of Azania, it identifies the pan-African political party founded in 1959.

[3] The *pass law*, imposed in 1952, was a kind of passport for black people. It was abolished in 1986.

[4] Translation by the author.

[5] Nyasaland was a British protectorate in Central Africa, established in 1907, and corresponds with the present-day state of Malawi, which gained its independence in 1964.

[6] William Kentridge produced many sketches, drawings, and engravings, evolving the work into two installations: *Preparing the Flute* in 2005 and *Black Box/Chambre Noire* in 2006. In both, maquettes of a theatre stage integrate puppets and music controlled by a computer.

[7] See e.g., the short film *Monument*, 1990.

[8] Linocut is a printing technique involving the engraving of a linoleum matrix.

[9] *The Refusal of Time* was presented in its completed form at *Documenta 13*, Kassel, 2012.

Author

Massimiliano Ciammaichella, Department of Architecture and Arts, Iuav University of Venice, ciamma@iuav.it

Reference List

Burgio, V. (2014). *William Kentridge*. Milano: Postmedia.

Guarracino, S. (2010). The Dance of the Dead Rhino: William Kentridge's Magic Flute. In *Altre Modernità*, n. 4, pp. 268-278.

Huyssen, A. (2017). The Shadow Play as Medium of Memory in William Kentridge. In R. Krauss (a cura di). *William Kentridge*, pp. 77-98. Cambridge-London: MIT Press.

Kentridge, W. (2016). *Sei lezioni di disegno*. Cremona: Johan & Levi.

Kentridge, W. (2014). *Six Drawing Lessons*. Cambridge: Harvard University Press.

Kentridge, W. (2005). *Black Box/Chambre Noire*. Berlin: Deutsche Guggenheim., 99

Krauss, R. (2000). "The Rock": William Kentridge's Drawing for Proection. In *October*, n. 92, pp. 3-35.

Le Borgne, F. (2013). Sobre Refuse The Hour, Kentridge e seus Espaços-Tempos de Criação. In *Revista Brasileira de Estudos da Presença*, n. 2, pp. 498-514.

Maltese, E.V. (a cura di). (2015). *Platone. Repubblica*. Roma: Newton Compton.

Maltz-Leca, L. (2013). Process/Procession: William Kentridge and the Process of Change. In *Art Bulletin*, n. 1, vol. 95, pp. 139-165.

Parker, P., Mokhesi-Parker, J. (1998). *In the Shadow of Sharpeville. Apartheid and Criminal Justice*. London: Macmillan Press.

Pelliccioni, F. (1972). Ascesa e tramonto del liberalismo in Sud Africa. In *Africa*, n. 4, pp. 651-658.

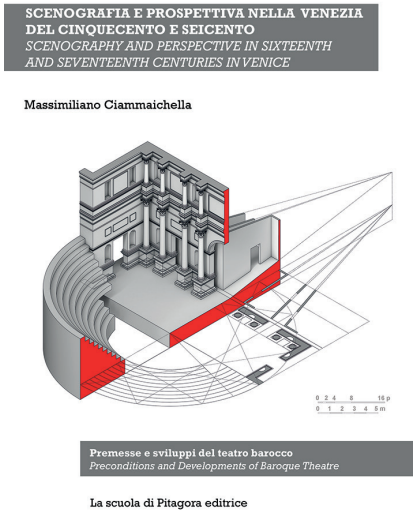
Reviews

Reviews

Massimiliano Ciammaichella

Scenografia e prospettiva nella Venezia del Cinquecento e Seicento. Premesse e sviluppi del teatro barocco

La scuola di Pitagora editrice
Napoli 2021
208 pp.
ISSN 2724-3699
ISBN 978-88-6542-795-8
(paper version)
ISBN 978-88-6542-796-5
(electronic version in PDF format)



Introduced by a *Preface* by Francesca Fatta, this interesting monographic volume by Massimiliano Ciammaichella investigates the relationship between the invention of scenography in Venice between the sixteenth and seventeenth centuries and the science of perspective, articulating the theme in three chapters: *La città dello spettacolo* ("The City of Spectacle"); *La matematica dell'illusione* ("The Mathematics of Illusion"); *La scena barocca* ("The Baroque Stage"). Preceded by the author's *Introduction*, the three chapters are followed by the *Conclusions* and the *Bibliography and Documentary Sources*, again by Ciammaichella. From the point of view of international impact, the *Introduction* and the *Conclusion* are entirely translated into English, while the three chapters are each followed by an ample summary, also translated into that language.

On the whole, the main theme of this monograph revolves around the connection between the publication of descriptive treatises on the works of scenographers active in Venice between the sixteenth and seventeenth centuries and the contemporary publication of geometrical treatises on perspective representation. According to the author, this connection is due to the fact that in that period Venice was the "undisputed home of Baroque melodrama" [p. 11] and, therefore, in the Venetian city the production of treatises in this field appears very consistent. Moreover, according to the author, another aspect (which becomes here the main one) links the two sectorial productions where, on the one hand, the treatises on scenography mainly describe the events related both to the scenic events and to the authors of the performances (although the figure of the scenographer was still characterized as having a subordinate role), on the other hand, in the treatises on the science of representation, the explanation of the geometrical foundations of perspective is accompanied by the description of the construction of stage sceneries and of the implementation of mechanisms able to animate them.

An interweaving, therefore, a hybridization of speculative interests (but also practical ones) that in seventeenth-century Venice creatively linked geometry to scenography in the common intent of invalidating the classical model of theater in order to open, as the author well summarizes, to the "magic of the fourth wall, in the illusionistic perspective box of scenography" [p. 11].

For the arguments clearly indicated in the first lines of the *Introduction*, the book therefore appears interesting in outlining the cultural premises and the developments of theatrical design as they are configured and transformed in Venice between the sixteenth and seventeenth centuries. The first chapter, *La città dello spettacolo* ("The City of Spectacle"), gives the reader a historic cross-section in which the multiple forms and activities of spectacle which

took place in Venice gradually changed their impact, both regarding the typology of the performances and the architectural configuration of the spaces that hosted the theatrical representations. In this sense, the reading of the three paragraphs which make up the first chapter guides the reader through this progressive evolution of the Venetian stage space which, from the mimic representations in masks without nearly any scenography, generates ephemeral theatrical stagings (conceived as closed and/or open-air spaces) then reaching, towards the end of the sixteenth century, the introduction of the first forms of public theaters with paid entrance. This historical transformation would in the seventeenth century lead Venice to inaugurate a modern type of spectacle, the melodrama, and at the same time, a new model of theater, the so-called "*teatro all'italiana*". Therefore, two innovative forms of representation that, between spectacle and architectural space, proposed a Venetian model that would be so acclaimed as to be exported abroad with great success.

The second chapter of the book, with the aforementioned and seductive title *La matematica dell'illusione* ("The Mathematics of Illusion"), is composed of two paragraphs dedicated to the examination of the geometrical foundations for the perspective representation of scenography as well as to the description of the techniques used in the mechanical construction of the scenes. This is a chapter nourished by the excellent epochal seasons that saw the codification, between the fifteenth and sixteenth centuries, of a new scientific and artistic culture, that is, the *perspectiva artificialis*, conceived by Brunelleschi, Alberti, Piero della Francesca, Leonardo da Vinci and Luca Pacioli, and divulged through treatises on perspective as a mathematical discipline. On these bases, and as recalled by Anna Sgrosso in her fundamental second volume entitled *Rinascimento e Barocco* (*Renaissance and Baroque*) of the series *La Geometria nell'immagine*, the seventeenth century built the "revenge of the geometers" [Sgrosso 2001, p. 217] with the great conquests of science, in theory and practice, and with the popularization of extreme perspectives, such as anamorphoses. Nourished by these events, the culture of theatrical representation established close connections between scenography and perspective, of which Ciammaichella in this second chapter describes the main steps that led not only to emphasize the depth of the theatrical scene (already conceived as a geometric and spatial configuration of central solid perspective) with the use of oblique planes, but also to transform the fixed scene into an animated stage thanks to the invention of extraordinarily conceived and designed machinery. From the masterly union of science and art, mechanical inventiveness freed the "fourth wall to host a dynamic scenography, in continuous transformation" [p. 67], hosting the events and acts of a new theatrical form, the previously mentioned melodrama. In this sense, the philosophy of the scientific revolution, which was to accompany the social and theoretical transformations of the seventeenth century, would strengthen, even more, the scientific conscience of the sixteenth century, leading the "new science" towards a quantitative image of nature in which Cartesian mechanism culminated in the celebration of the "machine." As Ciammaichella well states, in this epochal context "the figure of the stage painter evolved into that of the skilled Baroque engineer" [p. 91]. What the author affirms brings to mind the time of bastioned military architecture, a real war machine capable of associating spatial form to offensive devices (firing weapons). Similarly, theatrical scenery was transformed into stage machinery, housing dynamic mechanical devices capable of changing the perspective image of the represented environments and thus arousing surprise and wonder.

The relationship established between the place of the performance and the action on stage is the subject of critical reflection in the third chapter, entitled *La scena barocca* ("The Baroque Stage"). In this chapter, starting from the description of the transformation of the classical theater into a public theatre with paid entrance, the relationship between a large number of works conceived by architects and stage designers and the new theatrical spaces in Venice, which hosted the performances, is examined. The aim is to show how this relationship was so strong, affirms Ciammaichella, as to be a real symbiosis.

The need to better describe the relationships existing between the fundamentals of the science of perspective representation and the projects of the stage designers working in Venice becomes an opportunity for Massimiliano Ciammaichella to visualize these theatrical spaces through graphic reconstructions of the settings. The three chapters are enhanced by a rich and varied iconographic apparatus constantly accompanying the text. There are more than one hundred images including reproductions of paintings, drawings and engravings (loose or contained in treatises) as well as autograph drawings, including an image that, using a satellite shot of Venice, shows the location of musical theaters at the end of the seventeenth century. More specifically, the drawings by the author (about twenty) constitute a valid aid to

the comprehension of the assumptions, not only for the obvious reason of allowing faster communication by means of visual images, but also for the use of the visualization of plans, elevations and, above all, axonometric or perspective schemes, accompanied by clear graphics in various shades of red and grey. In this sense, Ciammaichella attributes to these autograph drawings the task of representing the hypotheses of spatial reconstruction for the stage set designed by Giorgio Vasari for *La Talanta*, by Sebastiano Serlio for the provisional theater proposed in the *Secondo Libro di Perspectiva*, by Andrea Palladio for the play *Antigone* (whose cross-section is reproduced on the cover of the monograph), of the scenic space proposed by Ludovico Cardi, known as Cigoli, of the plan of the Teatro San Cassan (in 1670, as well as according to the project by Francesco Bagnolo of 1762), of the plan of the Teatro San Moisè (according to the 1742 drawing by Gabriel Pierre Martin Dumont and the renovation project of 1793 by Carlo Neumann Rizzi). Similarly, to other autograph drawings the author assigns the task of illustrating the identification of the geometric principles underlying the construction of the scenery for the Teatro di Sabbioneta, for the tragic scene proposed by Daniele Barbaro and for the stage with canopies indicated by Giulio Troili.

These reconstructions are based on a thorough and scrupulous critical re-reading of the documentary, iconographic and archival sources consulted by Massimiliano Ciammaichella, as well as the analysis of the spatial relationships between the theaters examined and the spectacles performed in them. Therefore, these graphical analyses appear fully exhaustive and convincing, strengthening and qualifying even further the scientific-cultural contribution of the monographic volume both within the disciplinary community of Drawing and in relation to the more general theme of theatrical representation.

Ornella Zerlenga

Author

Ornella Zerlenga, Department of Architecture and Industrial Design, University of Campania 'Luigi Vanvitelli', ornella.zerlenga@unicampania.it

Reference List

Sgrosso, A. (2001). *Rinascimento e Barocco*. Torino: UTET.

Reviews

Elena Ippoliti

Il disegno per Gaetano Rapisardi. Progetti per Siracusa tra cronache e storia

Franco Angeli
Milano 2020
321 pp.
ISBN 9788-88-917-8942-6

The architectures 'forgotten' in the drawer, as Vittorio Magnago Lampugnani stated in his 1982 volume, *La realtà dell'immagine. Disegni di architettura nel ventesimo secolo*, are those representations which, without being debased by compromises, give back the idea of architecture in its highest vision, ideational and projectual purity. Basically, they are drawings express the 'sign' value, a term with multiple meanings including 'demonstrate' and 'designate', as a linguistic and poetic system of the architectural design.
Elena Ippoliti, in her book *Il disegno per Gaetano Rapisardi. Progetti per Siracusa tra cronache e storia*, not only tells a possible history, or better said the possible architectural events of a city, but offers the reader both new interpretation keys and potential research horizons.
In fact, the volume can absolutely abandon the reader to imaginative spatial situations (desirable for those dealing with a political vision of the city). Furthermore, the book offers scholars constituent elements to investigate the History of Representation fields gathering modes and techniques but above all the thermometer of ideas pertaining to a historical context and, in this case, the professional condition of those who, like Gaetano Rapisardi, operated in the field overshadowed by Marcello Piacentini.
The author lucidly circumscribes Rapisardi's field of action in 'his' Syracuse investigating the architect's projects proposed for his native city in a remoteness condition. Therefore these projects weren't polluted by the professional relationships he had in Rome, his adopted city. At that time Rapisardi was, like many others, an 'emigrant' who left Sicily to train elsewhere, at the Accademia di Belle Arti in Florence.
However, Gaetano Rapisardi works 'all round' in Italy, above all by taking part in numerous design competitions, many of which he won together with his brother Ernesto. He turned his attention to design in Rome, Bari, Udine, Naples, Campobasso, Milan, Gallipoli, Reggio Calabria, Messina and even Syracuse, where he designed one of the city's most important buildings, the Pantheon dei Caduti siracusani.
The Sicilian architect's workload was therefore very wide and the well-preserved archive contains a countless number of project drawings, letters and other documents. It would have been a difficult task to attempt to write a complete work on Rapisardi's activities and this would certainly have led more to a compilation/divulgative study rather than a massive volume on the subject of Drawing. There is, however, a precise reason for limiting this book to the study of the projects for Syracuse, which is "a long-considered choice that seemed the only possible way to achieve the main objective of the volume: to approach the 'drawings by' and the 'drawings for' Gaetano Rapisardi. An objective that, in the space of a book, only such a decisive cut would have made it possible to achieve" [p. 14].

The structure of the book is very clear; six chapters define the core of the volume and each of them, with the exception of the third chapter on architectural competitions in Syracuse, investigates a specific project in great detail, but always with precise references either to the urban contexts in which they would have been built or to works of a similar type.
The first chapter, I *Monumenti ai Caduti della Grande Guerra*, indicates to the reader the scope of the volume contents as well as the quantity of the graphic corpus produced by Rapisardi. The author begins with the paragraph on the cult of victims, rightly referring to the cultural debate of the time on this issue in which "the controversies surrounding the erection of monuments to the victims, which have an immediate national reverberation, highlight two main critical points: the first is related to local interests that prevent a serene assessment of the projects quality; the second, of a more general order, is connected to the need to renew the architectural language and in particular the monumental one. It is therefore no coincidence that the magazine *Architettura* e *arti decorative*, founded in 1921 by the Associazione Artistica tra i Cultori di Architettura, dealt assiduously with the subject from the very first issues" [p. 20].
But there is more.
Elena Ippoliti, in her pointedly approach to the theme, provides the reader with an exhaustive graphic examination of projects relating to the War Memorial monuments. Her furnish the chapter with representations by Limongelli, Del Debbio, Fasolo, Aschieri, Sandri and Sottsass to indicate the thermometer of the debate and, in the case of the Monument to Costanzo Ciano at Montenero di Livorno, letting the designers, Arturo Dazzi and Rapisardi speak through the project report in a continuous cross-reference between history and representation.
In dealing with the Rapisardi brothers' project for the Monumento ai Caduti di Messina, which in the archives consists of "only three preparatory drawings and a quick sketch drawn on a piece of glossy paper, used for a different purpose" [p. 47], the author succeeds in telling the events of the competition with extreme skill through the jury's report and the correspondence between Enrico Calandra and Marcello Piacentini regarding certain aspects of the two designers' delivery timing of the designs. The digital reconstruction and the correct perspective insertion of it in the project site, with the background of Antonio Zanca's palazzo del Municipio, give the reader an image of a 'possible' Messina, of what it would have been if the project had been realised.
The author's 'reconstructive' operation not only triggers imaginative procedures but also specifies how the aid of the digital model can, on the one hand, assist the History of architecture and, on the other, its primary role at the moment in which archive drawings, especially those of architecture that has never been built, take on body and three-dimensional form, legitimising their existence.
The chapter's iconography is completed by a number of extraordinary drawings by Ernesto and Gaetano Rapisardi regarding the projects for Messina in the blocks identified in the Master Plan by engineer Luigi Borzì, director of the municipal technical office. These representations, executed with great mastery and refinement, lead to two reflections. The first is that the architects' attention was directed more to the 'skin' of the building rather than to its distributional system, and the second concerns the preference for one method of representation rather than another. In the latter case, the large production of drawings in orthogonal projection, treated in pencil and charcoal with the use of shadows, testify to a consolidated way of representation on the part of the Syracuse architect. Elena Ippoliti writes: "The drawings, dated between 1928 and 1929, although barely subsequent to the previous ones, testify to a language which, having abandoned the archetypes of historicist eclecticism, tries to identify formal solutions capable of reinterpreting tradition in a modern and monumental key: giant orders, theories of statues, high reliefs, coats of arms, inscriptions. A language that the Rapisardi brothers show they know how to control without any hesitation through the practice of drawing that goes as far as the true-to-life outlines of the most minute details" [p. 56].
In the second chapter devoted to the events surrounding the design of the Pantheon dei Caduti siracusani, Elena Ippoliti captivates the reader like a writer in a novel. All the difficulties involved in the construction of the building are dealt with in a compelling discourse, interspersed with the words of the protagonists and the correspondence, which retraces with chronological precision all the stages leding to the building of the monument, inaugurated on 13 August 1937. The extraordinary accompanying iconographic apparatus assists the story, which without it would be 'mutilated', demonstrating how the relationship between text and image is predominant in the volume and that the history of architecture is also the history of architectural representation.
The following chapters on the architectural competitions in Syracuse, the projects for the area of the Tempio di Apollo and piazza Archimede, the pa-

lazzo Comunale and the palazzo di Giustizia are dealt with by the author with the same methodological rigour and always with a continuous commentary on Rapisardi's drawing on the projects tackled. The author writes about a representation of the project for the area of the Tempio di Apollo: "A drawing that must therefore be considered little more than a very personal sketch by Gaetano Rapisardi, where the very few signs on the plan document his vision: the volume of the building is delineated by hatching the perimeter of the ground connection only, an incisive red mark highlights the new alignments, while a green crayon is used to fill in the widely enlarged spaces, barely hinting at a possible green layout. In the same paper cut-out, a quick perspective sketch in the lower right prefigures the solution not only in terms of its volume but also in its main compositional and architectural lines" [p. 191].

All in all, a volume that is certainly useful for taking stock of the progress of research in the History of Representation and an indispensable book for the History of architecture, which can find in it both correct information and indispensable elements for a more exhaustive and well-founded evaluation of the variety and richness of modern architecture in Sicily.

Francesco Maggio

Author

Francesco Maggio, Department of Architecture, University of Palermo, francesco.maggio@unipa.it

Reviews

Veronica Riavis

La Chiesa di Sant'Ignazio a Gorizia tra architettura e pittura.

Analisi geometrica e restituzioni per la rappresentazione tattile

EUT Edizioni Università di Trieste
Trieste 2020
226 pp.
ISBN 978-88-5511-210-9

Many important museums are now looking carefully at the technologies of Virtual Reality (VR) and Augmented Reality (AR) with the aim of offering their users appropriate cultural and educational insights. Despite the interest that the new digital strategies of architectural and art representation arouse in these contexts, their diffusion is not widespread yet. For now, AR and VR technologies remain almost exclusively aimed at an audience without disabilities, although digital world–by its very nature–could easily overcome (or at least bypass) the most common problems linked with physical limitations.
It can be considered as a real contradiction the fact that today there are national laws that oblige institutions to adapt the access to their buildings in order to allow everyone to reach specific spaces (for example wheelchair ramps and paths for the blind people), but no legislation has yet been promulgated to regulate a more democratic sharing of the contents that those 'accessible' spaces host.
Veronica Riavis' book, entitled *La Chiesa di Sant'Ignazio a Gorizia tra architettura e pittura. Analisi geometrica e restituzioni per la rappresentazione tattile* (*The Church of Sant'Ignazio in Gorizia between architecture and painting. Geometric analysis and restitutions for a tactile representation*) demonstrates that an alternative and more inclusive use of VR and AR technologies is possible.
Part I deals with these issues, outlining the state of the art and focusing the attention on problems related to visual disabilities. From a table on p. 25, which shows the number of those who are blind in Italy, we can deduce that a non-negligible section of our population is precluded from enjoying almost all the architectural and artistic heritage. The author, after identifying some specific supports for blind people, identifies the technologies that could allow them to overcome their disability in the world of culture. The purpose of this section of the book is to outline a strategy of tactile representation of the arts through the education of the senses and creating mental images.
It is curious that the author chose a Jesuit church as a case study to experiment with 3D prototyping techniques that would allow blind people to perceive, with the touch, what the eyes do not allow them to see. Indeed, after the Council of Trent, it was precisely the Jesuit order that spreads the inclusive devotional renewal that the Counter-Reformation had triggered. Starting from the first half of the seventeenth century (the church of Sant'Ignazio in Gorizia was founded in 1626) new precise rules governed religious architecture and sacred painting. The church spaces were freed from the physical limits

previously provided between religious officers and faithful people, at the same time the stories that decorated the altars were also freed from the exegetical symbols to restore the moods of the characters, so that everyone could interpret and recognize the feelings. In essence, the Counter-Reformation made the religious experience more inclusive.
Among the major protagonists of the century, we find a Jesuit scientist and a Catholic artist, respectively François d'Aguilon and Pieter Paul Rubens. The collaboration between them was not limited to the publishing of an important treatise on Optics [d'Aguilon 1613], which in the following centuries will have great influence for the science of representation, but they probably collaborated in the construction of the Jesuit church in Antwerp and its decoration. This Counter-Reformation church was among the prototypes more imitated wherever the Jesuits established, and Veronica Riavis is aware about the importance to historically contextualize the church of St. Ignatius in Gorizia by looking at other buildings erected in further cities by the Jesuits.
In *Part II* of the book we find a study about religious architecture connected to the principles of the Counter-Reformation and, in particular, an insight on the Church of Jesus in Rome by Jacopo Barozzi da Vignola and Giacomo della Porta. In the same section of the book, we can find also a biography of Christoph Tausch, a pupil of Andrea Pozzo and author of the project of the church of Sant'Ignazio in Gorizia as well as of its main decoration. Veronica Riavis retraces the student's debts towards the master and analyzes Tausch's pictorial works with special attention to his *quadrature*, widespread in the main cities of Eastern Europe.
Studying the treatises by Andrea Pozzo and Giulio Troili, Veronica Riavis proposes in *Part III* of her book the perspective restitution of the painted architecture, which illusory contains the stories of the main altar of the church of Sant'Ignazio in Gorizia. The virtual reconstruction does not only concern this precious decorative apparatus but it relates to the entire religious building. In both cases, the 3D models are built basing on appropriate digital surveys. The virtual reconstruction of the church of Sant'Ignazio in Gorizia and the illusory architecture of its main altar are followed by the description of the design and execution of the tactile prototypes that allow blind people to perceive an artwork through the sensitivity of their fingers and the 'eyes' of their mind.
The great merit of this book can be seen in the way in which the author has remained, in a certain sense, faithful to the inclusive spirit of the Counter-Reformation. Virtually modeling the church of St. Ignatius in Gorizia and the illusionistic architecture of its main altar, Veronica Riavis walks on an innovative path, that is not adequately explored yet in the field of VR and AR applications, helping everyone, blind people and not, in the knowledge of an artwork.
Digital tools, as well as traditional-analogical ones, are not in fact neutral means: scholars need to have a methodological and epistemic awareness before using them correctly. Richard White demonstrated that over time the representation of space had not only the purpose of generating images capable of conveying information, but also the role of a research tool [White 2010]. If the conclusion of the American scholar is correct for the traditional methods and techniques of representation, it is even more so for new technologies, which, thanks to the wide range of possibilities they offer, can be considered as a tool for integrating the study processes and learning: in conclusion, they are not just a simple viewers of contents.
Today, the support provided by technology allows the creation of 3D models that can be used for the analysis of artistic works as well as to set up simulations relating to the transformations of urban space and architecture. The advanced use of intelligent models has extended the field of application far beyond the three dimensions, incorporating information such as time, digital survey, historical documentation collected in the archive, etc. An easy way to understand the wide range of possibilities, that the virtual world generates, is to consider the 3D model as a platform on which it is possible, beyond the formal data, to upload many other information, which in turn can be organized and stratified over time, as well as questioned. The disciplines of Drawing and Representation must consider this new challenge and provide a reconstruction of documents by means of 3D models aimed at disseminating analytical interpretations at different levels of complexity, involving the disabled and non-disabled tourist, but also the students and the scholars.
The tactile prototyping of the digital reconstructions proposed by Veronica Riavis for the church of Sant'Ignazio in Gorizia fully accepts this challenge so, if on the one hand her work

aims to enhance a cultural asset and spread its knowledge through the education of the touch of blind people and the creation of mental images, on the other hand, it can act as an immaterial and synthetic place where the analyzes carried out give a form usable to all, at all levels of knowledge, relating to Christoph Tausch's architectural and artistic works.

Andrea Giordano

Author

Andrea Giordano, Department of Civil, Environmental and Architectural Engineering, University of Padova, andrea.giordano@unipd.it

Reference List

d'Aguilon, F. (1613). *Opticorum Libri Sex*. Antuerpiae: ex Officina Plantiniana, apud viduam et filios Io. Moreti.

White, R. (2010). *The Middle Ground: Indians, Empires, and Republics in the Great Lakes Region, 1650-1815*. Cambridge: Cambridge University Press.

Reviews

Roberta Spallone, Marco Vitali

Sistemi voltati complessi: geometria, disegno, costruzione

Complex Vaulted Systems: Geometry, Design, Construction

Aracne editrice

Canterano (Roma) 2020
264 pp.
ISBN 978-88-255-3053-7

After attending the "Corso di Eccellenza" in 2019, a course included in the Dottorato in Beni architettonici e paesaggistici of the Dipartimento di Architettura e Design at the Scuola di Dottorato del Politecnico di Torino, this volume, entitled *Sistemi voltati complessi: geometria, disegno, costruzione* (*Complex Vaulted Systems: Geometry, Design, Construction*), was published by Aracne.

The book becomes an important reference for the specific topic with which the research deals: the analysis of the geometric systems that govern the design and construction of vaults. This study helps to simplify and understand the vaults essence and internal structure, whose complexity and virtuosity have always astonished the spectator.

The content of the book has been organized in the same way as the structure of the specialized course where it all started. It begins with a preface by Emanuele Romeo, Director of the Dottorato di Ricerca in Beni Architettonici e Paesaggistici of the Politecnico di Torino. This chapter focuses on the real aims of the university research and its essential reversion to society, especially on historical heritage.

In an initial section, the coordinators of the publication reflect on the motive and relevance of the research carried out.

Roberta Spallone explains the major reasons for undertaking the research. This should be the starting point for any academic work. These reasons are the appropriate disciplinary framework within the area of architectural design and the interest and novelty of the subject addressed.

Roberta sets out the transdisciplinary nature of this field of study, which involves so different scientific areas such as the history of architecture and building construction, restoration, current construction techniques of historical buildings, drawing and surveying of historical architecture and even geometry and the latest generation of digital graphic techniques.

This issue sufficiently justifies the relevance of the subject to be addressed and not so much because its novelty. The study and drawing of historical architecture are not new, but the methods that infographic advances now allow us to discover novelties in elements and buildings that have been very well studied.

Marco Vitali, for his part, discusses in detail the specific study of the vaults of civil architecture of the Baroque period in Piedmont. This work is the result of two-decade teamwork research.

In the baroque sacred space, extensive developments are built for its covering, motivated fundamentally by the appearance of the new paradigm of the 'central plan', which constitutes a large part of these models. On this basis, the author proposes a parallel investigation applied to the space of civil architecture, not so frequently analyzed in

the field of the historiography of monumental architecture and restoration. Starting with the survey plans, the author models in three dimensions and configures an augmented reality of the spaces analyzed, providing interesting diagrams in which geometry and drawing make a decisive contribution to clarifying the complex compositional methods of Baroque architects.
In the first part of the publication, which is the second content block of contributions to the research theme, there are five chapters written by as many authors. All of them are related to the main theme of the book: the complex vaults.
In his section, Andrea Giordano analyzes the geometric characteristics of vaulted systems and proposes a new reading of the complex mechanisms of stone stereotomy through the use of the new tools of three-dimensional digital drawing. He contributes his own idea of using the Visual Programming Language (VPL) to create a 'stereotomic alphabet'. This contribution is illustrated by three-dimensional models of the proposals from some important treatises on stereotomy.
José Calvo-López analyzes the geometric problems that occurred during the pre-industrial era when carving the stone blocks that made up the vaults.
He shows the inevitable relationship with the development of geometry for their correct resolution. The rope, as the basis of the *in situ* outlines, becomes a simple but essential tool for the stonemason. The illustrations that accompany the chapter make it easy to read and understand.
Carlo Bianchini studies the application of one of the most important treatises in the seventeenth century. Two of these treatises–mathematics and architecture–propose the novel 'construction' of a kind of 'virtual treatise'.
Ana López-Mozo proposes a study on asymmetrical Gothic vaults, which the author defines and determines by firstly taking into account the general classification of the elements that make up the Gothic vault and then the characterization of the particular type she intends to analyze. The author distinguishes between the two systems that make up the Gothic vaults: nerves and plementery. With these systems, a very versatile mechanism is constituted to achieve the covering of spaces with any geometry, even irregular. The author adds some photographs to her discussion showing details of existing vaults in different parts of Europe that help you to understand her arguments. It ends with an interesting comparative diagram with the several examples studied.
Finally, Pablo Navarro-Camallonga studies the vaulted systems of carved stone in the framework of the ancient Kingdom of Valencia in the 15th century. The author himself states it is a part of his PhD work. It is a type of vault that precisely differs from those analyzed by Ana López-Mozo, in which the placement of the voussoirs is continuous and its particular stereotomy is in fact what shapes the geometry of the vault finally built. The author bases his work on formal analysis, through historical documentation, and on the metric analysis of the built works. Photographs of the analyzed elements, photogrammetric surveys and geometric analyses are included to always support the author's thesis.
In the second and final part of the book, six graduates' contributions have been chosen among those participating in the Symposium. All contributions share the same topic: vaulted structures and address various issues of research interest: from brick vaults, very frequent in Mediterranean architecture, to more singular and unpublished, such as vaults in Ancient Egyptian architecture. Essential issues are dealt with to complete the whole book, for instance the study of the nomenclature of vaulted systems; more specific studies on Guarini's treatises, probably influenced by Bianchini's aforementioned lectures; a study of comparative analysis of three specific points in the Mediterranean area referring to the use and construction of vaults: Mallorca, Valencia and Palermo; and finally a curious study about the vaults known as "Swallow dome", typical in the Caucasus area. The author analyzes it and then compares the formal system with the dome in the Chapel of the Holy Shroud in Turin. This high point may not be a coincidence and perhaps it is a tribute to the University where the research was carried out.
Finally, the book closes with a postface by Concha López-González who is a professor at the Polytechnic University of Valencia. She outlines the essential relationship between university research and society, just as Roberta Spallone had explained in the preface. A book itself is the ultimate expression of this relationship. It makes the results of research available to society in a compiled, synchronous and attractive way, confronting the current inflation of indexed articles, which the vertiginous university competition frequently shows us, being finally aimed at a much more specialized readers.
This fantastic book fulfils all the requirements of a good research. First, the book deals with a relevant subject: the vaulted systems in architecture. Secondly, it makes an innovative contribution to the analysis or the results. The continuous use of new technologies helps

us to understand the enormous complexity of vault constructions, their geometries and stereometries. Making a computer three-dimensional model seems to be complex in this technological 21st century, although medieval masters were able to build cathedrals just by using their tools and stone tracings. Isn't it amazing? And thirdly, their contribution to knowledge and society.

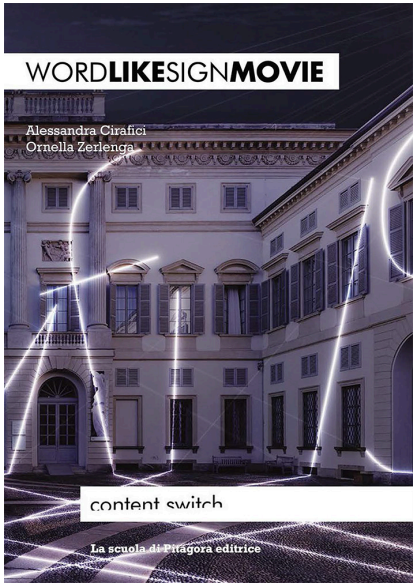
Eduardo Carazo Lefort

Author

Eduardo Carazo Lefort, School of Architecture of Valladolid, University of Valladolid, eduardo.carazo.lefort@uva.es

Reviews

Alessandra Cirafici, Ornella Zerlenga
WordLikeSignMovie. Content switch
La scuola di Pitagora editrice
Napoli 2020
229 pp.
ISBN 978-88-6542-394-3



The pages of the book by Alessandra Cirafici and Ornella Zerlenga, immediately reveal the central theme of the reflection, that related to the 'word' considered in an intertwining of signs, spaces, languages and media.
Only by leafing through the volume, from the paratextual elements to the pages of the central body, it is possible to detect information and clues, articulated in a balanced alternation of texts and images, which well allude to the topics, cultural visions, approaches of the research presented in the volume.
For this reason, I think it is interesting to develop the review of the book trying to present the themes as they gradually emerge in the succession of its parts.
In this cognitive process it is possible to appreciate the clarification that the topics treated gradually take on, but also the relevance that they express, right away, thanks to the skilful use of the specific languages and codes of that precious set of pages that make up the 'threshold' of the book.
On the cover, therefore, the central theme of the volume, represented in the title *WordLikeSignMovie*–a chain of terms represented without solution of continuity that well interprets the idea of connection between the typologies of the linguistic sign–receives a semantic reinforcement from the effective authorial image, the laser installation site specific *Adaptation 2016* by Arthur Duff, created in the entrance courtyard of the Galleria d'Arte Moderna in Milan. A further refinement is provided by the *Content switch* subtitle which, introducing the idea of change, signals a significant methodological trait, a sort of gradual re-orientation which, as confirmed in the preface, outlines the path of theoretical reflection in favor of multiple and thematic intersections.
It is, as the authors write, "a progressive, modulated and conscious 'change of program'", a sensitive opening towards new scenarios fueled by technological innovation and the continuous evolution of creative thinking.
In the index of the book, the sequence of contributions, organized around three main parts–essays, interviews, workshops–, each developed through a double point of view–two authors for the essays, two for the interviews, two for the design 'descriptions'–,offers an interesting nuance of gaze on what is addressed. In particular, the chapters *Scrittura in 'carta'* e *Scrittura in 'video'*, respectively edited by Alessandra Cirafici and Ornella Zerlenga, propose an articulated theoretical reflection on the 'word' in relation to a plurality of expressive forms and to diversified modes of use / interaction, outlining a thought that seems to be partly preliminary, partly consequent to the research and experimentation developed in the didactic workshops.
The interviews with Anna Maria Pugliese and Arthur Duff highlight some founding topics of their researches, noting, in particular, the originality of the artistic

vision with respect to central issues in the debate on contemporary visual languages, which also involve the disciplines of the project related to visuality.
The contributions of Alice Palmieri and Vincenzo Cirillo, respectively authors of the essays *La grafica della parola. Declinazioni e sperimentazioni* and *Il disegno delle video-esperienze*, provide a detailed description of the theoretical-methodological process of the workshops. *Content switch: website* is a presentation text of the website collecting the results of the experimental research.
In this general framework, the chapters *Scrittura 'in carta'* and *Scrittura 'in video',* each divided into four writings, are certainly central. Therefore, I would like to point out some themes particularly useful for understanding the disciplinary point of view at the basis of the research presented in the volume and which certainly refer to some of the main issues of contemporary theoretical debate.
Following the index, in the chapter *Scrittura 'in carta'* by Alessandra Cirafici, the theme of pluridisciplinarity and interdisciplinarity, now pervasive in multiple design fields and intrinsic to graphic design, seems to be one of the founding elements of the research proposed, an essential feature of the theoretical premise and of the design experimentation developed in the activity of the workshops. Connected to this aspect is then the theme of hybridization of languages, supports, techniques, as well as that of the context transition of the visual project–from surface to space–which also implies a passage of scale of the artifacts.
In this vision, in which the graphic signs seem to take the form of an elastic material available to be molded even in the fruition phase, some theoretical references are included to the theme of interaction and interface, respectively process and filter for accessing a repertoire of products, services, works, etc. ever wider and more articulated.
Definitely current the reflection in which Alessandra Cirafici, also recalling Christofer Fryling theoretical approach, proposes 'visual research' as a design methodological process oriented to 'problem finding', or to the definition and formalization of questions through which imaging and thinking about possible future scenarios. The essay concludes with the introduction of the design experimentation developed with the artist Anna Maria Pugliese on 'poetry', that is, on the word as sound, rhythm, graphic sign, image and much more; an opportunity, as Alessandra Cirafici writes for "navigating in collaboration with other knowledge, other cultural and creative attitudes", which has also triggered interesting semiotic considerations.
Finally, in the essays *Questioni di lettere, Dialoghi a distanza* and *Flowing. Flussi di memorie*, with reference to the training activity of the workshop developed with the students of the Design a Communication Course of the University of Campania 'Vanvitelli', the author underlines the conceptual and operational relationships with the work of Anna Maria Pugliese, and points out a widespread experimental attitude which, in a dimension of dialogue with digital type design, echoes the research of the avant-gardes and visual poetry.
A significant interdisciplinary vision emerges that sees the exploration of reworking processes about words, verses, thoughts, memories proposed in the artist's performance; a suggestive translingual tendency emerges aimed at identifying new codes, products and communication channels to expand the possibilities of fruition of the work, making it accessible even in a deferred time, precisely a 'remote dialogue'.
In the chapters developed by Ornella Zerlenga starting from *Scrittura in 'video'*, the theoretical reflection shifts to the processes triggered, in art and visual communication, by the video technique where space and time are connected, as the author emphasizes, "according to discontinuous, interstitial, brief, interactive and, above all, immersive logics".
Among the many topics dealt with, I remember, in particular, the references to the enhancement of the body dimension in the work fruition–as a consequence of the involvement of multiple sensory channels that create dynamic and interacting information flows–and of the temporal dimension intrinsic to the video product. Arguments also put by the author in relation to the right for all to enjoy art, recognizing precisely in the multisensory and immersive experiences a fundamental contribution towards accessibility.
In the text *Arte & Schermo. Video-grafica* the reflection is oriented to the relationship between writing and video, with references to the video-poetry experiments of the 80s-90s of the twentieth century and to videography, of which some fundamental evolutionary episodes are also reported.
Fascinating is the theme relating to the dialectic between writing and space, both the one that takes shape within the video product, through the application of animation to the footage, but also that which can be experienced in real space, for example through the interaction of projections of marks on architectural surfaces.
In the *Percezione & Sensazione. Video-ambienti*, with reference to the idea of "video-environment or sensitive environment, together, multimedia, inter-

active, immersive", Ornella Zerlenga opens the reflection on the active role of the user, often co-author of the work, and on the different forms of overlap between real and virtual (virtual reality / augmented reality) also introducing, in a theoretical perspective that includes central issues in the contemporary philosophical debate, considerations on the ethical implications related to the development of some sophisticated technological applications.

Finally, in the chapter *Scrittura & Workshop. Video-esperienze*, the author presents the workshops *La memoria come strumento di coscienza creativa* and *WordLikeSignMovie*, developed with multimedia artists Anna Maria Pugliese and Arthur Duff, that offered an opportunity of reflection and experimentation on video-poetry and video-environments for the students of the *Laboratorio* of Graphic Creations of the *Corso di Laurea Triennale in Design e Comunicazione* (*Dipartimento di Architettura e Disegno industriale* of the Università degli Studi della Campania 'Luigi Vanvitelli').

A book, therefore, which between research and project verification addresses current issues not only in the disciplinary specificity of representation, but also, transversally, in all areas of contemporary creativity.

Enrica Bistagnino

Author

Enrica Bistagnino, Department of Architecture and Design, University of Genova, enrica.bistagnino@unige.it

Reviews

Giorgia Aureli, Fabio Colonnese, Silvia Cutarelli (eds)

Intersezioni. Ricerche di Storia, Disegno e Restauro dell'Architettura

Artemide Edizioni
Roma 2020
352 pp.
ISBN 978-88-7575-352-8

Turi Sottile's lively bright graphics on the cover (acrylic on transparent blue, 80x80 cm, 2009) are an evocative visual representation of the book's contents. The title *Lasciando aperta la porta dell'intelletto tutto può succedere* (By leaving the door of the intellect open, anything can happen) conjures up the delicate, multifaceted creativity of the original and innovative nature of this study in the field of Architecture.
The book, edited by Giorgia Aureli, Fabio Colonnese and Silvia Cutarelli, and presented by Donatella Fiorani, is a compendium of the topics illustrated during the seminars organised as part of the Research Doctorates in the History, Drawing and Restoration of Architecture taught at the Department of History, Drawing and Restoration of Architecture from 2017 to 2019 (Sapienza University of Rome).
The meetings, organised every year as part of the Doctorate course, are participated by non-resident experts, most of whom are teachers from other Italian and foreign universities involved in the contemporary debate about science and culture; the experts are invited to deliver a presentation on topics regarding the Disciplinary Scientific Sectors of the Doctorate. The seminars have always involved doctorate students from all three Disciplinary Scientific Sectors and all the teachers of the Doctoral College; the objective is to encourage a debate about aspects and problems regarding the subjects included in the study course. The educational goal is to boost the development of a research, analysis and critical interpretation method as well as create synergies between the doctorate students in various fields and promote interdisciplinary studies.
The book presents the topics studied in-depth during eleven sections; each one contains essays regarding the disciplinary scientific sectors of the History, Drawing and Restoration of Architecture, as well as the conclusions and concise considerations written by the Researchers Giorgia Aureli, Fabio Colonnese, Silvia Cutarelli and Elisabetta Montenegro. These authors emphasise the links between heterogeneous studies–divided by subject-matter, approaches, study processes, methods and objectives–in order to highlight the disciplinary intersections between contributions and, more in general, encourage positive research contamination between separate fields on common issues.
The topics refer to issues such as: Proportion, form and structure in Architecture; Representation, construction and transformation of the city; The Twentieth Century, design and worksite; Surfaces, material and image; Roman architecture between the centre and outposts of the Empire; Architecture and the city; Architecture, form and function; Architecture and visual arts; Architecture and competitions; Finished and unfinished in Architecture; the Ephemeral (and immaterial) in Architecture. Rapporteurs include: Piero Albisinni, Maria Teresa Bartoli, Federico Bellini, Rita Bertucci, Mario Bevilacqua, Lorenzo Bianchi, Thomas E. Boothby, Francesco Cervellini, Massimiliano Ciammaichella, Alessandra Cirafici, Laura De

Carlo, Roberto De Rubertis, Carolina Di Biase, Maria Diodato, Francesco Doglioni, Lorenzo Finocchi Ghersi, Francesco Paolo Fiore, Marco Folin, Roberto Gargiani, Alfonso Giancotti, Andrew Hopkins, Loughlin Kealy, Tommaso Manfredi, Claudio Menichelli, Camilla Mileto, Stefano Francesco Musso, Caterina Palestini, Lia M. Papa, Biagio Roma, Marida Talamona, Giorgio Testa, Fernando Vegas, and Paolo Vitti.

In her presentation Donatella Fiorani, coordinator of the Doctorate from 2017 to 2019, illustrates the cultural project of the Doctorate–education, training, research and interdisciplinary studies–and also provides a brief history of the most recent doctorates. She specifies that a decision was taken to publish the book not only because those involved were firm supporters of the formative method adopted in the three disciplinary sectors, but also because they wished to share this cultural approach with the two teachers responsible for the History Section and the Drawing Section: respectively Paola Zampa and Laura Carnevali. The multidisciplinary nature of the seminars is based on assessments regarding the important subjects in question, including the properties of architecture, chronological and linguistic specifications, and possible dialectics regarding approach, scales and recurrent topics in today's world.

An in-depth study of the cultural contents broadened the research boundaries and knowledge-gathering potential thanks to a fertile contamination between genres and study languages. The educational course encouraged the involvement of individuals and, by creating an integrated vision, helped to overcome fragmented knowledge-gathering.

In the section dedicated to the Representation, construction and transformation of the City there is a contribution entitled *Representation by fragments. Places and visions of the contemporary city* involving the field of Drawing. Written by Biagio Roma (Sapienza University of Rome), the essay is an interesting visual urban narrative of the city that exploits drawings, paintings, photographs, and films. It also provides many critical ideas about the urban scenarios that in turn become potential design sites for the contemporary city. He also indicates places that deserve to be interpreted, monitored and documented. The authors state that the goal is always to "draw, survey and understand the existing scenario in order to be ready to change it, either by designing the contemporary city or imagining an ideal city".

In the section focusing on the Ephemeral (and immaterial) in Architecture as regards History, the authors tackle the concept of the ephemeral and movement in architecture and analyse the buildings where processions pass by.

The contribution by Andrew Hopkins (University of L'Aquila) entitled *The ephemeral and the concept of movement in architecture* focuses on connected ephemeral architecture, in other words on the ways in which the individual discovers and sometimes creates the ephemeral through his own movements, clearly with references to the nineteenth century. He states that the *flâneur* is an obvious example; a person who walks through the city intent on observing others who, like himself, move along the city's streets.

As regards our contemporary world, Hopkins studies the amazing pavilion designed by Francesco Dal Co–the Vatican Chapel–erected in 2018 in the garden of the island of San Giorgio Maggiore belonging to the Cini Foundation. He points out the pilgrims' role: "Like the pilgrims of yesteryear who discovered the churches for indulgences as they gradually crossed through Rome, so too contemporary pilgrims–in other words the faithful of contemporary art and architecture–stroll across the island of San Giorgio Maggiore in Venice to discover these very beautiful chapels, designed by ten of the most cutting-edge architects of this day and age; ephemeral objects discovered and experienced by the visitors thanks to their movements".

As regards Restoration, in the section Surfaces: Material and image, Francesco Doglioni (IUAV University of Venice) tackles a topic entitled, *Materials and images of Venetian architecture. Conservation and restoration of the pluralism of surfaces.*

The article focuses on "interest in the plurality of materials, surfaces and the images they create, to which we owe the multifaceted variety of Venetian façades" [pp. ????]. She uses an "observation method that examines data regarding material culture–choice of materials, workmanship during construction–and links it to data regarding figurative culture, in other words the colour and texture of the image, and sometimes to the design that is the visible result of a certain building method".

All the contributions provide ideas for research on individual topics or broader and more complex issues, proving that different kinds of training and knowledge are part of a Research Doctorate; a collective memory of critical dialogue–crucial to help young people decide on their own knowledge-gathering path.

Emanuela Chiavoni

Author

Emanuela Chiavoni, Department of History, Representation and Restoration of Architecture, Sapienza University of Rome, emanuela.chiavoni@uniroma1.it

Events

Events

Documentazione & Digitale 2020 Rome Knowledge and communication of Cultural Heritage

Cecilia Bolognesi

The event presented by the Department of History, Design and Restoration of Architecture of Sapienza University of Rome, and sponsored by UID Unione Italiana per il Disegno [1], is a moment of exchange and scientific and cultural update; the event is in its third edition after the previous editions held at the University of Pavia and the Politecnico di Torino. The origin of the meetings comes specifically from the scientific research of Representation, understood in a high sense as a key to knowledge, communication of the imagined and the real, the built environment but also the natural one. Even before for the others, a drawing is produced precisely for those who elaborates it and who finds in that action of materialization of thought an advancement of a personal knowledge with which it compares and improves, and later, as today, this can become a shared experience. Representation as a shared subject is integrated with disciplines coming from other fields such as history and restoration. But it is also treated as Memory, as synchronic and diachronic experience of the human experience in the meanings that Franco Purini underlines.

In technical terms, the purpose of the initiative is to guarantee an update of scientific innovations in the field of digital documentation of the Built Heritage, aiming at knowledge for valorization. Therefore, within it we can find research with innovative implications, methodological debates, experimental applications, tests of the best consolidated practices necessary to take possession in terms of knowledge and dissemination of cultural heritage; the medium is the research of young researchers, who become the background for dialogue and confrontation with the scientific community.

A series of introductory reports given by personalities who have the responsibility of managing cultural heritage starts the communications: the presence of Erminia Sciacchitano (MIBACT), Alfonsina Russo (Director of the Archaeological Park of the Colosseum), Federica Rinaldi (Director of the Colosseum), Stefano Borghini (Responsible for the implementation of the Digital Archaeological Park), Dario Aureli (Head of the Technical Office of Palazzo Barberini), along with Carlo Bianchini (Director of the Department of History, Representation and Restoration of Architecture of Sapienza University of Rome), Emanuela Chiavoni (Coordinator of the Doctorate in History, Representation and Restoration of Architecture of Sapienza University of Rome) and Francesca Fatta (President of Unione Italiana per il Disegno), together with the professors of the various universities that are part of the organizing committee, demonstrates both the liveliness of the theme and its concrete permeability between the field of research and the field of application in the realm of heritage. Specifically, the various introductions to the day clearly expressed one of the need that occurred during the pandemic months: that is to be able to communicate cultural content in the heritage sphere, even with respect to places and sites. These actions, advocated by the MIBACT and museum directors through a three-year plan for the digitization and digital innovation of museums, have had the ability to accelerate a path of communication of heritage to an increasingly broad audience; in some cases, as explained by the Director of the Colosseum Park, and Stefano Borghini, they have been able to create not only a replacement of real visits with virtual ones, but an extension of the experience to further content, with more engaging and immersive modes, so much so as to make the museum institution a forum, a new space for debate among the public, researchers, and experts. The complex cultural history of the park of the Colosseum becomes a point of reference: in the necessity of

https://doi.org/10.26375/disegno.8.2021.29

its transmission to the public they have grown actions of storytelling supported by different technologies, from the physical models to the virtual ones, to the projections, to the immersive fruitions with an amplification of the experience that multiplies the contents and the meanings.
The contents expanded by the growth of digital tools within the cultural heritage have also demonstrated a greater inclusive capacity towards the public; some experiences can meet the needs of usability for a public otherwise affected in a visit in presence, other experiences are developed and brought for example within the study session referring to categories fragile in sight, or hearing, readily supported by touch for the use of tactile maps and other supports in view of the enlargement of the fruition.
The topics covered are many, but the general lines of research that run through the various researches can basically be ascribed to four macro areas all hinged on the same research question: how digital representation and documentation can create intelligent models that incorporate our knowledge of designers and how this heritage becomes a new source of knowledge and how this heritage becomes a new form of collective intelligence for the benefit of the heritage itself.
The first topic, and perhaps the most discussed within the reports exposed, concerns which semantic modeling to give to our models for architecture, models that we create starting from the existing, for example, with a process that immediately affects the three phases declined by Riccardo Migliari: the semantic modeling is a moment of segmentation of the mass rich in information but unaware of its constitution, after which processes of synthesis are operated, but also reduction and projection. It is a complex pro-

Fig. 1. Flyer of the event.

cess, above all within the BIM authoring software, which obliges us to discretize architectures that are sometimes very complex, to make choices and compromises to which we do not want to surrender so easily. It is therefore a matter of declining new taxonomies, the most common one that most of us refer to is the one related to historical architecture, to elaborate a lexicon congruous to its construction.
Directly related to the semantic modeling of digital architectural representations of heritage, many interventions seek the dialogue between models and formats that derive from them to support the use of Artificial Intelligence; the latter must be considered useful within systems for querying and managing the models themselves. On the one hand, theoretical and methodological issues of the digital model are investigated, on the other hand, simplifications consistent with an understanding of content for a smart use by AI. The field of application is vast and touches similar themes in all interventions: after the acquisition of digital data and the definition of a model structuring technique, the management of annotations and the structuring of AI processes remain the frontier of application still too little explored but where collective intelligence is growing. Scripting and neural networks for the management of digital twins belong to this type of research and it is difficult to recognize the perimeters of disciplinary competences, where a large part of the success of the research is determined by the initial modeling approach. The model therefore recurs as a central element of all the developments investigated, a multiple and integrated descriptive model. The neural networks find different applications in the research in the field of automatic recognition by means of Artificial Intelligence algorithms of the semantic structure of the model, with complex phases of training to the recognition of the parts, illustrated and applied to complex cases, considering heritage.
The model in its structure of relational database, is the center of the construction of a third strand of the searches, more focused on the management of the multiscale informative systems for the valorization of the architectural heritage. Once again themes touch the variety of languages, the interoperability of the systems and the use of different documental apparatuses by different users, ranging from the model to the combined management of historical memory, information and interventions on the work. Communication to public, the profiling of the different users and of the different answers becomes a research theme and the databases explore under new points of view the structure of the model for declinations suitable for every situation undertaken. Finally, the event reports some interventions aimed at analyzing past pictorial works of art or related to the more recent graphic heritage, bringing the issue of representation on a more direct cognitive level, as mentioned at the beginning of this thought; some interventions analyze the phenomenon in its context of reference, explaining the added value that artists can offer in the enhancement of architectural heritage both historical and contemporary.
In synthesis, the whole conference represents a dense and variegated analysis of the state of the art of what in our sector intersects the concepts of model, document, digital, in the relationships that exist between the parts at the service of a growth in the knowledge of architecture; particularly valuable thanks to a series of young researchers here included.

Notes

[1] Recording of the event, available online from 10.12.2020 at: <https://www.youtube.com/watch?v=8ZyulvDSw1A> (accessed 10 May 2021).

Author

Cecilia Bolognesi, Department of Architecture, Built Environment and Construction Engineering, cecilia.bolognesi@polimi.it

Events

Workshop 3D Modeling & BIM *Digital Twin*

Elena D'Angelo

The VII edition of the *3D Modeling & BIM Workshop–Digital Twin* took place on April 14, 2021 in webinar mode, like the VI edition.
The first main consideration concerns the possibility offered by the telematic link, which has become, in the last year, the most widespread communication tool, allowing the scientific communities to easily stay in touch and effectively disseminate their research. From north to south, passing through the center, the geographical location of the participants was irrelevant: there were 220 participants in the study day. This perfectly shows how, in the future, the conferences must contemplate the possibility of allowing remote connection, enabling those who are unable to move easily to participate.
The first part of the workshop sees the greetings of several experts: prof. Carlo Bianchini, Vice Rector for Architectural Heritage and Director of the Department of History, Design and Restoration of Architecture, Sapienza, University of Rome, prof. Francesca Fatta, President of the Italian Union of Design, architect Christian Rocchi, President of the Order of Architects, Planners, Landscape Designers and Conservators of Rome and the Province, and the engineer Massimo Babudri, BIM Delegate of the Order of Engineers of Rome.
This demonstrates how the academic and professional world are strongly interested in increasingly topical issues, also considering the indications contained in the MIT 560 Decree of 2017. The necessary connection between the world of the research and the world of the profession–or applied research–is highlighted by the interventions of the keynote speakers, particularly by prof. Francesca Fatta as Full Professor of the Mediterranean University of Reggio Calabria with her intervention entitled *The digital world and the human sciences: the role of Drawing* and that of the architect Elena Gigliarelli, Director of the Institute of Cultural Heritage Sciences of the National Research Council, with her contribution entitled *Heritage BIM experiments in the CNR ISPC*.
Their interventions are in continuity with the contribution of the keynote speaker of the 6th edition, Christian Florian, BIM Manager of Permasteelisa, thanks to which it was evident how much the world of companies, operating in the BIM field, provides the possibility to pass from essential vision of the research to the operational and construction methods of the building site. Today more than ever, this concept is combined with the urgence to develop increasingly profitable methods of managing new buildings and heritage, capable of responding to the needs and the many variations that occur in the definition of the architectural project. Only thanks to the virtuous partnership between research and applied research it is possible to reach qualitatively effective processes and concrete supports.
What has been observed denotes the substantial difference between the first editions of the Workshop and the current one. The transition from speculations of a mainly theoretical nature to actual methods applied to existing or newly built artifacts, indicates an ever clearer and more profound evolution of course. This push towards the concrete use of the BIM procedure, also given by the recent updates of the legislation on public procurement (UNI 11337 standard on BIM), promote several tools that can actually be used and integrated into common intervention practices. The limit, as known, can be found in the difficulty of relating the information of digital objects with tools that operate according to different logics, due to the different supports with which they are processed. Currently, the interaction of information is entrusted to systems that are still underperforming, used in partial forms, only in some sectors and not reworkable. The intent–which seems to be pursued with the contribution of computer scientists, programmers, soft-

https://doi.org/10.26375/disegno.8.2021.30

Fig. 1. Flyer of the event.

ware houses in close collaboration with the public administration–is to increasingly define the level of information interchange (non-geometric attributes) between digital objects and IT tools.
The approach to the problem is therefore of a semantic nature and the goal is to overcome the cumbersome exchange of information, so that the Building Information Modeling procedure is fully effective. The fundamental difference between BIM management methods and management methods applicable to historical and cultural heritage (HBIM) fits into this context. In fact, if the field of new constructions seems to have taken a clear direction, the same does not apply for the building field. Surely the substantial difference can be found in the difficulty underlying the delicate dynamics of managing architectural assets, which totally evade the logic of the new construction and on which research is trying to give answers according to the contingencies and characteristics of each context.
In general, the last few years have been characterized by various studies relating to attempts to apply BIM processes to historical buildings, which have led the world of research to question the effectiveness and reasonableness of the forcing of the process in this direction. The doubt derives precisely from the rigid logic that structures the BIM modelers, programmed to facilitate new construction projects. Think for example of the concept of standardization of parametric elements or of the conferment of greater efficiency or functionality of a three-dimensional model. It is evident that in this perspective the system still struggles to consider some peculiar characteristics of the heritage. In the first place, the strong geometric discontinuity of the artifacts that belong to different periods from ours and that are often in a state of neglect. Linked to this concept is the difficulty of transposing the indications into the IT tools, both of a formal geometric nature, and

relating to the state of conservation and therefore to the pathologies affecting the objects. Another aspect, not to be underestimated, is the need to find and translate within the system data relating to the study of historical and archival sources, essential for the knowledge and interpretation of a structure in a state of ruin. This type of reconnaissance involves multiple professional figures (archaeologists, art historians, restorers, geologists) who, with all the difficulties involved, tend to a common goal. In this sense, exploiting the interoperability of the BIM system becomes even more a delicate matter in the face of the huge number of aspects that must be selected, confiscated, made usable and understandable by all the professionals involved.
The challenge is precisely to propose solutions that can overcome the stringent logic of the tool and allow its use also to operators working in the field of restoration, conservation, and maintenance of cultural heritage (public and private). In these terms, the contributions shown in this edition of the Workshop are in line with the general trend of experiences conducted on a case-by-case basis. They propose interesting applications of methods related to the HBIM field and beyond, a symptom of a growing process maturation and a continuous refinement of the product. Specifically, the concept of the 'Digital Twin' fits well into the current debate, asserting that any object of the built heritage is susceptible to a homologous representation within the digital space which, in addition to re-proposing its geometric and formal aspect, can contain and transmit a quantity of news that tends to infinity. This last aspect is strongly current, especially in relation to two main needs: the implementing choices that contemplate interventions that are aware and respectful of the context in which one operates and, at the same time, propose supports capable of optimizing costs and times of realization. Another fundamental aspect of the seismic risk and improvement sector concerns the need to create digital archives, which can serve as a precious testimony of highly vulnerable artifacts. Finally, the topics covered come to social aspects related to 3D modeling applied to the field of inclusion, a desirable path from every point of view. The use of physical interaction systems with technological tools has opened the doors to sectors that operate in different fields, establishing an increasingly stringent connection between human needs and the automated object. Thanks to this, it was possible to conduct various reflections within contexts of public and cultural interest, in which factors of social inclusion and accessibility intervene, which differentiate services based on the user's needs and allow us to hypothesize and define customized technological infrastructures.

Author

Elena D'Angelo, Department of History, Representation and Restoration of Architecture, Sapienza University of Rome, elena.dangelo@uniroma1.it

Events

Remediating Distances Presentation of IMG Journal 3/2020

Letizia Bollini

IMG Journal (https://img-journal.unibo.it) is an emerging scientific journal part of the network of IMG initiatives (http://www.img-network.it/img-conference/> (accessed 2021, May 14),–inaugurated by the first international conference held in 2017 at the University Campus in Bressanone. It represents a meeting point and an interdisciplinary academic exchange aimed to explore and discuss, from different points of view, the intersectional space between *image*s, *imagery* and *imagination*. The six-monthly open-access scientific journal, born from the joint initiative of Alessandro Luigini, professor of Drawing at the Faculty of Education Sciences of the Free University of Bozen-Bolzano, editor-in-chief, together with Chiara Panciroli, professor at the Department of Education Sciences of the University of Bologna in the field of General Education and Educational Technologies, has recently closed the call for the fifth issue: *Imaging peripheries*.

The seminar organized online on 18 February 2021 was the occasion to officially present IMG Journal starting with the third issue: *Remediating Distance*s, released on 31 October 2020. A "dense" volume–more than five hundred pages, although it is a digital format–composed, in addition to the editorial and the final *Composite* section, of 23 wide-ranging essays. The two editors, Matteo Treleani, professor at the Université Côte d'Azur, EUR CREATES Arts et Humanité, Sic. Lab and Francesco Zucconi, currently researcher at the Department of Architecture and Arts of the IUAV in Venice, associate member of the Centre d'Histoire et de Théorie des Arts, École des Hautes Études en Sciences Sociales (EHESS) in Paris and formerly a Lauro de Bosis Fellow at Harvard, have, in fact, been able to give the topic an international perspective by offering an articulate and choral overview at the same time. The contributions include those by Emanuele Arielli, Kris Belden-Adams, Iain Chambers, Marianna Charitonidou, Francesco Casetti, Pietro Montani, Olga Moskatova, Nicola Perugini, Karen Pinkus, Paola Puma, to name but a few of those cited in the debate. The theme of *Remediation of distance*s seemed more topical than ever, in a time still suspended between emergency and *new normality*. In that space, mediation and media are the scenarios and, at the same time, the means of our daily interactions. Technology has been the place where the dichotomies of distance/closeness, mediation/proximity have been theorized and explored. The place, not of interconnected remote points, but instead of constructing and setting up environments and media configurations that made us experience with our senses–separate bodies, synchronized minds as Bruno Bachimont puts it–the "*not here* and now" of co-presence practices.

Whether it be images (Luca Acquarelli) or migrations between the shores of the Mediterranean (Iain Chambers), proximity and distance become the structural and paradigmatic elements, the keys to ontological interpretations, of contemporaneity. The spatial dimension corresponds to the emotional, relational and social dimension experienced in co-presence–'isolated together' as underlined by Pauline Chevalier–or in the alienating encounter mediated by *virtuality*–the Pietro Conte's 'reuniting' concept. In the transversality of the topic proposed by the curators, themes emerge like conceptual interpretations which are aggregated and recomposed around recurring keywords, such as images, death and mourning, bodies, digital (virtual) technologies. The presentation also focuses on hitherto implicit and, perhaps, intentionally ignored aspects, with respect to the relationship between connection infrastructures, tools, access and practices, digital processes, in other words, the 'digital divide' as a measure of social imbalances, which, especially in the case of distance learning, have become dramatically visible.

The February event, coordinated by Alessandro Luigini and Chiara Panciroli, was divided into several moments, start-

https://doi.org/10.26375/disegno.8.2021.31

ing with institutional greetings sent by Maurizio Fabbri, Director of the Department of Educational Sciences 'Giovanni Maria Bertin' of the University of Bologna, with which the magazine has strong links, also in editorial terms. The speech of Rossella Salerno, Vice-President of UID–Unione Italiana per il Disegno (Italian Union for Drawing)–in confirming the close collaboration between IMG and the scientific society–underlined the tangency between the theme of the 3/2020 issue and that of the 42nd International Conference of Teachers of the Disciplines of Representation *Connettere. Un disegno per annodare e tessere (Connecting. Drawing for weaving relationships)*, where *distance* and *technology* will be two of three leitmotifs of discussion and debate.

The second moment saw the two editors-in-chief officially presenting the IMG Journal, born in 2019 as a meeting point between different perspectives and converging interests on visuality, with a strong vocation for interdisciplinarity and as a choral and collective work, as far as the activities of the editorial board are concerned. The theme of the third issue, introduced by the two curators, is, in fact, an overview of the voices that are transversally animating the scientific community and practice in the various areas ranging from design to pedagogy, from psychology to media studies, from historical research to project culture.

The debate was opened and animated as discussant by the member of the Scientific Committee Alessandra Cirafici, professor at the University of Campania 'Luigi Vanvitelli' and Pier Giuseppe Rossi, member of the Scientific Committee Pier Giuseppe Rossi, professor at the Department of Education, Cultural Heritage and Tourism Sciences at the University of Macerata, who contributed to bring the topic into sharper focus.

In the multi-voice debate, which also involved some of the authors–including Pietro Conte, researcher in Aesthetics at the Department of Philosophy and Cultural Heritage of the University Ca' Foscari of Venice and Luca Acquarelli of the University of Lille–some reflections emerged above all on the relationship between 'representing' as a process of image construction and 'visuality', as a form of visual action–as also recalled by Calvino in his fourth *American Lecture*–but also as the primacy of Western *ocularity* and the fixity of the point of view. The latter has now been undermined by the digital revolution. The relationship between vision, perception, (co)presence or 'elsewhere'–also in terms of time–becomes a central issue, when the point of view is replaced by a mediating tool, i.e. by the simulative and immersive possibilities of Virtual Reality (VR), hybrid or Augmented Reality (AR). What was previously a territory becom then a 'border' in which the body itself from mediator becomes mediated. The perceptive analogies generated by technology clash, however, with the experience of a dislocated space, on the one hand, and with the fragmentation of temporality, on the other. An 'exhausted' space in which everything possible seems to run out or in which the rhetorical polarities of virtuality are questioned.

Remediating Distances thus offers a 'fresco' in progress of contemporaneity and an articulate and critical mapping of the underlying dynamics that are materializing in our *new normality*.

The seminar was also an opportunity to present the third edition of the biennial international IMG Conference, which–after those in Bressanone in 2017 and Alghero in 2019–will be held on 25-26 November in Milan. Daniele Villa, professor of Drawing at the DAStU of the Politecnico di Milano and Franca Zuccoli, professor of Special Didactics and Pedagogy at the Department of Human Sciences for Education 'Riccardo Massa' of the University of Milano-Bicocca, coordinators of the event, recalled how the title of the conference–*Image Learning*–stems from the desire to culturally and scientifically hybridize the fields of visuality, so that learning from/with images ultimately leads us back to the relationship of *re-mediation* between the subject and space.

Fig. 1. Cover of issue No. 3/2020 of IMG journal.

Author

Letizia Bollini, Faculty of Design and Art, Free University of Bozen-Bolzano, letizia.bollini@unibz.it

Events

Second Annual Travelling Meeting of the *XYdigitale* Project and the *XY* Journal

Alessandro Luigini

For almost 20 years, several events have radically, and in our opinion permanently, changed the scientific publishing. For example, in 1997 was born *Web of Science* [1]; in 1999 starts *Open Access Initiative* [2]; in 2002 was signed the *Budapest Open Access Initiative* [3], followed in 2003 by *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* [4] and in 2004 by the *Dichiarazione di Messina* [5]; also in 2004, Elsevier made *Scopus* available online [6].

The availability of information of all kinds and the possibility of finding it through search engines, has forced a shift in the center of gravity of our engagement with scientific texts, which is increasingly moving from libraries to our digital devices. Not everything is online or free available, and it is certainly possible to encounter a great amount of superficial or partial information–if not erroneous–but the direction is outlined: in the DOAJ database [7] in 2018, nearly 600,000 open access articles were catalogued out of a total of just under 2,500,000 scientific articles published globally [8]. Almost one every four scientific articles. *XY dimensioni del disegno* was a leading contributor to the scientific and cultural debate in the field of Drawing between 1986 and 2002. Thanks to its continuous exploration of disciplinary boundaries it has represented a reference point for many scholars, as has all the innovative work of its founder and editor-in-chief Roberto de Rubertis, one of the most eminent figures in the field of representation studies. After an interruption of almost three lustrums, in 2016 the *XY* journal resumed its editorial activity with the subtitle *Critical review of studies on the representation of architecture and use of the image in science and art*, filling a void that in the meantime only the cycle of seminars of *Idee per la Rappresentazione* between 2007 and 2014 and a few other occasional events had inhabited [9].

Today's *XY* project has interpreted the most current instances of scientific publishing and in addition to the paper edition, published by the University of Trento and Officina Edizioni, it is published on an OJS platform entirely open access, does not charge authors publication fees, uses abstracts and keywords useful for indexing, and has full bilingual texts in Italian and English. As Giovanna Massari–head of the editorial staff and a long-time supporter of open access–recalls, the journal is only the backbone of the entire *XY digital* project, which also includes the series *I libri di XY* and *I quaderni di XY*, as far as scientific publications are concerned, and the annual travelling meetings held in 2019 in Rome at the Aula Magna of the Department of Architecture of Sapienza University of Rome [10], and online in 2020, organized by the Department of Architecture of the University of Campania "L. Vanvitelli" and edited by Alessandra Cirafici, Paolo Giordano and Ornella Zerlenga [11].

If one compares the editorial of the last issue of the first series, ended in 2002, with the evolution of scientific publishing–and perhaps of the entire *modus operandi* in university research–that we outlined at the beginning, one understands that those years of pause have not passed without effect. Although changed in form by adapting to the new needs of the publishing context, the scientific project still stands out for the relevance and topicality of its approach. In fact, the years of interruption were a gestation that today demonstrates the validity of XY's scientific proposal as a theorem that was valid in the 1980s and 1990s and remains equally valid today.

As Vito Cardone recalled during the presentation of the new digital series, which he strongly supported, held at the University of Trento in 2015, since its first edition *XY* has always

https://doi.org/10.26375/disegno.8.2021.32

Fig. 1. Flyer of the event.

emerged as a provocation, bordering on heresy, in a cultural context that perhaps in those years was not yet fully ready [Cardone 2016]. Research in the field of images among scholars of representation, on the other hand, has never been an exoticism or a pan-Sophic fancy, but a frontier context that has acquired its own acknowledgement over time.
This genealogy was briefly recalled at the opening of the online *2nd annual meeting of the digital XY journal* on 27 November 2020. On that occasion, it was recalled how *XY* has been a decisive reference for the growth of an entire generation of researchers, encouraged by the magazine to explore new contexts in which to apply the domain of knowledge that the discipline of Drawing has codified over the years.
The meeting program continued with the presentation of the call in progress at the date of the event–with Franco Purini's intervention, who outlined five points for investigation on the theme of the current call *The geography of the image* [12]: 1) what is the image today; 2) the image as opinion maker; 3) who produces the images; 4) geographical declinations of the visual language; 5) what is the duration of images.
The mere examination of these five questions, as Fabio Quici has pointed out, seems to outline a program of scientific investigation whose development possibilities go far beyond what a journal issue can fully contain, and the debate that ensued proved this: numerous interventions, both by scholars personally involved in the journal and by authors who have contributed to it or are regular readers, opened up as many perspectives for the development of the proposed path. As an example, and to show how *XY* can raise deep research questions, let us mention only the first one.

We know that the scientific literature is full of attempts, almost never exhaustive, to define what an image is, and that even a scholar of the stature of James Elkins has found it easier to go down the road of *reductio ad absurdum* and try to define what an image is not [Elkins 2019] also following the promotion of the conference *What is an image?* held in Chicago in 2008 and the subsequent in-depth study in the book of the same name published in 2011 [Elkins, Naef 2011]. Partly because of the broad domain of studies that have images as their object (aesthetics, art history, visual studies and *Bildwissenschaft*, graphic sciences, semiotics, etc.) it is necessary to clarify the context of application of the question. From a geographical point of view, for example–in a partial short-circuiting between the first and the fourth question proposed by Purini–even the domain of the word 'image', from a linguistic point of view, risks fueling divergences, so much so that Bredekamp feels the need to emphasize that some of the differences between the approach of German-speaking and Anglophone art history or, Bredekamp feels the need to stress that some of the differences between German-speaking and English-speaking art history or, even more, between *Bildwissenschaft* and visual studies can be found in the semantic depth of the German word *Bild*, which includes 'image', 'picture', 'figure' and 'illustration' [Bredekamp 2003]. Or like Fabrizio Gay who, speaking in the debate during the *XY* meeting, points out that the first fundamental distinction to be made is between the image object, the artefact, and the image as the form of the content, as already distinguished, for example, in Husserl's phenomenology in *Bilding* (the iconic thing) and *Bildobjekt* (the iconic object) [Calì 2002]. Therefore, on the seemingly simple question "what is an image", it is clear that there is still a lot of space for the setting up of an ontological discourse, for defining a domain of the field of study, and that we hope can be developed in the journal, as in other contexts.

Following the debate on the theme of the current call, which lasted over an hour, other themes were presented during the meeting as possible proposals for future calls. This second part is certainly a *unicum* in the scientific publishing panorama, and concretely clarifies what Ornella Zerlenga meant when, at the end of her introduction, she recalled how *XY* was a project accustomed to «speak in the plural rather than the singular». In fact, the epistemological model proposed by the journal is one of openness, listening, frontier, as we have already said, which would collide with a top-down direction, and which instead favors, instead, an open participation right from the phase of developing the ideas for the call for papers.

The theme presented by the curators of the meeting, *Freehand drawing as conceptual expression*, proposes to investigate the role of autograph drawing as an intimate cognitive process, focused on a slow manual skill that allows an investigation of details (Zerlenga), an act of critical resistance against the overpowering of the pixel to find a new archetypal drawing (Giordano), with the need to address the problem of the incisiveness of graphic communication and expand the goal of a collective knowledge built through individual gestures–bottom-up–overcoming the limit of consolidated knowledge–top-down–also from an inclusive perspective (Cirafici). The subsequent proposals were: *Drawings of images, images without drawing* proposed by Lucio Altarelli; *The Trieste School of Experimental Psychology and Perceptology* by Gianni Contessi; *Resolution and definition of images* by Edoardo Dotto; *Cultural heritage, new technologies and society* by Manuel Franco Taboada and *Urgent drawings*, by Irene Cazzaro, Cristina Pellegatta and Starlight Vattano.

In conclusion, the plurality of the themes proposed, their evidently multi-faceted nature, once again demonstrates the value of the *XY*, a project that since 1986 has stimulated an entire scientific community to research for its own frontiers, not to consolidate them but to expand and bring the field of Drawing to unexplored places, often unexpected, rarely fruitless, but always scientifically stimulating.

Notes

[1] <http://www.webofknowledge.com/> (accessed 10 April 2021).

[2] <https://openarchives.org/> (accessed 10 April 2021).

[3] <https://www.budapestopenaccessinitiative.org/> (accessed 10 April 2021).

[4] <https://openaccess.mpg.de/Berlin-Declaration> (accessed 10 April 2021).

[5] Today, the website of the 2004 Messina conference is no longer accessible, but the full text of the declaration is available on the website of the 10-year conference at the following address: <https://cab.unime.it/decennale/wp-content/uploads/2014/03/Dich_MessinaI-TA.pdf> (accessed 10 April 2021).

[6] <https://www.scopus.com/> (accessed 10 April 2021).

[7] The DOAJ *Directory of Open Access Journals* was founded in 2003. <https://doaj.org/> (accessed 10 April 2021).

[8] Source: National Science Foundation, <https://www.nsf.gov/> (accessed 10 April 2021).

[9] Although the cycle of seminars *Idee per la rappresentazione* was born and developed autonomously from XY, it is significant to note, in order to understand the commonality of scientific approach, that all the promoters of that fruitful experience are currently part of the scientific committee of the magazine.

[10] <https://www.youtube.com/watch?v=eFWd-V3BKbdw&t=1s> (accessed 10 April 2021).

[11] <https://www.youtube.com/watch?v=PZtBqP-zP6P4&t=4888s> (accessed 10 April 2021).

[12] <http://www.xydigitale.it/la-rivista-xy-dimensioni-del-disegno/la-nuova-serie-dal-2016/60-.html> (accessed 10 April 2021).

Author

Alessandro Luigini, Faculty of Education, Free University of Bozen-Bolzano, alessandro.luigini@unibz.it

Reference List

Bredekamp, H. (2003). A neglected tradition? Art history as Bildwissenschaft. In *Critical inquiry*, vol. 29, n. 3, pp. 418-428. <https://doi.org/10.1086/376303> (accessed 10 April 2021).

Calì, C. (2002). *Husserl e l'immagine*. Palermo: Centro Internazionale studi di Estetica.

Cardone, V. (2016). Immaginare un'area culturale delle immagini visive. In *XY*, vol. 1, n. 1, pp. 12-27. <https://doi.org/10.15168/xy.v1i1.12> (accessed 10 April 2021).

de Rubertis, R. (2002). Editoriale. In *XY le dimensioni del disegno*, n. 44-45-46, pp. 3-5.

de Rubertis, R. (2016). Editoriale. Il progetto XY digitale. In *XY*, vol. 1, n. 1, pp. 4-7. <https://doi.org/10.15168/xy.v1i1.10> (accessed 10 April 2021).

Elkins, J. (2019). Imagining images. Seven problems. In *Img journal*, vol. 1, n.1, pp. 14-33.

Elkins, J., Naef, M. (Eds.). (2011). *What Is an Image?* University park, Pennsylvania: Penn State University Press. <https://doi:10.5325/j.ctv14gpdjx> (accessed 10 April 2021).

Gay, F. (2020). *A ragion veduta. Immaginazione progettuale, rappresentazione e morfologia degli artefatti*. Alghero: Publica.

The UID Library

The UID Library

2021

Bianconi, F., Filippucci, M. (a cura di). (2021). *Digital Draw Connections. Representing Complexity and Contradiction in Landscape*. Cham (Svizzera): Springer.

Casonato, C., Muscogiuri, M. (2021). *Mario Bellini. Disegno Architettura Design. Drawing Architecture Design*. Santarcangelo di Romagna: Maggioli Editore.

Gay, F. (2021). *A ragion veduta: immaginazione progettuale, rappresentazione e morfologia degli artefatti*. Alghero: Publica.

Maglioccola, F. (2021). *Shen LiYuan. Ingegnere cinese formatosi a Napoli*. Napoli: Rogiosi Editore.

Martínez-Medina, A. (2021). *Cuaderno de Nueva Tabarca. Dibujo, Proyecto y Obra de la restauración de las murallas de la ciudadela*. Alicante: Servicio de Publicaciones de la Universidad de Alicante.

Salerno, R. (2021). *Gli Spazi e le Immagini: tra materiale e immateriale*. DICAM Trento e Officina Edizioni.

UID Awards 2020

UID Award 2020

Golden award to Eduardo Carazo Lefort

The UID Golden Award 2020 is intended to honor a professor of Architectural Graphic Expression who, over the last thirty-five years, has been capable of combining a demanding professional practice, an intense dedication to teaching and extensive research on graphic, architectural and urban heritage.
Eduardo Carazo Lefort, currently director of the Department of Urban Planning and Representation at the University of Valladolid, has a professional practice that has earned him wide recognition in the region of Castilla y León, with numerous awards won in competitions and the publication of his built work in monographs and architectural journals.
But above all, Eduardo Carazo is a true university professor, committed to teaching Architectural Graphic Analysis and Degree Projects and to performing managerial roles for the Rectorate of the University of Valladolid. He has recently been appointed by the Ministry of Universities as a member of the National Evaluation Agency to assess the scientific achievements of professors in the disciplinary sector of architecture and civil engineering.
As a researcher, he has devoted himself in particular to the study of the urban form of the cities of Castilla y León, publishing the book Valladolid: Forma Urbis, and directing several doctoral theses on the cities of Zamora, Burgos, Oviedo and Porto. There is one last aspect we would like to highlight: his cordiality, his positive attitude and his human qualities. As an example, among all the tasks he carries out, his main priority has always been the training of young teachers and their academic promotion at the University of Valladolid.

Golden award to Secondino Coppo

The UID Golden Award 2020 to Secondino COPPO is intended to reward his long career as a professor, researcher and acknowledged head of a School of international importance in the field of urban survey and representation of the city. His work has demonstrated not only the high profile and originality of his research, but also the importance of teamwork, bringing together scholars and researchers from many generations who are now, in turn, esteemed professors. His studies, laden with theory and applied research, are still today a point of reference in the field of urban surveying, projecting the discipline of surveying to the decision-making stages in the process of designing complex systems, areas in which he has published numerous monographs and essays. Scientific coordinator of numerous research projects, including those related to Il Disegno dei Portici a Torino and Il Disegno di Luoghi e Mercati, again referred to the Piedmontese capital. Secondino Coppo has held important academic roles: president of the area of training in Civil Engineering, director of the Department of Construction and Territorial Systems Engineering, coordinator of the Doctorate in Surveying and Representation, Conservation and Restoration; as well as in our association, where he currently holds the role of Arbitrator.
His refinement, correctness and ability to relate to all of us continue to make Dino Coppo a figure of scientific and emotional reference of great importance.

Silver award "Gaspare de Fiore"

Matteo Bigongiari, L'architettura fortificata di Leonardo da Vinci in Toscana. Rilievi digitali delle fortificazioni di Piombino per la interpretazione critica dei progetti leonardiani; tutor prof. Stefano Bertocci, co-tutor prof.ssa Pilar Chías Navarro.
A thesis in which the fortifications of Piombino are studied in relation to Leonardo da Vinci's project drawings. The work starts from the use of digital technologies for the study of ancient drawings and develops appropriately and convincingly along the lines of an in-depth graphic analysis integrated with the previous historical-documentary and historical-artistic studies. After having contextualized Leonardo's drawings in the light of the history of the fortifications, it proposes a precise survey of the current state of the fortifications of the city of Piombino and searches for precise correspondences between Leonardo's designs and the built elements, presenting the precious final reflections in graphics of excellent expressive quality. The work is conducted with methodological clarity and with full awareness of the instruments used and shows, in a clear overview, the vast possibilities of investigation provided by the tools of representation.

Veronica Riavis, Rappresentazioni tattili di architettura e pittura: ricostruzione geometrica della chiesa di Sant'Ignanzio a Gorzia e restituzione prospettica dell'affresco parietale; tutor prof. Alberto Sdegno, co-tutor prof. Fabio Crosilla.
A thesis concerning the historical/critical study of the large quadratura perspective fresco conserved in a church of the Isonzo area, and its translation into forms that can be perceived haptically by the visually-impaired. The thesis, as well as for the completeness of the description of the processes of survey, restitution and 3D printing in rapid prototyping, stands out especially for the actual experimental success of the prototype realized and tested for its ability to translate visual perspective spatiality into equivalents accessible through haptics.

Simona Scandurra, Processi di traduzione dei dati di rilievo strumentale per la realizzazione di modelli informativi del patrimonio architettonico esistente; tutor prof.ssa Antonella di Luggo.
A thesis which, within a rigorous and appropriate theoretical-methodological framework, addresses the study of the potentialities and criticalities inherent in the processes of transposition of data acquired with 3D no-contact technologies in information models proper to HBIM systems applied to historic built heritage. A case study of the great complex of the State Archives of Naples (strongly stratified, 9th-20th century, housed in the ancient Benedictine monastery dedicated to Saints Severino and Sossio), with the survey of the marble Atrium and of the important adjacent architectural spaces. Of particular interest, for the critical/assessment implications that arise, the experiments on the construction, directly on the 3D model, of historical-synchronic and diachronic sections, aimed at documenting and visualizing the transformations of the architectural organism over time, and on the modeling of complex elements such as vaults, conducted according to an interesting and timely process of parametric elaboration critically evaluated in the relationship between the model and the actual reality of the architectural elements.

The Jury also unanimously proposes to the President to confer 4 honorable mentions UID 2020 to the following PhD Theses:

Raffaella De Marco, Il rilievo digitale per l'analisi dei sistemi strutturali nell'edilizia storica; tutor prof. Sandro Parrinello.
A thesis that proposes an interesting interdisciplinary approach aimed at investigating the possible contribution of survey and modeling in the communication of the structural database, in relation to the relationship between structure and form, between form and model, between model and structure. In particular, the different contexts of investigation and experimentation presented allow the analysis of the structural system in historical architecture with the aim of verifying codes and graphical languages useful for solving the problem of documenting-evaluating-computing mechanical behavioral models. Highly significant is the application to the case study of the urban aggregate of the dense urban fabric of Bethlehem, where the level of complexity grows in relation to the articulated historical, morpho-typological and figurative structuring, on the border between architectural and urban scale.

Marika Griffo, Dal dato all'informazione. Integrazioni ed evoluzioni del modello digitale; tutor prof. Carlo Bianchini, prof. Graziano Mario Valenti.
A thesis that represents, with a wide range of case studies – the Basilica Julia, the Baths of Diocletian and the Nymphaeum of Egeria – the state of the art of the techniques of survey and documentation that aim to produce a model as a "digital clone" of the "asset" for its future intelligibility, including the use of tools such as H-BIM, GIS and Web GIS, of collaborative platforms (the Virtual Research Environments: Europeana, Visual Media Service…), analyzing Ontologies Linked Open Data techniques, and various data input techniques according to different data collection and documentation technologies.

Martino Pavignano, Rappresentare l'architettura. Il viaggio ideale di Giovanni Battista Cipriani tra disegni, libri e stampe; tutor prof.ssa Anna Marotta, prof. Sergio Pace.
A thesis of exemplary completeness dedicated to the reconstruction and study of the corpus of Giovanni Battista Cipriani's graphic work against the background of the visual and architectural culture between the last quarter of the 18th century and the first half of the 19th century. This work sheds new light on that part of the history of chalcographic drawing of architecture set between the two clamorous cases of the prints of "Le antichità romane…" by Giovanbattista Piranesi and those of the "Édifices de Rome moderne…" by Paul-Marie Letarouilly.

Chiara Pietropaolo, Turris babel. È-temen-an-ki. La "casa delle fondamenta del cielo e della terra". Teoria e rappresentazione tra mito e realtà; tutor prof. Gaetano Ginex, co-tutor prof. Gianfranco Neri.
A thesis that investigates the complex theme of the Tower of Babel. After a chronological examination of its principal representations, the work proposes the analysis – carried out with the tools of representation – of two famous paintings of 16th century Flemish art, that of Pieter Breugel the Elder and that of Lucas van Valchenborch. The study of the two images makes it possible to examine the three-dimensional form of the constructions represented, providing fascinating hypotheses on their conformation and tectonics, realizing analytical graphics as well as virtual and physical models. The work also takes into consideration recent acquisitions on the same theme, primarily the work of Massimo Scolari and that of Katsuhiro Otomo, and explores the plastic potential of the elements studied.