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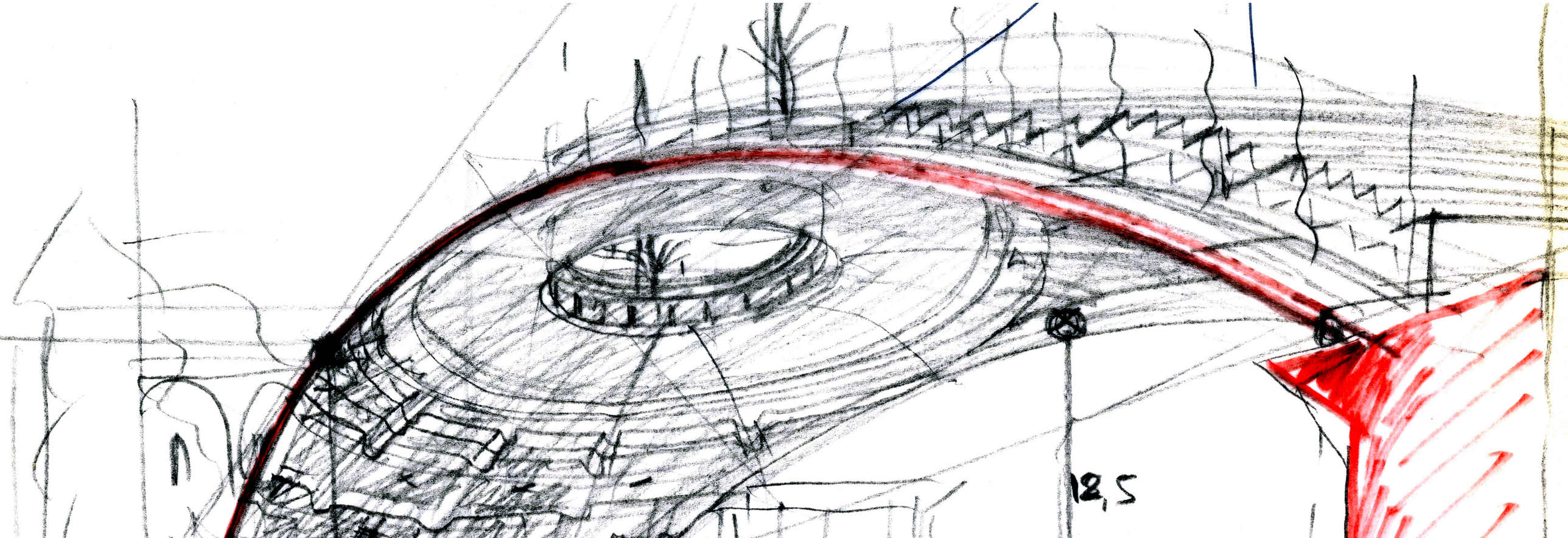

diségno

10.2022

DRAWING IN ARCHITECTURAL ARCHIVES

diségno

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Cover
Sketch (detail), design for the Ponte dell'Accademia by Francesco Cellini and Giovanni Morabito, 1985. University Iuav of Venice, Archivio Progetti - Bastiana and Francesco Dal Co collection.

The published articles have been subjected to double blind peer review, which entails selection by at least two international experts on specific topics.
For Issue No. 10/2022, the evaluation of contributions has been entrusted to the following referees:
Fabrizio Agnello, Giuseppe Amoruso, Adriana Arena, Marinella Arena, Laura Baratin, Salvatore Barba, Cristiana Bartolomei, Carlo Battini, Francesco Bergamo, Marco Giorgio Bevilacqua, Alessio Bortot, Stefano Brusaporci, Pedro Cabezos Bernal, Cristina Càndito, Marco Carpiceci, Mario Centofanti, Valeria Cera, Stefano Chiarenza, Emanuela Chiavoni, Alessandra Cirafici, Vincenzo Cirillo, Daniele Colistra, Giuseppe D'Acunto, Antonella Di Luggo, Isabella Friso, Carlo Inglese, Alfonso Ippolito, Pedro Antonio Janeiro, Federica Maietti, Marco Muscogiuri, Daniela Palomba, Lia Maria Papa, Leonardo Paris, Andrea Pirinu, Manuela Piscitelli, Daniele Rossi, Gabriele Rossi, Marta Salvatore, Giovanna Spadafora, Daniele Villa, Marco Vitali, Andrea Zerbi.

Consultant for English translations Elena Migliorati.

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Editorial

Francesca Fatta

Since 2018, the Archives Commission of the Unione Italiana per il Disegno (UID), coordinated by Caterina Palestini, has invested heavily in the project entitled *Il Disegno negli Archivi di Architettura* (Drawing in the Archives of Architecture) with the aim of communicating, through an examination of the research carried out by teachers and researchers in the disciplinary field, the contribution that graphic analysis and representation, both traditional and digital, can make on the subject of the Archives of Architecture and Civil Engineering. The working group also includes Piero Albisinni, Emanuela Chiavoni, Laura Farroni, Cinzia Garofalo, Francesco Maggio, Chiara Vernizzi and Marco Vitali.
In these few years of work, the Commission has arrived at the definition of a database aiming to offer new readings through graphic contributions, analysis and digital reconfigurations. The intention is to go beyond traditional project drawings with re-drawings, models and three-dimensional explorations, to achieve a dynamic and interactive fruition of the original materials kept in archives.
This introduction clarifies even more the motivations behind the decision to devote Issue No. 10 of the journal *diségno* to the theme of architectural archives, entrusting Caterina Palestini with the task of opening with her Cover. Palestini writes: "Specifically, the role of drawing appears decisive, due to what it can offer in the reading of archival materials in its dual capacity: as a configurator of the idea that becomes form, expressed in the many testimonies of original documents conserved in the archives of architecture, and as a tool of analysis that allows us to go back and reconfigure its contents, even with the new languages of digital representation."
To delimit the many areas that contribute to defining the theme, the structure of this issue of the journal is divided into three topics: digital archiving methodologies;

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the renewed binomial archive/museum; and the digital reconfigurations of archival projects.
Chiara Vernizzi opens Topic 1. *Research Methodologies* and, going into the construction of digital archives that are part of the constituted heritage, states that digitalization, in addition to being a tool of fundamental importance in the dissemination of the values that drawings embody due to their intrinsic cultural and artistic significance, poses numerous questions related to acquisition techniques, the structuring of the information to be collected and communicated, and the conservation of digital materials, whose fragility and transience is not second to that of the analog supports on which architectural drawings are traditionally realized.
Next, for Topic 2. *Collections*, there is the opening essay by Margherita Guccione, Director of the Museum of 21st Century Arts (MAXXI) in Rome, who explains how central the relationship between archive and museum is today, "because architecture, absent in physical terms from the museum, in architecture exhibitions, […] is instead evoked, narrated, described or variously interpreted by drawings, models, photographs and every other form of representation, description, conceptualization, often starting precisely from archival documents."
Francesco Maggio and Eleonora Gelardi, for Topic 3. *Digital Reconfigurations*, in dealing with the archive under construction designed by architect Luciana Natoli, take up the concept that "An archive of architecture can be built with a double register; the analytical register of filing […] and another one, hermeneutic […]. The interaction between these two figures makes it possible to create the chronological iter of the graphic documents held in the fonds […], or to construct the design history from sheets that find different locations in the archive."
Therefore, if on the one hand an archive is the conservation of a patrimony of memories, on the other, it is a source of rethinking, revisiting, and knowledge for a design culture. Moreover, the archive becomes a "dynamic presence" in a place of culture, according to new systems of fruition thanks to which representation and multimedia bring its documentary topicality back into play.
Once again, *diségno*, with this tenth issue, wants to delve into disciplinary territories through the digital reconstruction of collective memory but, not limiting itself to this aspect, also wants to approach the margins and the many overlappings that exist between Drawing and History and between Drawing and Design, to show how an archive of drawings can represent a *corpus* of a culture always vital and productive because of the design responses determined.
Drawings in architectural archives mark our history and, as "a great present," prompt us to reflect on and disseminate the rich cultural and scientific heritage they represent. Necessary for consolidating their memory and fundamental for reasoning about the present, archives are the fabric underlying activities of design, research, protection, conservation and valorization of the historical-cultural heritage, and today much research draws excellent inspiration from the consideration of archives as instruments of strategic and cultural innovation.
As for the columns inspired by the theme of the journal, for a commentary on a drawing, Paola Puma chose the engraving of the Bodleian Library in Oxford that describes, in the labyrinthine vision of the library, the constant dialectic between the taxonomic value of research and the desire to lose oneself in the discovery; for Readings/Rereadings, Luigi Cocchiarella returns to the book, *I luoghi di Dedalo* by Vittorio Ugo according to a theory of architecture that investigates the analysis of archetypal forms and dimensions between history and the present, between nature and artifact.
This is followed by several reviews of books and recent events that have marked the last semester of activity of those who revolve around the UID.
In closing, as usual, I would like to give a brief preview of Issue No. 11 –already in the works– which will address the theme of *Design Drawing* and will be edited by Massimiliano Ciammaichella and Valeria Menchetelli.
With the renewal of the UID's collegiate bodies, the structure of the journal has also been updated, reorganizing the Scientific Committee and the Editorial Board - coordination, and including the recent entry of Ilaria Trizio and Michele Valentino as members of the Editorial Board - staff and the appointment of Valeria Menchetelli as Journal manager.
My sincere thanks go to the authors, editors and all the readers of our journal.

Research and Archives of Architecture: the Roles and Disseminations of Drawing

Caterina Palestini

"Computer drawings are a necessary means of communication between the architect and his collaborators and eventually with the construction people on site. Sketches and hand drawings are in less demand these days, though their importance and usefulness have lost none of their validity. The significance and uniqueness of hand drawings lies not in the clarity of their message but in their inherent imperfection. They communicate with no one but their creator. As our mind is never in complete control of our hand, it is free to create signs, left open for interpretation. Not once was I surprised at how hand drawing can evoke possibilities that most probably, I would not have been able to imagine consciously." [Hecker in Lepik 2012, p. 21].

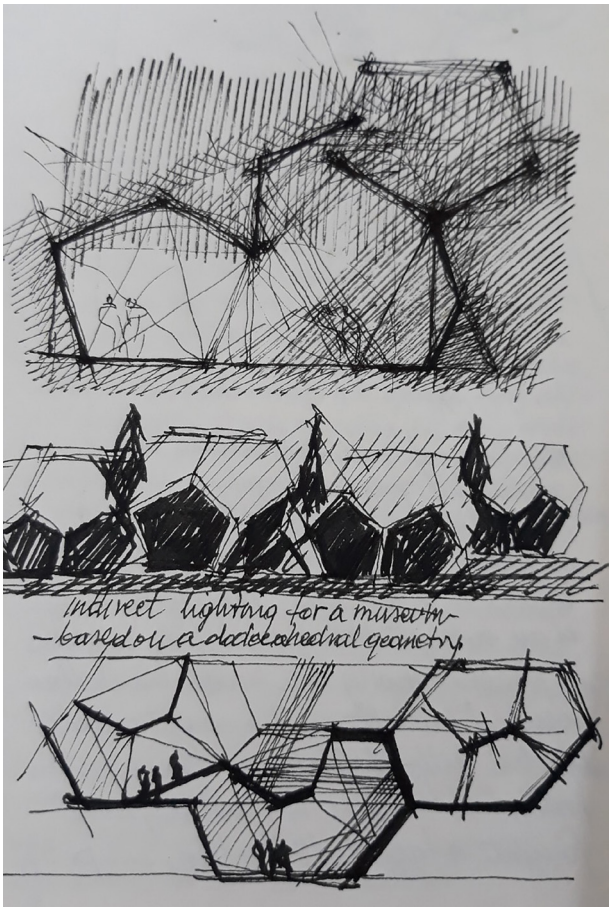
The concept of archive is customarily associated with the systematic collection of documents to be kept as a testimony of writings or graphic elaborations that permit subsequent consultations.
Archival materials generally refer to episodes related to a recent or ancient past that assumes historical documentary values to be safeguarded for the benefit of future research. Going beyond the rhetorical and outdated notion of a dusty space used for storage, archives with the aid of digitalization have transcended the physical limits of on-site consultation; it is, however, necessary to consider the further exploratory potentials concerning the research and communication of contents related to the materials deposited in them and, specifically, architectural drawings.
What archives suffer most from is the static dimension, the risk that the collections stored in it remain an end in themselves despite the opportunities of online consultation, and that the circumscribed intersections with research often make them a mere instrument of inquiry.
A greater openness to research can transform the potentials of the already precious documentary heritage they preserve into a cultural legacy to be analyzed and commu-

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

Fig. 1. Zvi Hecker, Sketches for the residential blocks of the second parcel of the Ramot Housing II complex (1984-1985) in Jerusalem, Sketchbooks No. 6, 7, January-December 1982, pp. 56, 57 (courtesy of Zvi Hecker archive, Berlin).

nicated. Reasoning along these lines, archives can assume the most dynamic role as centers of support for operational research, providing documentary materials which can form the basis for multidisciplinary investigations.
Specifically, the role of drawing appears decisive, due to what it can offer in the reading of archival materials in its dual capacity: as a configurator of the idea that becomes form, expressed in the many testimonies of original documents conserved in the archives of architecture, and as a tool of analysis that allows us to go back and reconfigure its contents, even with the new languages of digital representation [Palestini 2016].
Addressing the topic of digital innovations, it must be emphasized that while they constitute an indispensable working tool for designing, there is a risk that they may lead to a weakening of the cultural and methodological role of architectural drawing. Zvi Hecker, the architect of Jewish origin [Bottero 1997] who shapes his architecture through drawing by establishing an uninterrupted dialogue in search of the form [Gołota 2015] that transcends the individual design to regenerate itself between one drawing and the next [Hecker 2000], states that we must beware of the speed of automated composition processes [Klein 2002].
Indeed, the role of drawing as a tool for the prefiguration, elaboration and communication of an idea appears increasingly relegated to a design modality of the past. Currently, the heritage that documents the traditional process from an idea to the configuration of an architectural project, up to its possible realization, survives only on fragile paper supports and testifies to an autonomous way of thinking and designing, not subordinated by the transformations of the digital age.
In this sense, the archives of architecture define the privileged place for documenting the creative path formulated by those designers [Bruschi 2007] who have employed traditional drawing as a working tool.
At a time in history when the performances of digital drawing satisfy the needs of increasingly accelerated timelines, favoring the use of global design systems related to Building Information Modeling, there is a risk of losing the graphic expressiveness inherent in the humanity of the sign, in the importance of its imperfection that allows the meditations developed in the evolution of a design to emerge as an added value [Galliani, Piva 2005].
Graphic innovations have also involved the way of conceiving designs, overturning the approach to the genesis

Fig. 2. Zvi Hecker, Sections and project elevation for a museum based on the dodecahedron, Sketchbook No. 2, October 1979 - June 1980, p. 71, detail (courtesy of Zvi Hecker archive, Berlin).



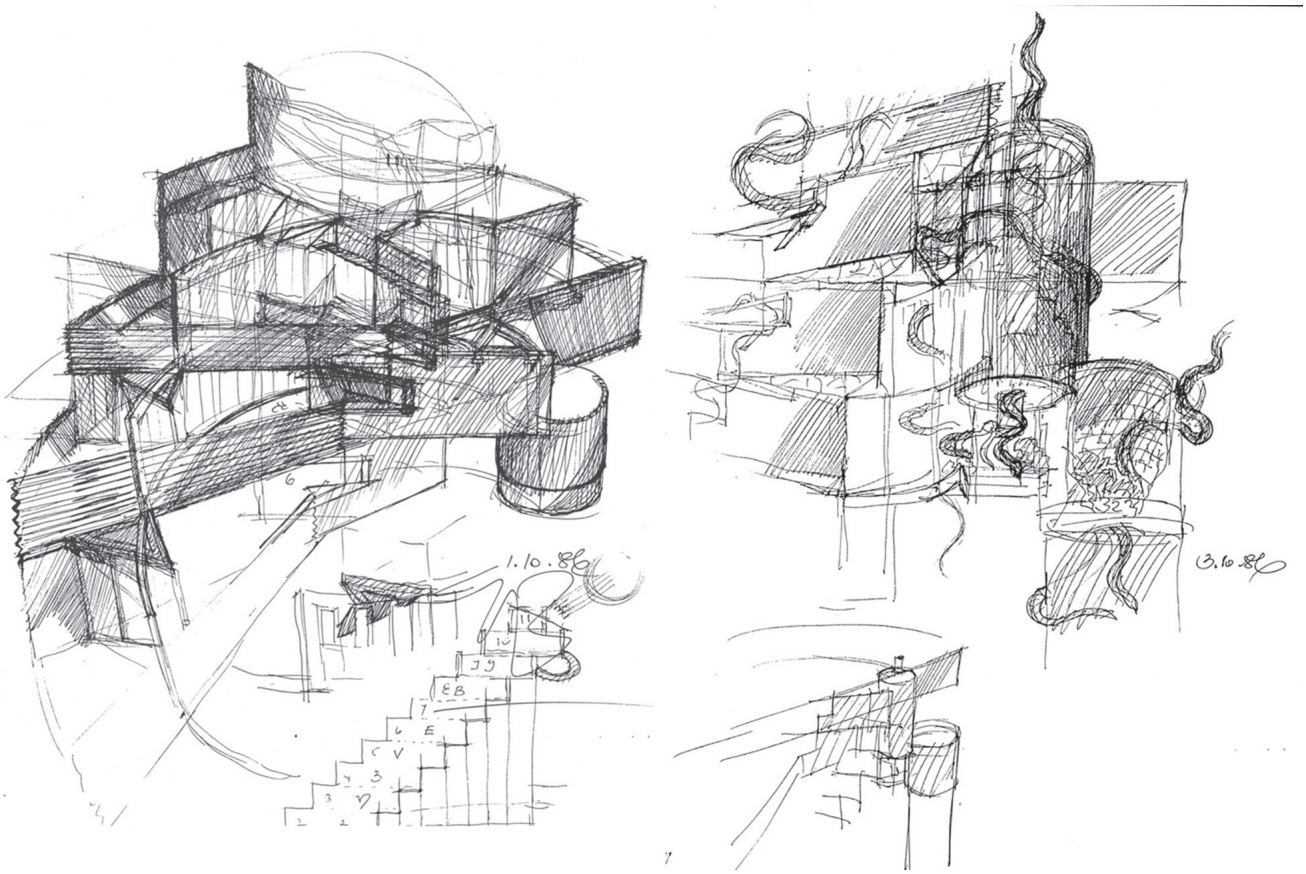


Fig. 3. Z. Hecker, sketches on the spiral shape with studies of 'snakes', elements that penetrate and generate continuity between the different bodies of the Spiral House in Ramat Gan, Tel Aviv, Israel, from Sketchbook No. 12, 1986 (courtesy of Zvi Hecker archive, Berlin).

of the form, entrusted from the beginning to digital modelling, from which two-dimensional aspects are deduced, obtained from three-dimensional formats through softwares that unify the sign in an impersonal manner. The prefigurative aspect is also entrusted to photorealistic renderings that on a par with photographic images do not allow us to distinguish physical reality from virtual space [Sacchi, Unali 2003].
Without denying the importance of computerized drawings in today's architectural profession, it is important to reiterate the values of the intuitive synthesis of traditional drawing, of drawing while thinking. Therefore, it becomes a priority to do research on the graphic-documentary materials kept in architectural archives: these can represent an active testimony not only for preserving, but also for analyzing the valences contained in the graphic elaborations that have led to the composition of the form, achieved through the steps clarifying the design.
In this logic, the meanings of an architectural design appear inseparable from its elaborative phases, from the graphic corpus that from sketches to the executive design leads to the final result, encompassing everything that leads to the composition of the work including the intermediate solutions, those left on paper [Farroni, Mancini 2019].
The graphic notes, the afterthoughts, the layering of signs constitute the humus of the composition, and take on the role of clarifying the various moments of the design process, the mediations with the client, the method adopted for reaching the final choices and the substantial dialogue between the author and the work, which together constitute the decisive steps in the evolutionary history of a project design.
The non-realization of a work, therefore, does not detract from the graphical-ideative path implied in the architectural project, which independently expresses visible and intangible information useful for gaining knowledge regarding the history of architecture, construction techniques and technologies, the development of theoretical thought, the poetics of individual designers and the relationships with the territories of reference.
Analog drawing, with its power of evocative transfer, rich in expressive possibilities related to its being imprecise and non-exact, allows an understanding of the different options developed during the entire design process.
The described process that an architect habitually follows, or followed, to study the configuration of an idea,

Fig. 4. F. Cellini, project sketch for an unbuilt bridge in Venice, 1985 (Cellini private Archive). From UID website, Il disegno negli Archivi di Architettura.

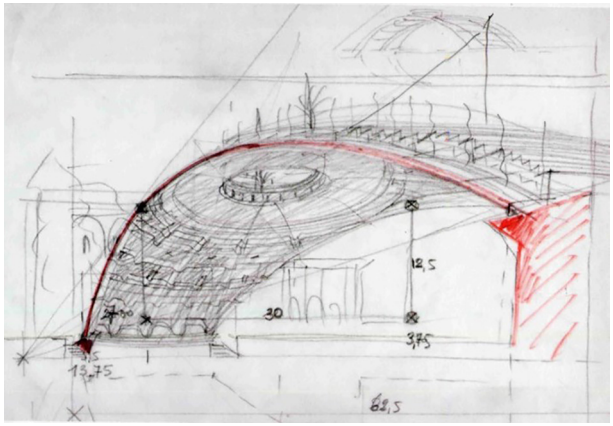
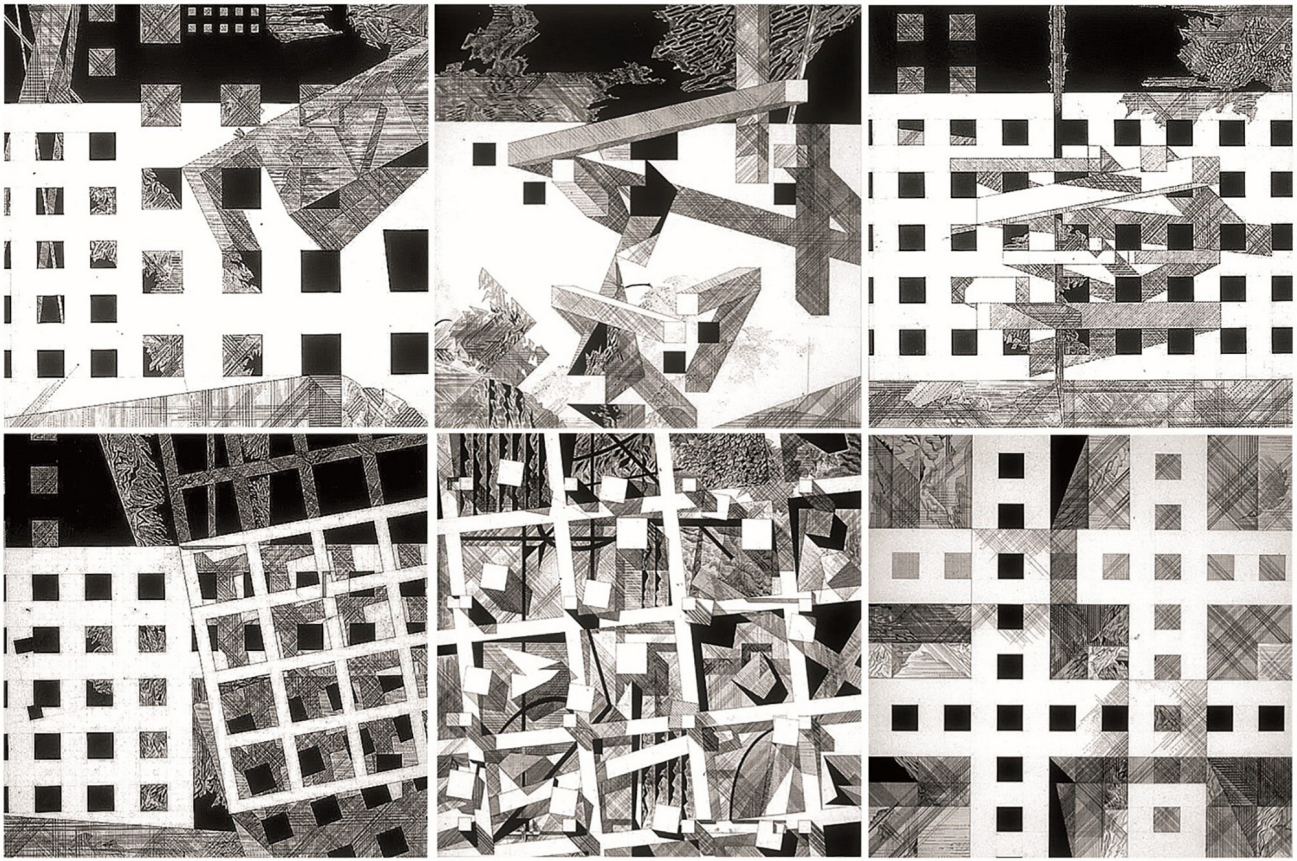


Fig. 5. F. Purini, Compositional drawings of the Brera Series, Come si agisce/Dentro l'architettura, published online. From UID website, Il disegno negli Archivi di Architettura.



and through which he comes to conceive a work of architecture, over time assumes the role of testimony, becoming itself a heritage to be passed down.
Specifically, drawings kept in architectural archives make it possible to document this compositional path, preserving the material and immaterial values underlying the genesis of a design.
The modern conception of archives being intended for research purposes can thus make a fundamental contribution to the development of design culture, also through the knowledge of the most recent design experiences produced by 20th-century architects.
The interest in the conservation and valorization of the archives of 20th-century architecture represents a well-established project that, since the start of the first systematic collections, continues its cultural journey by continuously enriching itself with new acquisitions managed through public and private institutional networks [Guccione 2009].
Architectural archives and museums have been working in this direction for several years, developing experiences in sharing and enhancing documentary materials. The Directorate General of Archives has launched a national project with the aim of acquiring and systematizing the archives of 20th-century architects and engineers of particular interest for the history of Italian architecture and urban planning, which has taken the form of territorial censuses supervised by various Archival Superintendencies [Guccione, Pesce, Reale 2002]. The purpose of these interventions is to ensure the safeguarding of these archives, also in consideration of the particular risks to which they are exposed not only because of the fragility of their supports and materials (drawings on translucent paper, models) subject to deterioration, and the particular value of the documents, but also because they reconstruct events related to the construction of the contemporary city with episodes regarding large cities or small provincial towns with reference to the different contexts and situations connected with post-war reconstruction. The latter was a particularly fertile period for the significant construction activity carried out in the aftermath of World War II, which in those years defined cultural identities and experimentations with new compositional languages. The data collected from the individual regional censuses were transferred to the *Sistema Informativo Unificato per le Soprintendenze Archivistiche* (SIUSA) (Unified Information System of the Archival Su-

Figs. 6, 7. F. Purini, Avvolgere e Stratificare, experimentations on theoretical design. Analyses and digital reconfigurations by L. Farroni and M. F. Mancini. From UID website, Il disegno negli Archivi di Architettura.

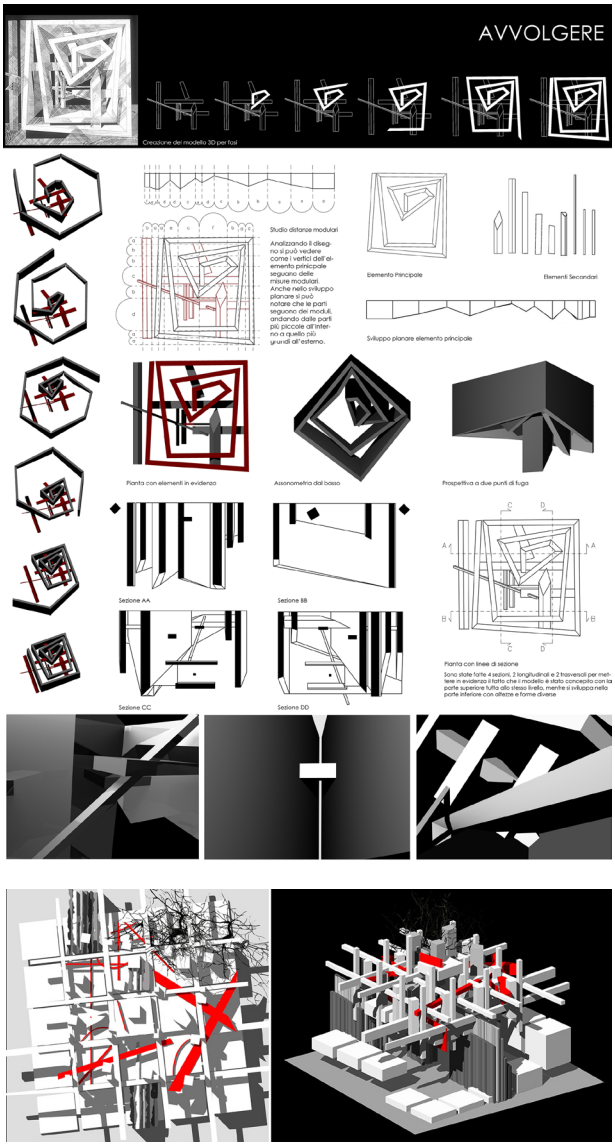
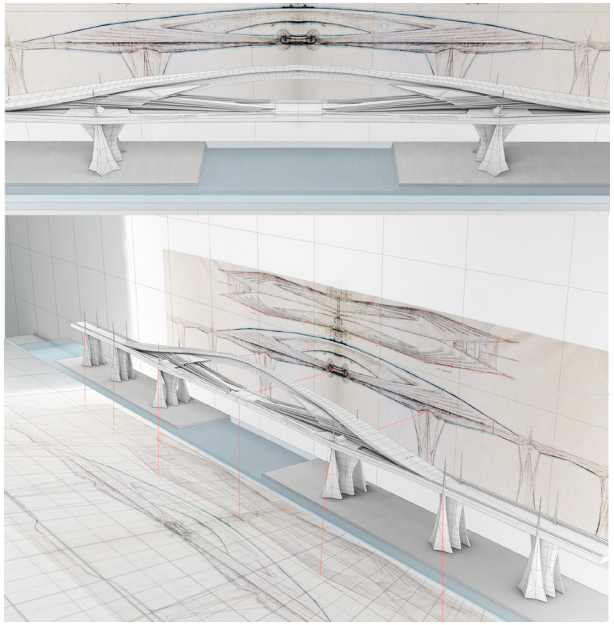
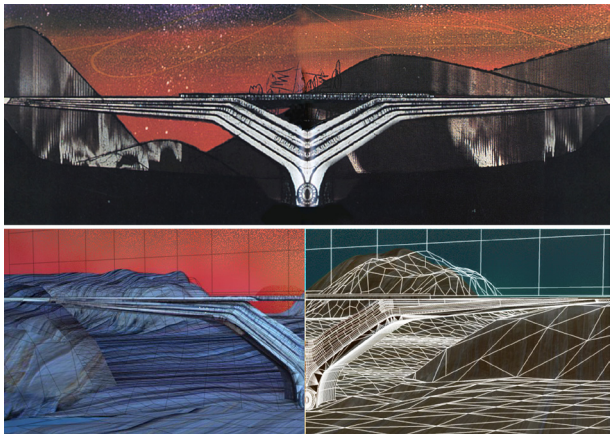


Fig. 8. P. Soleri, Arc bridge, three-dimensional reconstruction from project drawing (graphic elaboration by A. Basso).

Fig. 9. P. Soleri, Double Cantilever bridge, three-dimensional elaborations and graphic texture analysis with colour choices from the original sketches (graphic elaboration by A. Basso).





perintendencies) [Sistema Informativo Unificato per le Soprintendenze Archivistiche (SIUSA)], through the thematic path *Gli archivi dell'architettura contemporanea* (The Archives of Contemporary Architecture). The results of the census can also be viewed in the *Sistema Archivistico Nazionale* (SAN) (National Archiving System) [Sistema Archivistico Nazionale (SAN)], specifically in the thematic portal *Archivi degli architetti* (Architects' Archives), which was opened in 2012. This presents, in addition to archival resources, various contents (images, editorial texts), and places special emphasis on the "project" as the connecting element between the archival records and the work. It also aims to highlight the close connection of the archives with the works of which they bear witness, and how the protection of archival assets is correlated with that of architectural heritage, triggering a possible comparison between the original project drawings and the work of architecture realized, in the context in which it is located.

The institutional contexts, the *Istituto Centrale per il Catalogo e la Documentazione* (ICCD) (Central Institute of Cataloguing and Documentation) [Il nuovo Catalogo generale dei Beni Culturali] for the collection and conservation of historical-artistic heritage and the Ministry of Cultural Heritage, with a specific sector for archival heritage, have therefore worked actively over the last thirty years on the definition of description, metadata and interoperability models shared at the national and international level. In this context, at the end of the 1990s, the aforementioned national project on architectural archives was launched, for the purpose of acquiring and systematizing materials from private archives [Associazione nazionale Archivi Architettura contemporanea] that were in danger of disappearing due to their perishability, which proved to be of particular importance in opening to in-depth studies on the subject and on the experiments facilitated by digital resources.

In parallel with the activities of conservation institutes, research activities have been carried out by scholars of architectural drawing in regard to various topics: the two-dimensional analysis and interpretation of drawings, the three-dimensional reconfiguration of spaces, the experimentation with graphic languages for visualization, the immersive and interactive exploration of data and their interpretations, and the techniques for online presentation of 2D and 3D data.

These studies have led to the realization of digital and open-access products designed to define a communica-

Fig. 10. E. Del Debbio, unrealised project sketch for Villa Brizzi-Simen E42, reconfiguration and digital study model (graphic elaboration by the author).

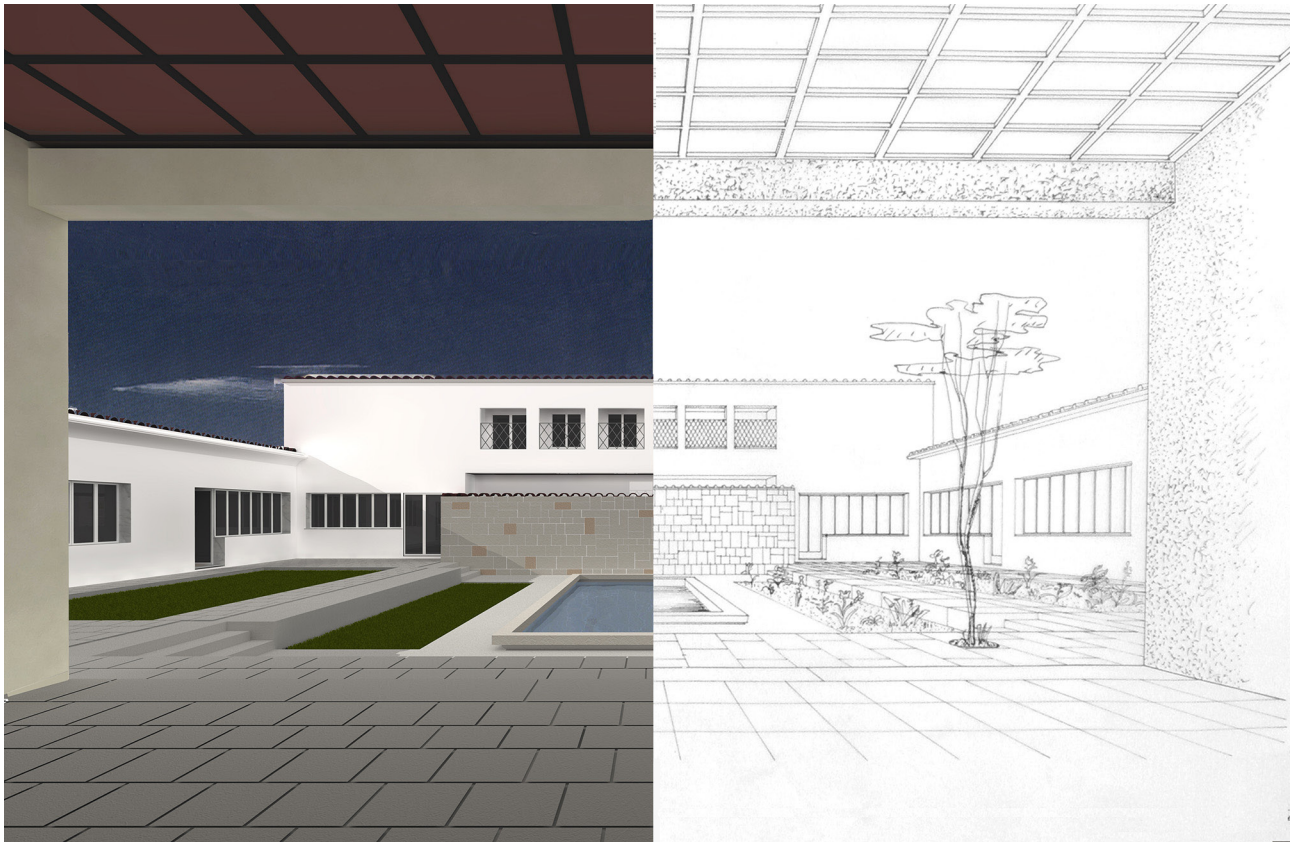


Fig. 11 A. Cataldi Madonna, sketches of project solutions for a residential complex with cinema, Pescara 1967 (Cataldi Madonna private Archive, graphic elaboration by C. Palestini and L. Pellegrini).

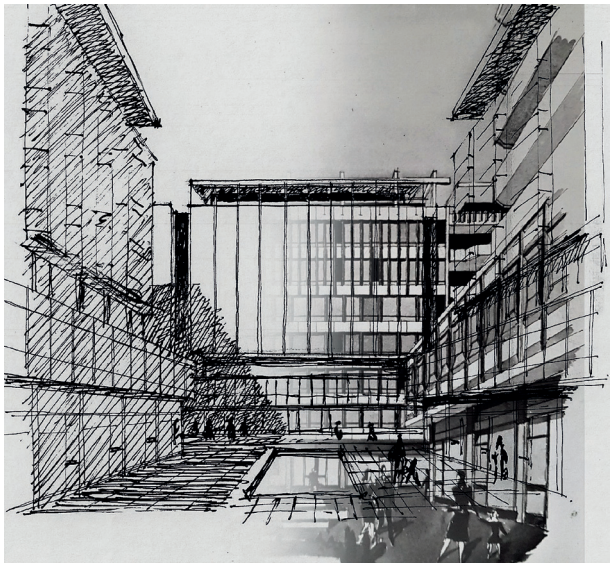
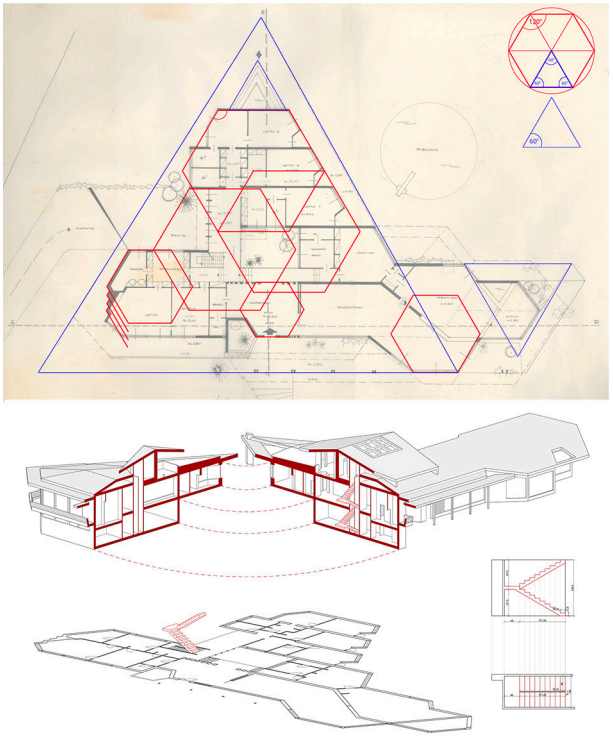


Fig. 12. A. Cataldi Madonna, Villa De Gennaro project, geometry analysis and three-dimensional reconstruction (graphic elaboration by C. Palestini and L. Pellegrini).



tion model for the valorization of the data deposited in archives [Biblioteca Hertziana], expanding, in particular, the accessibility, use and dissemination of analyses for the knowledge of architectural drawings. Thematic projects such as *Il Disegno negli Archivi di Architettura* (Drawing in the Archives of Architecture) promoted by the Unione Italiana per il Disegno [UID - Unione Italiana per il Disegno. Archivi, UID - Unione Italiana per il Disegno. Canale YouTube], concerning the graphic analysis, readings and three-dimensional reconstructions of original projects and of experimental case studies conserved in architectural archives have been directed towards this aim.
In conclusion, analysis through drawing, as described, can offer various possibilities for study and comparison with archival drawings, to permit their valorization, better use and two- and three-dimensional graphic explorations, also allowing the stimulation of visual reading skills on the part of the user based on interactive, graphic-textual associations and cross-references that clarify the cultural process of architectural prefiguration.

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The Bodleian Library in Oxford

Anonymous

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Trees and Labyrinths, Libraries and Archives: the Architectural Drawing between Real Space and Re-Imagined Space

Paola Puma

"An ark to save learning from the deluge," as Francis Bacon described it in 1605 [1], such was the imaginative power of the cathedral of knowledge that here, since the 15th century and above all thanks to the expansion carried out by Thomas Bodley between 1598 and 1602 (Rogers 1991, tables 38, 43, 46), it finally found the right space in the first reading room in Oxford to be deliberately built for this function.
The image represents the oldest of Oxford's libraries and the historical core of the Bodleian Library, one of the oldest European public libraries and today an imposing cultural institution that houses millions of documents and 40 collections in 28 structures, which flourished after the decisive initiative of Thomas Bodley which, at the beginning of the seventeenth century, allowed its modern foundation and gave impetus to its constant growth by founding on the first small collection of manuscripts originally housed in Duke Humfrey's Library, the important library complex of one of the most prestigious universities in the world.
Duke Humfrey's Library, in the image visible as the central hall in dim light, was opened in 1489 to house the collection of some 300 manuscripts, maps and rarities left to the University of Oxford at his death in 1447 by Humphrey of Lancaster, the first Duke of Gloucester and third son of King Henry IV of England.
To house this heritage, it was decided to build a room above the Divinity School, then under construction in the purest Perpendicular style [Sherwood, Pevsner 1996, p. 162], thus certainly constraining the unusual proportions of the library, wider than high, not very typical of late English Gothic architecture and yet the perfect setting for the Hogwarts wizard's library [2].

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

The environment was marked by a dense series of windows still today interspersed with bookcases positioned perpendicular to the walls; in another engraving dated 1675 the chains that then still tied the books to a bar placed in front of the underlying shelf are visible, so originally there must also have been high lecterns in front of which scholars read while standing, according to the arrangement inherited from medieval manuscript libraries.
On this side of the large arch diaphragming the rooms of the gallery and of the hall in the foreground, the arrangement is reversed, showing furnishings placed against the walls and, at the head of the bookcases, wooden cabinets containing manuscripts too rare and precious to be left on open shelves. Books go from the floor to the ceiling; above all, what characterizes the environment are the galleries surrounding the two large rooms at both ends of Duke Humfrey's Library: Arts End added in 1610-1612 (identifiable by the multi-light window that can be glimpsed at the back of the room), and Selden End, the last addition of 1634-37 which gave the building its final, and current, H-shaped configuration [Tyacke 1998, pp. 86, 87], and hosts the observer from whose point of view the scene is framed.
The light, an almost inevitable metaphor for knowledge that illuminates the mind, comes mainly from the focal point represented by the center window of Arts End; it is suggested by the sequence of narrow openings interspersed with the shelves of the hall, and above all by the windows of Selden End, placed laterally and to the back of the observer to frontally illuminate the gallery supported by slender columns, which, together with the two triangular pediments arranged parallel to the walls of Duke Humfrey's Library to frame the hall, reaffirm a grammar of the spatial envelope fully regulated by the language of architectural order.
The full light then alternates with the half-light necessary to reconcile study and concentration in the silence broken only by the sound of footsteps on the creaky wooden floor: the few people present are two scholars sitting on a bench and intent on discussing a volume lying open on a shelf and two other figures at the desk at the back of the room.
Their clothing places the image in times close to the foundation of the Bodleian while the engraving, by an unknown artist and measuring 33.3 x 25.5 cm, can be more likely dated to the first half of the nineteenth century, when it appeared in 1842 in the tenth annual of *Magasin Pittoresque*, a magazine published since 1833 in Paris; twenty years later the same engraving appeared again (with the dimensions 37.6 x 29.8 cm) in the second volume of *Old England*, a repertoire of artistic and architectural antiquities published by Charles Knight in 1860 [Knight 1860, p. 69] [3].
Returning to the graphic work of 1842, the decoration of the library is described in great detail, such as the reflections on the wooden floor or the architectural moldings that determine a classical architectural syntax defining the environment, even in symbolic terms, as a temple of knowledge.
The image is a one-point perspective view with the vanishing point placed at the height of the center horizontal line of the large window at the back of the room, while the vantage point in Selden End is advanced with respect to the room's geometric center and slightly offset on the right side.
Symmetry returns several times: the environment, made up of three rooms arranged in an H-shaped plan, is symmetrical, just as the framing chosen for the perspective is symmetrical (or almost), with an insistence that somehow seems to underline the rigidity and an obsequious "detachment" of the architecture of the library archive, the library as container, with respect to its content, the books that are the protagonists of the scene (if not the scene itself).
A distance that breaks down and, despite the same need for preservation and perpetuation of memory, dynamically compares the relationship between container and content that structures the consultation of an archive (and in the Italian lexicon the term *archivio* means both the container and the content).
This relationship also distinguishes the different classificatory architectures and representations of knowledge exemplified by the models of the tree and the labyrinth [Eco 2007] and is inverted in the digital archive, where the rigidity of branch classification has been gradually replaced by the evolutionary structures of semantics and ontological relationships (from the relational model to the object model to the mixed model ORDBMS - *Object Relational DBMS*) to create exponentially "linkable" open data.
Consultation of a digital archive is by its very nature dynamic and (often, profitably) Borgesianly labyrinthine in architectural archives where, through the power of graphic reconstruction, the objectivity of the text –bearer of informative elements regarding the artifact, the intentions of the designer, the constructive vicissitudes and so on– opens up to further critical variants of the interpretative hypothesis [Palestini 2017].
If, in fact, the materiality of the drawing on a sheet of paper (and the smell of the folder being opened and the rustle of the paper under one's fingers) triggers an immediate, even nostalgic link with the Past, only the subsequent maieutic

of reconstruction of the idea, more than that of the building, allows the construction of a broad memory that can transcend the purely descriptive dimension of the artifact, undermining the risk of a "presentist" approach (adopting the responsibility of the *Regime of historicity*, meaning the way of experiencing temporality and how a society treats its own past, invoked by Hartog).
Especially in a society characterized, as is ours, by rapid obsolescence, the gap between information and the deep meanings of memory, needs to activate memory by establishing the evocative power of the narrative layer on the materiality of informative contents [Marchis 2014].
It is precisely in the particular nature of architectural drawing to go beyond the material dimension of a support with documentary value to become a gateway to memories, a repository of stories and worlds of stories to be traversed bijectively from text to co-text / context, in turn an archive of other intra- and extra-textual information, and again from the paratext to the text [4].
For architects, graphic analysis is a vocational instrument of understanding and therefore of interpretation, and is not autonomous and free from constraints, but burdened by the responsibility of scientific, and even interdisciplinary reliability.
If on the one hand an architectural archive opens windows onto the real past (the event substantiated in the manufactured artifact), on the other hand, it draws on the document to open others, also on the possible past of projects realized only on paper, in which that drawing relives and redeems the oblivion of the unrealized in a different outcome, recovering the nature of the open ending characteristic of architectural projects [Albisinni, De Carlo 2016].
There is no doubt that digitization has been a fundamental trigger for the vitality of architectural archives in at least two directions:
- in digital archives, accessibility to sources is virtually total and is limited only by the robustness and sustainability of archival processes consisting of the solidity of the formation of the documentary structures; by the guarantee that the conditions of integrity and authenticity of the resources are respected over time; by the continuity of the maintenance over time of the conditions of readability and intelligibility of the contents;
- the digital reconstructions of drawings and paper documents make it easy to activate the narrative device of the timeline where time and place relate in "variably structured" knowledge spaces [UID 2021].
Furthermore, the space-time relationship calls into question a series of themes that problematize the relationship between architectural archives and archival architecture: the polycentrism of conservation, which links the types of architectural archives to the multiplicity of functions that can be activated, for example, in teaching or in museology, and transforms the archival bond into a wealth of cultural bond with the territories [Guccione 2009]; the perennial oscillation between the need for memory and the inevitability of volatility due to the technological obsolescence that afflicts digital documents; the problem of the digital environment consisting of the treatment of documentary memories and the keeping of originals, which become only authentic copies or, for interactive and dynamic documents such as databases and web pages, must be reduced to the keeping of components in authentic copies; the ambivalence of the congenital nature of the drawings preserved as a lasting testimony but then dynamically renewed at each reading, questioning the limit of authenticity, identity and integrity of the documents in the graphic reconstruction [Ghizzoni, Musiani 2021].
Perhaps in contemporary literary criticism we finally find a valid parallel between the literature of memory, which, especially between the two world wars, narrates the search for "lost time" [5], and the implicit iconographic literature that animates and "embodies" an archive of architecture.
Suspended between the illusion of taxonomic systematization of knowledge and confident technological projection is an archive of drawings, an almost two-way metaphor of orienting oneself as a value of research and of getting lost as a value of discovery, and always suspended between the ancient, memory and history, and the contemporary, digital society and visual culture, retrieving the "ark of learning" described by Bacon and the ark of memory, and therefore of the future, for the explorers of virtuality.

Notes

[1] As reported in the *Novum organum* (New Instrument) of the section *Masterpieces from the Collections of the Bodleian Libraries*, the metaphor between the new Bodleian library and Noah's Ark is in the dedication with which Bacon sends Thomas Bodley a copy of *Of proficience and advancement of learning* (1603-1605), the master work of *De dignitate et augmentis scientiarum* (1623), in turn the precursor text of the *Novum organum* in which Bacon proposed to King James I the idea of the empirical method as a new way of knowledge aimed at scientific progress. The dedication accompanies the volume with the words: "in regard of your great and rare desert of learning. For books are the

shrines where the Saint is, or is believed to be: and you having built an Ark to save learning from deluge."

[2] Duke Humfrey's Library is the filming set of the library of the Hogwarts School of Witchcraft and Wizardry, where Harry Potter tries to find out who Nicholas Flamel is.

[3] Our image is part of a chronological story that sees the representation of this iconic place published at different times: the first one documented dates back to 1675, when Duke Humfrey's Library is described by an engraving, published in table VII of the nearly 40 plates making up the Oxonia illustrated collection edited by David Loggan, consisting of two compared views illustrated on side-by-side pages measuring 61 x 44 cm, where the room is framed by the End rooms, the Arts End at the top and the Selden End below, both depicted with a perspective very similar to ours; at least one other illustration –a print listed in various editions with dimensions from 14.3 x 11.1 cm to 28.2 x 21.4 cm, with the title, *The Bodleian Library*, author of the work, Frederick MacKenzie, engraver of the plate, John Le Keux, and printer "Published 1st Jan.^{y} 1836, by JH Parker, Oxford, C. Tilt, Fleet St.^{t}, London, Le Keux, Harmondsworth"– is probably referable to the Oxford Almanacs for which between 1821 and 1853 Mackenzie had made 24 tables commissioned by the University of Oxford. Although Duke Humfrey's Library is the thematic fulcrum of all these representations, in all the engravings where it is present, the title identifies as the subject the Bodleian Library of the University of Oxford, never including the explicit mention of the historical room, true core of the Bodleian.

[4] All the archival information contained in the metadata file, in turn writes the history of the documentary element itself and, since everything that is "peripheral" to a text ends up becoming a hypertext, the paratext of a graphic text assumes a connotation that can best be investigated starting from the most stringent disciplinary tools to proceed subsequently with an inclusive approach, as suggested by the implications experienced by the Digital Humanities in regard to the unwanted uncritical impacts of purely quantitative investigation [Castellucci 2018].

[5] Even in the year dedicated to the celebration of Proust it cannot be overlooked, even if only by mentioning it, that this positivist memory will be flanked during the twentieth century by another dissonant universe of memory, gradually nourished by other subsequent modern utopian and dystopian visions, where memory does not refer only to the private and subjective, but is a social transformative capacity, which architectural culture has also repeatedly represented.

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DRAWING IN ARCHITECTURAL ARCHIVES

Research Methodologies

Architecture Drawings and Digital Archives: Acquisition, Structuring, Preservation

Chiara Vernizzi

Introduction

The central role of archival drawings as primary evidence for the history of architecture, landscape, cities and infrastructures has long been a clear fact.
As Manfredo Tafuri affirms, "architectural drawings, interpreted precisely as archaeological traces, from which a text is decomposed, also serve to 'disseminate' the work […] to the point of telling us something more about that work, as if the work alone did not speak sufficiently" [Tafuri 1983, p. 24]; also according to Tafuri, "a drawn work or a cycle of drawings of an architecture can even modify the reading of another work" [Tafuri 1983, p. 25].
According to Gillo Dorfles, "when we speak of Architectural Design (DA) –and not of design for architecture or design in architecture– we mean to specify the existence of an autonomous design, existing as such and not to be confused with other types of design […] a design, in short, linked in some way to the architectural fact" [Dorfles 1983, p. 33]. In the same essay, Dorfles speaks of "the artistic value –and not only a utilitarian expedient– of the DA" and then again considers "it is necessary here to judge the DA as an artistic operation in its own right, detached from what may be the characteristics of the building that may be constructed later on the basis of the primitive drawing" [Dorfles 1983, p. 34], stressing that it should not "be considered as an artistic operation in its own right, but as an artistic operation in the context of an architectural project". He underlined how we must not "fall into the ambiguity of wanting to always and unquestionably equate the value of the DA with that of the

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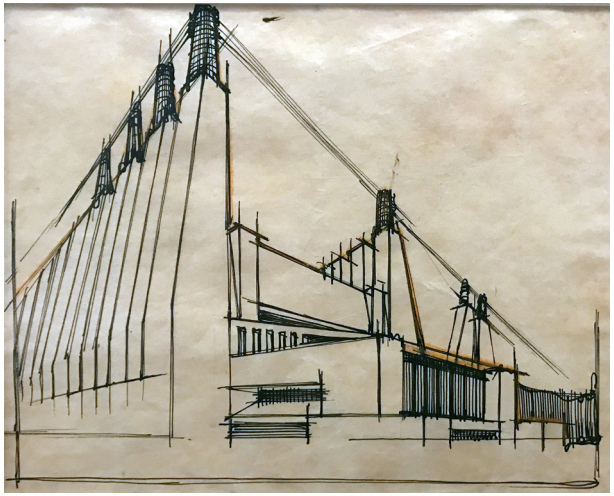


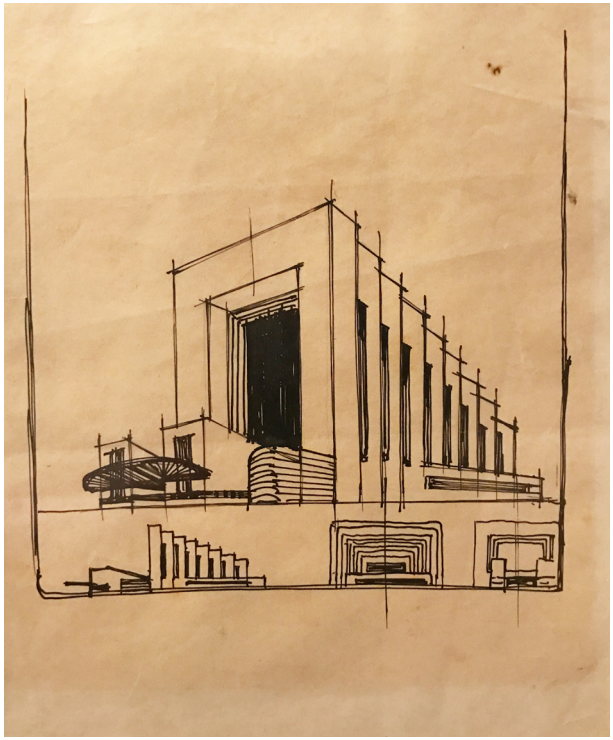


Fig. 1. Antonio Sant'Elia, 1913. Power station [Coppa, Mimmo, Minosi 2016, p. 94].

Fig. 2. Antonio Sant'Elia, 1913. Building composed of trilithic structures with decreasing dimensions alternating with glazing [Coppa, Mimmo, Minosi 2016, p. 92].

actual architectural work and, also, of admitting the existence of an autonomous value of the DA, even if this does not prelude the realization of a subsequent architectural work" [Dorfles 1983, p. 35].
Vittorio Gregotti, moreover, said: "every drawing collected has value as a document of a design process, it describes the complicated path that from the first initial ideas leads to that set of graphic communications that describe the object in all its parts, allowing its construction" [Gregotti 1983, p. 41].
These are just some of the voices that have been raised on the occasion of the constitution of CSAC (Centro Studi e Archivio della Comunicazione) of the University of Parma; voices of architects, engineers and designers gathered in 1980 by Arturo Carlo Quintavalle in the founding moment of a center whose fundamental purpose is the collection of documents for the formation and transmission of the architectural project, at least in its section dedicated to the project.
In this occasion, there are numerous issues related to the collected architectural drawings, ranging from the authorship of the drawings themselves, seen as an expression of the designer or of his poetics through the study drawings, but also the dichotomy between the role of the architectural drawings, drawn up according to the graphic codifications necessary to communicate in the shared technical language the characters of the project, and the ideational sketches, expression of the creative process of the author.
Since 1980, the form of the archives is still entirely traditional, structured in such a way as to be able to preserve the paper, photographic and plastic materials that need to be stored in very specific spaces and logics, in which the preserved drawings and projects tell, better than many words, the extraordinary story of modern and contemporary Italian architecture and its memory that has been preserved thanks to the work carried out in a capillary fabric of institutions, Superintendencies and State Archives, museums and university departments, foundations, professional orders, heirs of authors who have worked in this direction, albeit with specific aims and different methodological approaches
According to Antonia Pasqua Recchia of the DGA (Direzione Generale Archivi, MiC, General Direction of Archives), "the activities that make such diverse archives accessible and allow for the reconstruction of an organic documen-

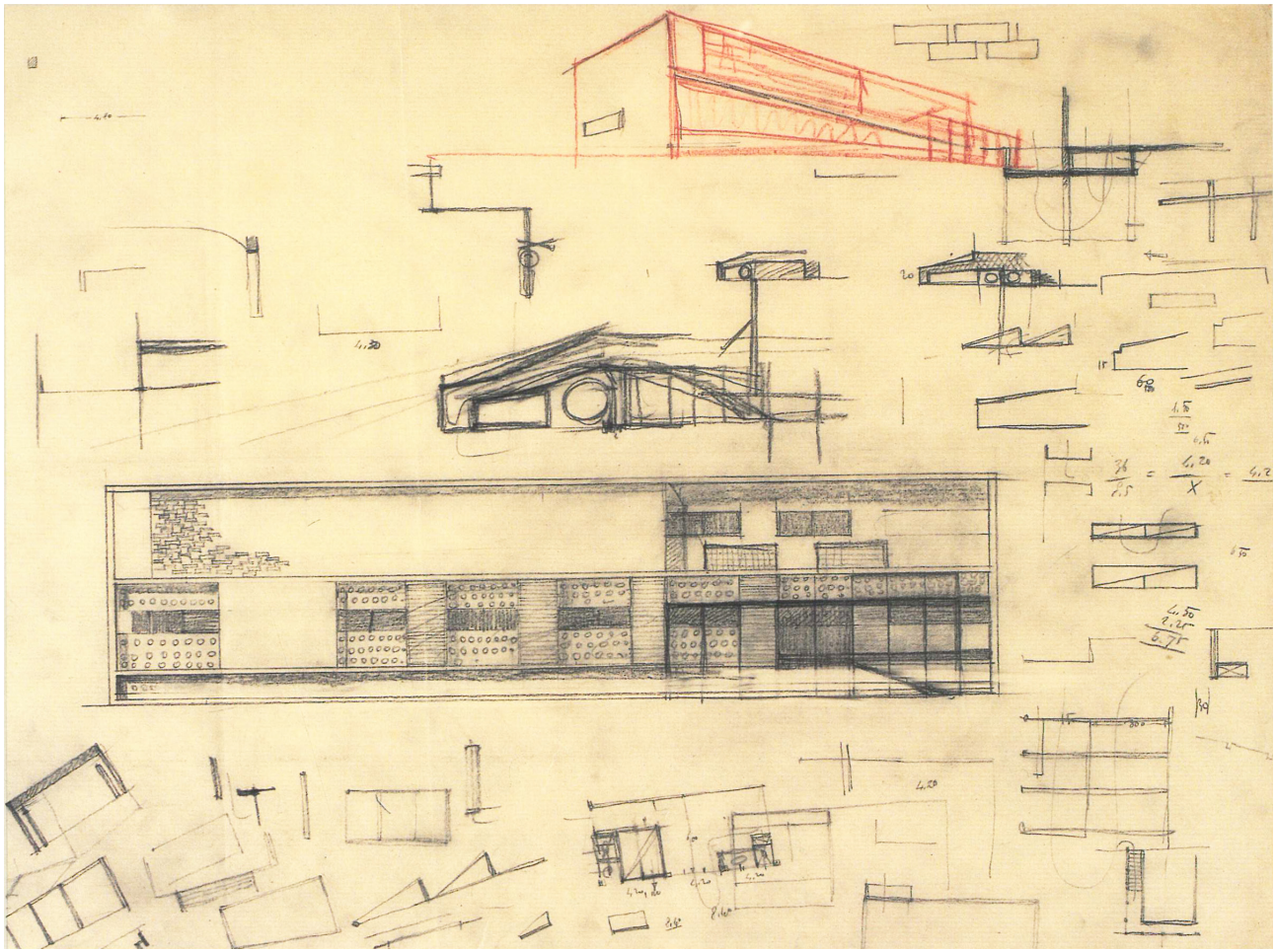
tary fabric on which to base the study of history are very complex and range from the identification of the archives themselves, to their inventorying and digitalization, to the construction of networks and knowledge systems through which to conduct research and cross-reference information and data" [Recchia 2008, p. 5].
The advent of digital technology, as we know, has opened new and different opportunities for the organization of archival material. On one hand, these possibilities allow the creation of digital copies to be consulted instead of paper copies, thus facilitating their preservation and safeguard; on the other hand, they facilitate remote consultation, making easier the archival research and the possibility of obtaining digital copies of studied materials.
This new scenario, together with the great opportunities and potential that the network offers, presents some critical steps that mainly concern the following three aspects.

Fig. 3. Antonio Sant'Elia, 1913. Industrial building with corner tower [Coppa, Mimmo, Minosi 2016, pp. 52, 53].

The acquisition of drawings

The topic of the acquisition of drawings from the archives is obviously a priority and cannot be dealt with in a unique way, given the delicacy of the supports we are dealing with. Paper of various weights, cardboard, glossy paper, paper glued on canvas supports, tracing paper, are undoubtedly the most common supports for architectural drawings, with different techniques of representation that range from pencil, ink, charcoal, to watercolor or other techniques of color application that, together with the different sizes of the drawings, make it impossible to identify univocal tools and procedures for their acquisition and transformation into digital images.
It is difficult, if not impossible, to use scanners or other acquisition tools that involve contact with the paper support, given the risk of altering its consistency, especially if it is already in a precarious state of preservation, as often happens in the case of ancient or valuable materials preserved in historical archives (e.g. in State Archives).
More and more often, the acquisition techniques used involve the use of a camera and the subsequent three-dimensional processing (photo modeling) of the images to reproduce the 'volumetric' consistency of the support.
An exemplary case is the one related to the exhibition on Leonardo da Vinci's drawings held at the Museum of Palazzo Poggi in Bologna between the end of 2019 and the beginning of 2020; an exhibition in which no original drawings were exhibited but only five digital elaborations of some of Leonardo's drawings. A "virtual exhibition, designed as something that wants to illustrate the process to produce and show knowledge, able to account for the entire system of preservation and communication of the original drawing which is absent'" [Ubertini 2019, p. 8]. "Through ISLe and its faithful reproduction of form, characters and appearance down to the microscopic scale, the exhibition aims to investigate, describe and communicate the drawings, their methods and content" [Ubertini 2019, p. 8] giving visitors the opportunity to see details of the drawings previously unimaginable [1].
The system of acquisition and reproduction of archival drawings developed by the Alma Mater Studiorum - University of Bologna, reaches in this case the apex of its technical possibilities through the project *ISLe* (*InSight Leonardo*), a digital communicative artifact developed to surrogate, investigate, describe and communicate drawings, their methods of representation and their contents, accurately reproducing their form and appearance. *ISLe* proposes the transposition of drawing into digital form as an interactive three-dimensional photorealistic replica […] proposing a unitary solution to two distinct and complementary issues. The first one is the constitution of archives of drawings that faithfully describe the information of the original physical analytical system […] the second issue is related to the methods for the acquisition and the three-dimensional restitution of drawings, that is

Fig. 4. Ignazio Gardella, 1936. Studies of the front and perspective sketches of the Alessandria anti-tubercular dispensary [Loi 1998, cover image].



the systems and the techniques that allow to reproduce and show analytically in a perceptive form the three-dimensionality of the graphic sign" [Apollonio et. al. 2019, p. 38] through the use of the grazing light photographic technique and other techniques, such as RTI (*Reflectance Transformation Imaging*), which show the characters of the micro-surface of the supports, restoring their two-dimensional shape and color and allowing the interactive re-illumination from any direction [2].
Beyond virtuous cases like this one, which, given the uniqueness of the materials studied, have seen the development of integrated systems of acquisition and restitution of exceptional refinement and performance capacity, there are many aspects linked to the reproduction of archival materials that scholars know well: the fidelity of the dimensional and formal data, first of all; the resolution of the images that allows us to see beyond what the naked eye sometimes permits; the 'weight' of the images in digital terms, also in relation to the possibility of sharing the material online, through the structuring of special platforms.

Structuring the Digital Archives

Another fundamental aspect concerns the structuring of the digital archives, so that it can be easily consulted and contain all the information which can be useful to scholars. An excellent example is the project on architectural archives, promoted by the DGA (Direzione Generale Archivi, General Direction for Archives): it was launched at the end of the 1990s with the aim of guaranteeing the preservation, knowledge and use of these sources of particular importance for the history of architecture and urban planning, for the reconstruction of the activity of designers and their works and, therefore, of the events related to the transformation of the territory and the built environment, as well as a correct reference for restoration interventions.
Motivations to which is added the equally significant one of preserving the original materials from the particular risks to which they are exposed due to the delicacy of the supports and the value of the works.
The 1999 pilot project [3] implemented by the Soprintendenza archivistica per il Lazio (Archival Superintendence Office of Lazio) was followed in the following years by other Superintendence Offices, with an almost complete coverage of the national territory.

Fig. 5. Pier Luigi Nervi, 1938. Perspective view of the tower of the Acqua e della Luce building, Rome [CSAC Parma, Project Section, Gio Ponti Fund] (photo by the author).

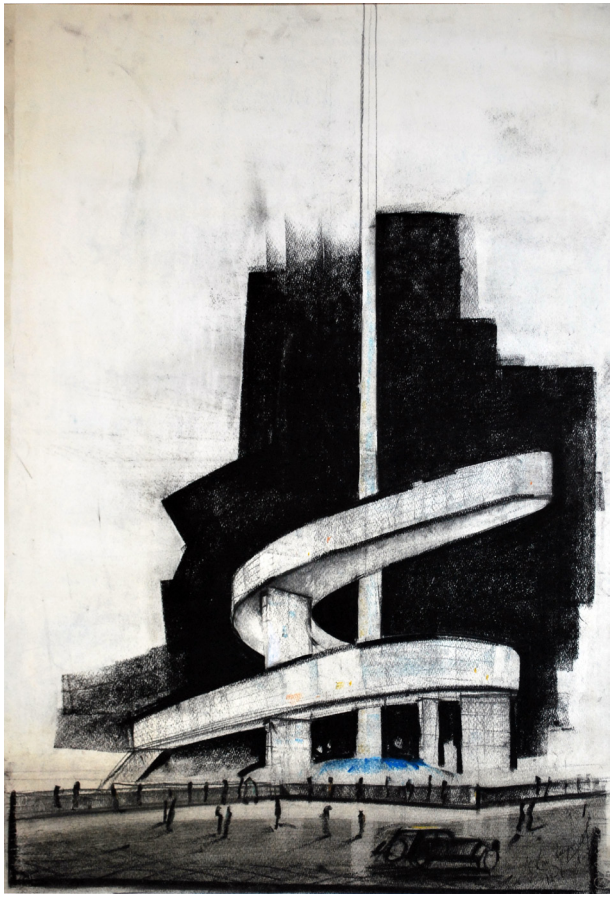
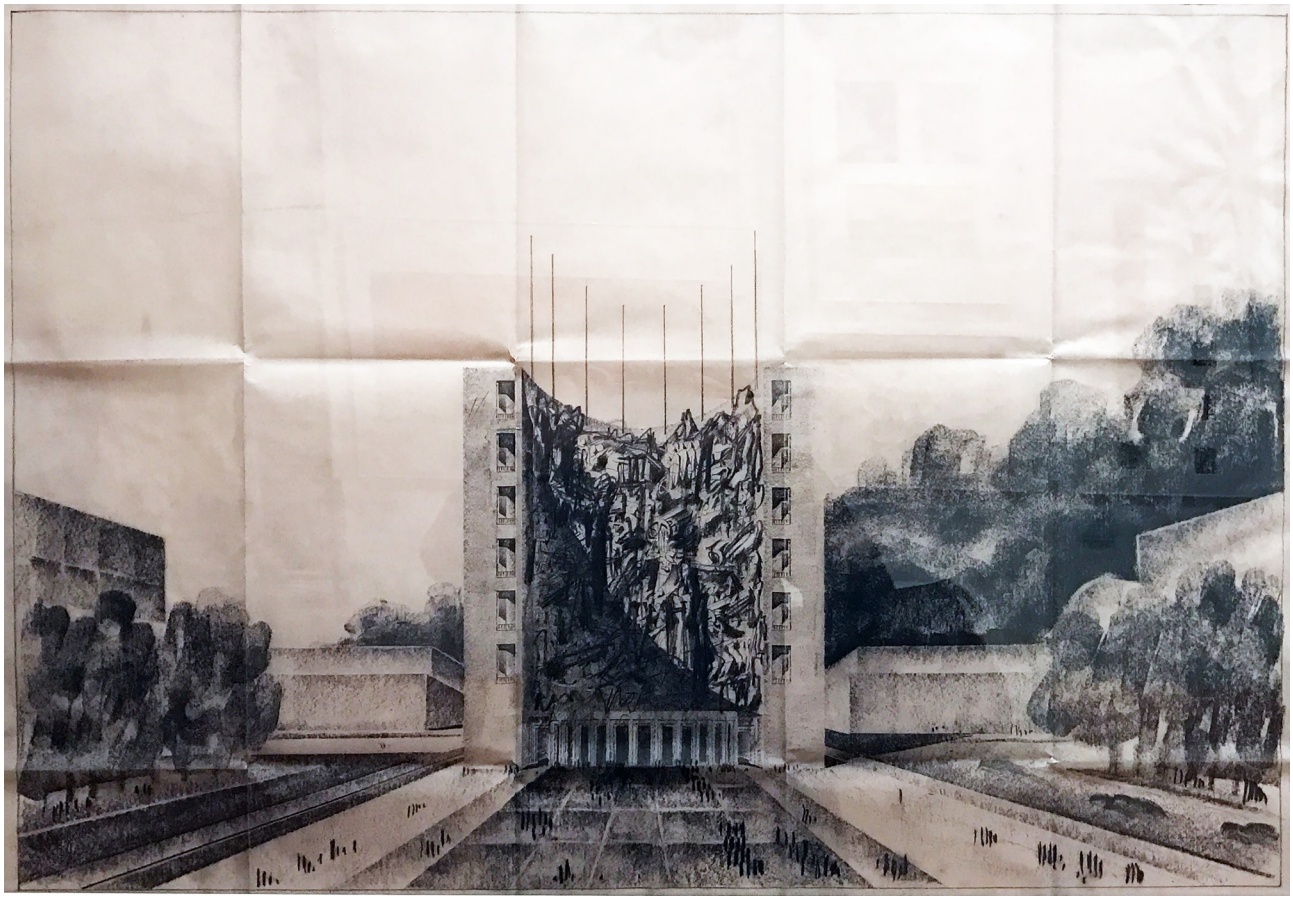


Fig. 6. Gio Ponti, 1938. Perspective view of the Acqua e della Luce building, Rome [CSAC Parma, Project Section, Gio Ponti Fund] (photo by the author).



This project includes a series of related interventions; in fact, in accordance with their institutional tasks, in addition to surveying and identifying the archives in the places where they are preserved, Superintendencies activated a series of measures for their protection and valorization, starting with the declaration of historical interest, which gives private archives the status of Cultural Heritage, and followed by reorganization and inventorying (indispensable to make the archival complexes usable), high-fidelity reproduction of graphic works (to allow a better preservation of the originals and a wider use of the images, by inserting them in databases that can also be consulted on the web), restoration of deteriorated documents (particularly complex due to the peculiar characteristics and fragility of the different supports of the drawings); finally, to find places of preservation, in many cases favoring the acquisition by the State Archives. The results of the regional censuses were able to flow into a shared information system within SIUSA (Sistema Informativo Unificato per le Soprintendenze Archivistiche, Unified Information System of the Archival Superintendencies) [4], where a dedicated thematic path was created, which serves as a connection point for the results of the censuses [Sistema Informativo Unificato].
The situation that emerges from SIUSA, where data continues to be inserted, updated and published, clearly shows the results achieved: there are about 800 archives of designers [Archivi degli Architetti], including some of the most famous protagonists of 20th century architecture, such as Achille Castiglioni, Luigi Cosenza, Costantino Dardi, Plinio Marconi, Luigi Moretti, Pier Luigi Nervi, Mario Ridolfi, Giuseppe Samonà, just to name a few. The places of preservation are very diverse: from private individuals to State Archives, cultural institutions (universities, foundations, academies) and professional orders. This confirms the polycentrism of preservation, typical of the Italian situation; a characteristic that makes it even more important to have descriptive systems that allow the retrieval of information and the identification of the archives and sometimes the nuclei of the same archives that are physically divided (such as that of Pier Luigi Nervi's drawings) and give a complete and coherent description.
In 2012, an important step was added, in the context of the increasing attention to the use and valorization by the archival administration, with the creation of the website Archivi degli architetti within the SAN (Sistema Archivistico Nazionale, National Archival System) [Sistema Archivistico Nazionale]; which presents, in addition to the archival resources, various contents (images, editorial texts) that enrich the information potential, even though they cannot exhaust it [5].
In the web-based platform, the reference context is that of the history of Italian architecture in the last two centuries, to be retraced through six sections dedicated to the partners, to the territorial paths, to the protagonists and to the projects they developed in the course of their activity, with a multimedia gallery of images and other digital resources, which allows different search modes.
Obviously, there are many other digital archives referring to single institutions, e.g. MAXXI (Museo delle Arti del XXI secolo) or CSAC (Centro Studi e Archivio della Comunicazione) that allow online consultation of their catalogs and in some cases also offer the possibility of viewing part of the images online.
In all of these web-based platforms, the metadata and the entries in the cards that illustrate the archival material preserved are fundamental. They must be able to transmit precise informations of different kinds; from the precise location of the source, to aspects tied to the supports, formats, and representation techniques used relative to the materials present in the various fonds, up to the contents, the projection methods, the presence or absence of inscriptions, annotations and, finally, the state of preservation.

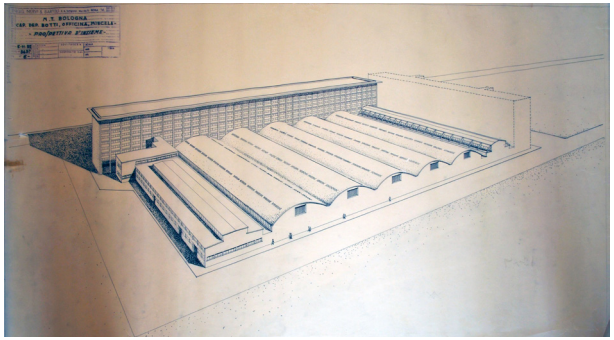
Preservation of Digital Materials

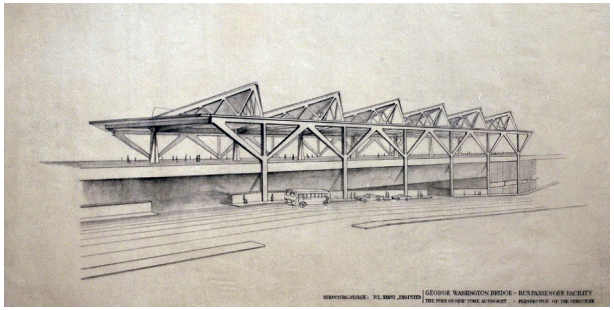
The issue of preservation of images in digital format constitutes a very delicate point and concerns not only the digital formats into which analogue graphic works have been transformed, but also the digital formats into which the actual graphic works were born. This refers to the drawings of contemporary architects, 'digital natives' who, if on one hand simplified the acquisition phase, cancelling it, on the other hand are also subject to the problem of corruptibility and obsolescence of the supports.
In fact, the preservation of digitally archived materials has long been one of the most challenging problems for the scientific and professional community, both from a theoretical and methodological point of view and in terms of identifying and implementing low-cost, easy-to-adopt solutions. Technological obsolescence is the main reason, though not the only one, for this difficulty.

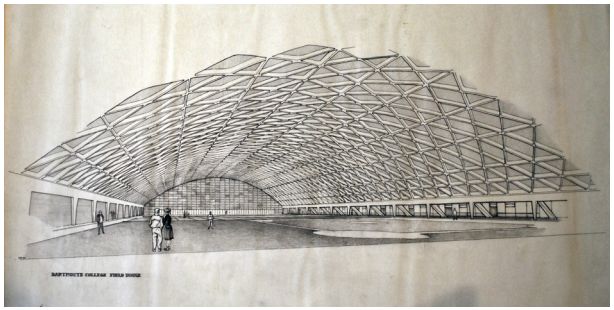
Fig. 7. Pier Luigi Nervi, 1952. Manifattura Tabacchi Bologna - Barrel storage sheds and mixing workshop[CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).

Fig. 8. Pier Luigi Nervi, 1960. George Washington Bridge - Bus Passenger, New York. Perspective view [CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).

Fig. 9. Pier Luigi Nervi, 1961. Field House Dartmouth College, New Hampshire. Perspective view [CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).







Unlike what happens with analogical documentary sources, for which the passage of time determines, in the absence of pathological situations, the dual effect of increasing the value of the resource, which remains unchanged over time, and of ensuring the conditions for verifying its authenticity (e.g., by analyzing the support, the materials, and the data), the obsolescence of technology is the main reason, analyzing the support, the writing materials, the structure of the graphic document, the typology of the annotations), the management and the keeping of digital documents must face a continuous, unstoppable and inevitable process of technological transformation, which neither organizations nor individuals are able to escape without jeopardizing, on the one hand, the accessibility of the contents over time and, on the other, the guarantees of integrity of the sources themselves.

The complexity of the problem has long been clear to experts, but only a few years ago some international research initiatives have been launched that are able to ensure the amount of financial resources and, above all, the continuity over time of the work programs necessary to obtain significant results. The fragility of the media, the ease of manipulation, and the frequency and relevance of technological changes have also highlighted, especially in recent years, the essential need to create repositories/archives capable of ensuring a high level of reliability and security.

Digital preservation is a dynamic process that, as mentioned, requires a continuous monitoring of experimentation and research activities and, above all, requires substantial investments. The manipulation (in terms of reworking) of the information content of an archival document is a positive investment, if it saves repetitive consultation and sometimes even dangerous photocopying activities.

The fragility of the media, as already pointed out, is a risk factor especially in terms of security, while the incessant evolution of digital formats has challenging consequences. In order for computer archives to be preserved, it is indispensable that two substantially conflicting needs are reconciled: authenticity (which consists mainly in the activities of certain identification and guarantee of the integrity of the documents and their relationships) and the general and long-term accessibility of the document systems, made possible by the use of technological and organizational solutions that allow the overcoming of obsolescence problems. In essence, the preservation function is increasingly configured as an articulated and dynamic complex of activities, tools, procedures that, with the aim of ensuring the conditions for the survival of digital materials, require

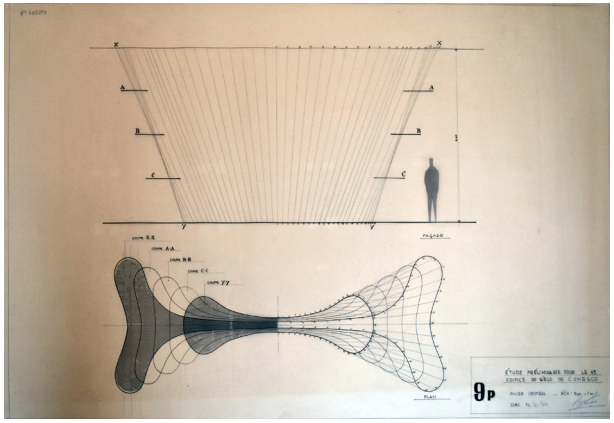
clear principles and a regulatory framework of reference. In an interview by Lucia Bosso [Bosso 2022], Kristin Fallon, an expert in the use of digital tools for the archiving of digitally edited design documentation, also emphasizes the urgency of managing the multiplicity of digital formats that are used in the production of images in contemporary design, which leads to the creation of digital documents that make up the archives of today's architects, some of which can already be consulted online [6].
The creation of these online archives necessarily poses a question, well emphasized by Fallon [Bosso 2022]: that of choice, linked to the organization and management of digital documentation, in order to regulate the creation, management and preservation of digital data, thanks to prescriptions to be applied at the very moment of data creation and throughout the entire design process.

Conclusions

The creation of digital archives of architectural drawings is now a widespread practice and is made necessary by several factors, as explained in the preceding paragraphs. Depending on the materials in question, it is not easy to define a structure for the information useful to bypass the need to consult the native formats of the archival materials, which are always a precious source of information and emotions that only the physical and visual contact with the original can transmit.
For those who work in the field of architectural representation, the possibility of consulting historical and project archives is fundamental. It is also fundamental to be able to find one's way through the institutions [7] that collect and catalogue material and its location in an attempt to systematize information and make it easier, if not direct online consultation, to find locations and sources to consult, in the construction of a 'catalog of catalogs' that recalls that of the Library of Babel of Borgesian memory [Borges 2003, pp. 67-76].
As Dante Giacosa said, "creativity is the soul of the project and is expressed in drawing, an irreplaceable means of expression, the first and greatest help in the eyes of the designer. Designers must be aware and proud, verbal description is not enough, in technology. Drawing is necessary; redoing it several times, perfecting it. […] *drawing stimulates the imagination and helps the fantasy*" [quoted by Koenig 1983, p. 61].

Fig. 10. Pier Luigi Nervi, 1961. Unesco headquarters, Paris - preliminary studies for the 4th building of the Unesco headquarters - central pillar [CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).

Fig. 11. Pier Luigi Nervi, 1964. Papal Audience Hall - Vatican City. Studies for the Pilgrims' Hall - floor variant for the throne area [CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).



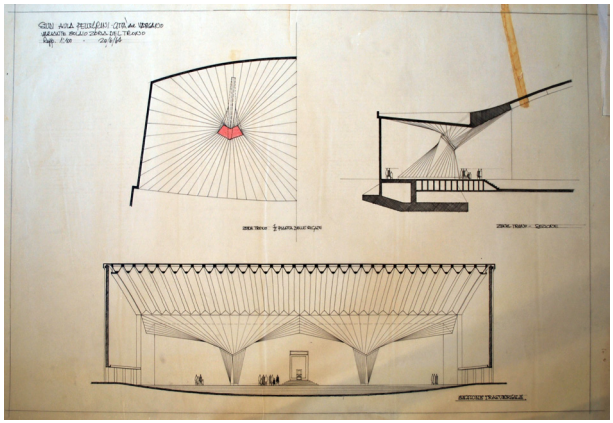
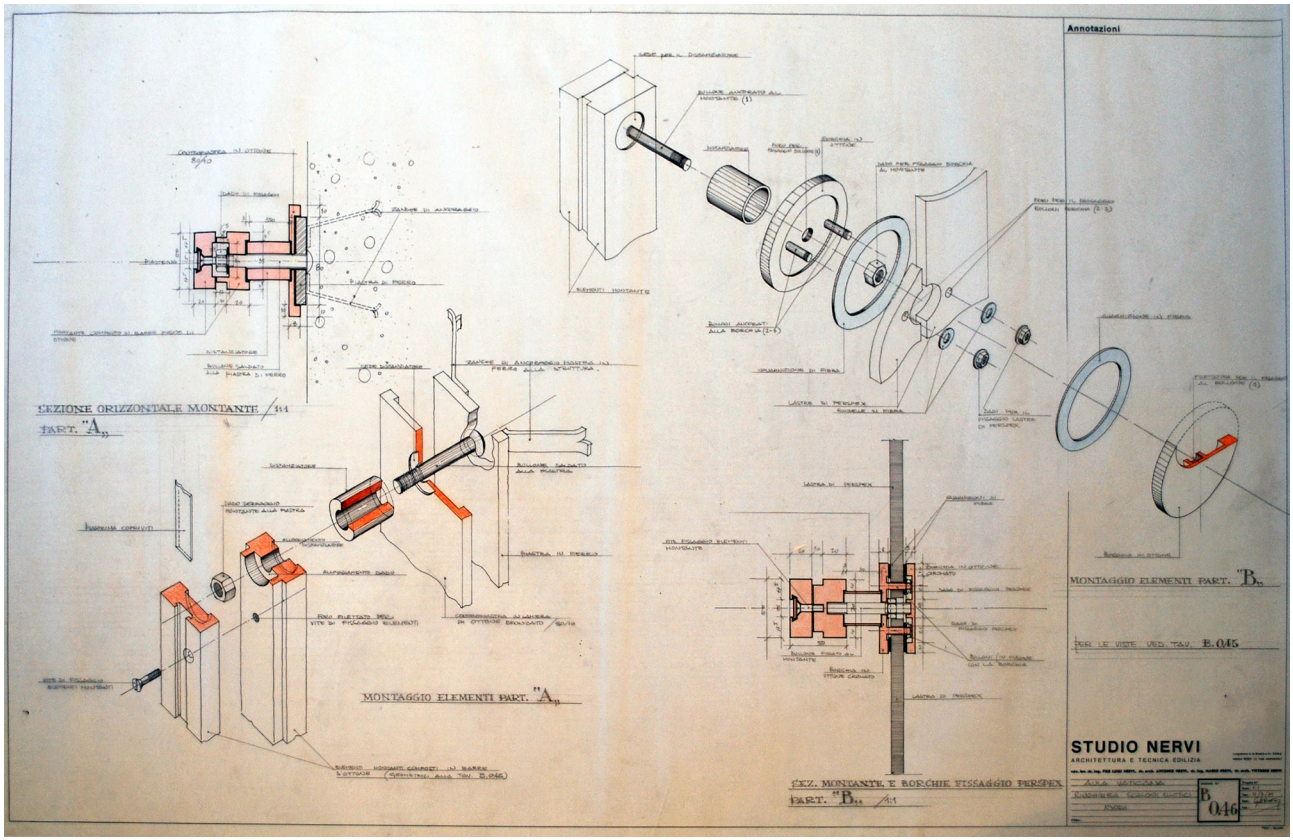


Fig. 12. Pier Luigi Nervi, 1971. Papal Audience Hall - Vatican City. Vatican Hall - Elliptical staircase railing - knots [CSAC Parma, Project Section, Pier Luigi Nervi Fund] (photo by the author).



The boundless historical, modern and contemporary iconographic patrimony related to architectural design is a fundamental element of the training and continuous growth of those who, for work or passion, work in the field of architecture and, in particular, architectural representation. For this reason, the archives that collect these materials play a fundamental role and must be structured in such a way as to be widely accessible and usable. This is possible only through the definition of an adequate process of acquisition of the materials and a correct structuring of the informative data on them and on the appropriate preservation strategies, both for analog and digital material.
Beyond the examples of institutions that, due to their role and mission, deal with this, there are many interesting examples of the creation of archives based on architectural drawings and structured according to specific logics, linked to the peculiarities of the materials collected.
One of these archives is certainly the one created by the UID (Unione Italiana per il Disegno) Archival Commission, *Drawing in the Archives of Architecture* [9], whose objective is to communicate, through the research carried out by professors and researchers of the disciplinary area, the contribution that graphic analysis and representation, both traditional and digital, can provide on the theme of the Archives of Architecture, Engineering and Design and on the iconographic materials they contain.
This database aims to offer new interpretations through graphic contributions, analyses and digital reconfigurations that, starting from traditional project drawings, allow traditional graphic analyses and three-dimensional explorations that go beyond the limits of the sheet, providing a more dynamic and interactive use of the original materials kept in the archives and exemplifying, through the collection of a series of disciplinary researches carried out on these materials, the wealth of analyses and in-depth research ideas that can be developed through the study and knowledge of the architectural drawings kept and preserved in the Archives.

Notes

[1] *ISLe: InSight Leonardo*.

[2] For a detailed description of the process, see Apollonio et. al. 2019, pp. 31-51.

[3] Again in 1999, the proceedings of the international conference organized by the Ufficio centrale per i beni archivistici (Central Office for Archival Assets) and held in Reggio Emilia in October 1993, *Archives for the History of Architecture*, were published. Many archivists and architects who studied the history of architecture and conservation participated in the conference, providing a broad picture of the documentary sources and preservation institutions.

[4] Such a far-reaching project has found support in several agreements signed by the Direzione generale per gli Archivi (General Directorate for Archives) with the Direzione generale per l'architettura e l'arte contemporanee (General Directorate for Architecture and Contemporary Art) for the drafting of a national plan for the protection of the Documentary Heritage for 20th century architecture (2001), with the Mendrisio Academy of Italian Switzerland (2002, renewed in 2012), with the MAXXI Foundation (2012), with the DG ABAP (Direzione Generale Archeologia, Belle Arti e Paesaggio) and the AAA/Italia (Associazione nazionale Archivi di Architettura, National Association of Architecture Archives, 2013).

[5] Dr. Elisabetta Reale, current Director of the Istituto Centrale degli Archivi (Central Institute of Archives), spoke in depth about SAN and the entire system of architectural archives in her talk entitled *Gli archivi di architettura nei sistemi archivistici nazionali: dal censimento alla valorizzazione* (Architectural archives in the national archival systems: from census to valorization), held on February 9th, 2022 within the review *Gli archivi di architettura nel XXI secolo. I luoghi delle idee e delle testimonianze*, curated by Laura Farroni, Michele Beccu and Marta Faienza (Roma Tre University).

[6] See, for example, the website of the Fondazione Renzo Piano (Renzo Piano Foundation) [Fondazione Renzo Piano].

[7] See, for example, the activity of the AAA ITALIA (Associazione nazionale Archivi dell'Architettura, Association of Architecture Archives) [Associazione nazionale Archivi dell'Architettura].

[8] Current composition oif the UID (Unione Italiana per il Disegno) Archives Commission: Caterina Palestini (Coordinator), Piero Albisinni, Emanuela Chiavoni, Laura Farroni, Cinzia Garofalo, Francesco Maggio, Chiara Vernizzi, Marco Vitali.

[9] <https://www.unioneitalianadisegno.it/wp/archivi/> (accessed 27 January 2022).

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New Perspectives for Drawings in Italian Architecture Archives: Reflections and Experiments

Laura Farroni, Marta Faienza, Matteo Flavio Mancini

Abstract

The value of Italian architecture is linked not only to the built work, but also to the apparatus of its representations, a complex world of information often scattered in different places of conservation and treated in a non-homogeneous way. The paper aims to present some reflections on the contributions that the discipline of drawing can provide in the different areas –knowledge, preservation, use and accessibility– of architectural drawing conservation and enhancement process. The research highlights the need for a unitary conceptual model of management that includes: the descriptive data, through a uniform path of cataloguing; the realisation of digital analysis and reconstructions, through methodologies that allow the evaluation and visualisation of their degree of reliability; the definition of strategies and products to implement different forms of accessibility according to the type of recipient and interaction desired.

Keywords: drawings archive, 3D modelling, virtual reality, augmented reality, accessibility.

Introduction

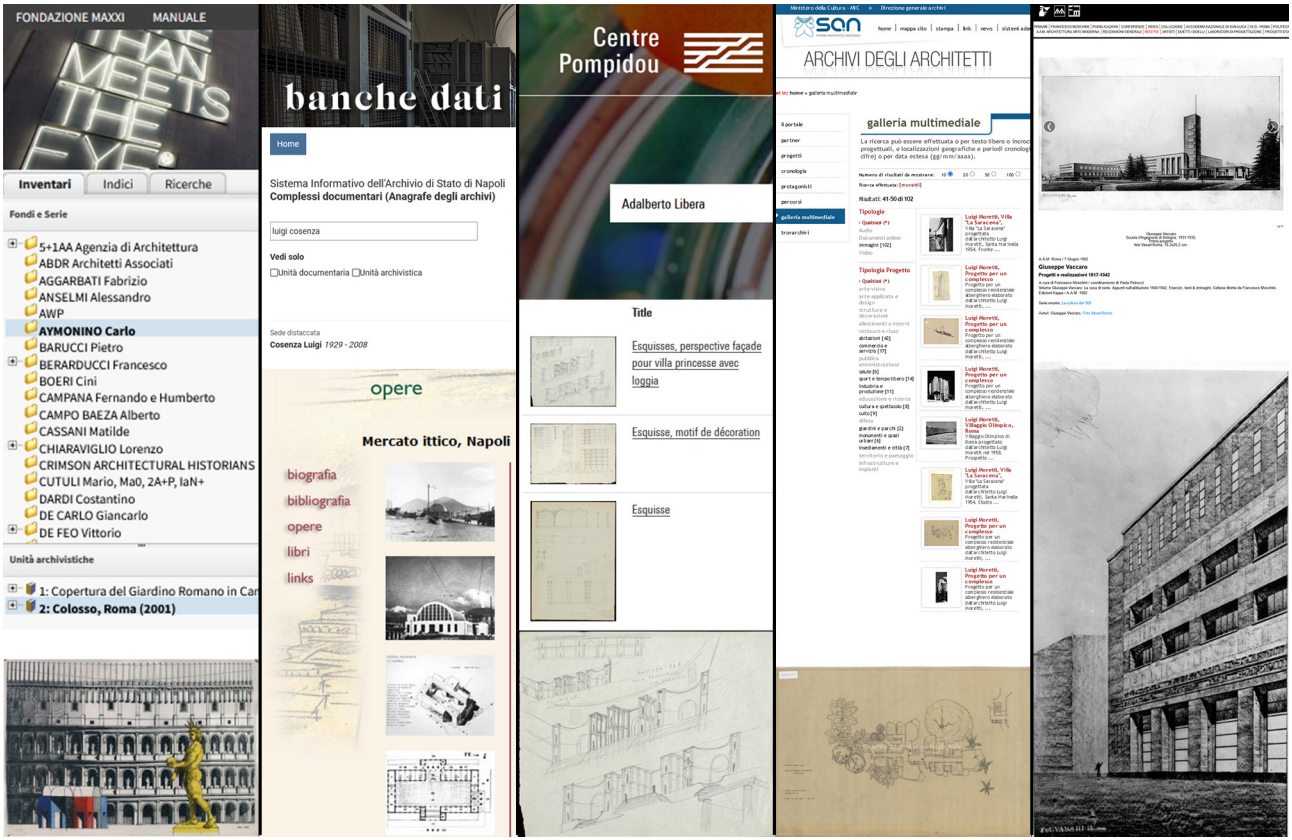
This essay aims to show a methodological framework and experiments to clarify the role and contribution of drawing, in the context of already established architecture archives. Drawing can contribute to developing new knowledge scenarios, for its different theoretical, speculative, analytical and applicative declinations and its ability to take a holistic approach to the issues under investigation [Farroni 2012].
It can interpret the variety of information in the architectural image, since its specificity is the knowledge of drawing evolution, both as an instrument for tracing signs and as a graphic expression for the project communication as a result of reflections and operative verification practices. The discipline is distinguished by the proposition of two-dimensional analyses and three-dimensional digital reconstructions.
The reflection on specimens collected in archival collections becomes an opportunity to experiment with different digital techniques in order to explore the architectural characteristics, and spatial configurations proposed, creating new content that enhances accessibility and understanding for different audiences. The research has considered two areas. On the one hand, it has taken note of the technical-scientific elaborations produced in institutional contexts – in particular, the studies and regulations produced by the Central Institute for Catalogue and Documentation (ICCD) and the archival sector of the Ministry of Culture (MiC), concerning the

contexts of origin and representation of documentary production, the latter seen as the hierarchical structure of information. At the same time, it surveyed the experiments conducted in scientific research projects in the interpretation and enhancement of drawings. From the former, it emerged that legislation and practices define standardised description models shared at national and international level. In particular, standards for cataloguing, archival description, metadata and interoperability of systems and digital content have been implemented at the European level and globally, thanks to a long process of research involving public institutions, the academic world, and industry. The second one, on the other hand, revealed many examples that cannot be ascribed to shared procedures. It is, therefore, necessary to understand where and how the contribution of drawing can implement such a complex system.

From the state of the art to the proposal of a unitary model for the description, interpretation and valorisation of architectural drawing

The analysis started from the survey of architectural archives [Guccione et al. 1999; Bruschi 2007] and required an in-depth study of theoretical assumptions, cataloguing and archival tools and practices. This first activity highlighted the complexity of the scenario and of the research work necessary to experiment with a unitary conceptual model, that includes the contribution of drawing and is characterised by scientific rigour, innovation and usability. The first phase of the research aimed at defining thematic surveys: the fonds of architects preserved in private or public institutions and bodies, for which the data accessible on the main institutional platforms such as SAN (Sistema Archivistico Nazionale), SIUSA (Sistema Informativo Unificato per le Soprintendenze Archivistiche), SIAS (Sistema Informativo degli Archivi di Stato) and the main research bodies in the field of architecture such as Accademia Nazionale di San Luca, Centro Archivi di Architettura del MAXXI, Archivio Progetti Iuav, Archivio del Moderno were analysed; thematic, monographic and experimental projects on architects' archives promoted by public and private institutions to guarantee easier accessibility to this documentation, but carried out with different methodologies, often in multidisciplinary contexts, and therefore characterised by a significant lack of homogeneity. These include the *Portale degli Archivi degli architetti*, promoted by the Direzione Generale per gli Archivi, *Architetture del secondo '900* by the Direzione Generale Creatività Urbana, *Lineamenta* by the Bibliotheca Hertziana, and *Il Disegno negli Archivi di Architettura* by the UID Unione Italiana per il Disegno. In addition, three-dimensional digita reconstruction projects starting from traditional project drawings were investigated, which aim to offer new readings through graphic contributions, analysis and digital reconfigurations through a dynamic and interactive use. These include *Il Disegno negli Archivi di Architettura* (UID), and some studies by the DIDA Department of Architecture of the University of Florence. In addition, of course, to the individual actions of scholars and researchers, but which do not fall within the case histories identified, and which highlight the need to provide a reference model in which to convey in-depth studies [Vernizzi 2011; Maggio 2021; Ippoliti, Calvano 2021].
The survey work led to a reflection on the proposed cataloguing models. In order to verify the data actually in use, such as traditional and computerised inventories, catalogues and databases of architectural drawings and related documentation, it was decided to analyse the fonds of some masters of the second half of the 20th century and some contemporary architects. The studied fonds, all divided between different conservators, were: Aymonino (1926-2010), Luigi Cosenza (1905-1984), Adalberto Libera (1903-1963), Luigi Moretti (1907-1973), Giuseppe Vaccaro (1896-1970), Francesco Cellini (1944) and Studio ABDR (1982) (1982) (fig. 1) [Guccione, Terenzoni 2002; OAR 2019].
The analysis of the data allowed the elaboration of a Virtual Fund record, based on the ISAD (International Standard Archival Description) [1] and ISAAR (International Standard Archival Authority Records) [2] standards, in which standardised information was collected on: consistency, content description, archival/legal history, conditions governing access, conservator, qualification and personal data (tab. 1).
In addition, an analysis of the data exposure models (front end) was also deemed necessary, looking at platforms and databases that can be consulted on the web to analyse the type and quality of descriptive data exposed.
State of the art revealed the complex and heterogeneous nature of the documentation and the implications

Fig. 1. Front-end screenshots of some of the funds related to Carlo Aymonino, Luigi Cosenza, Adalberto Libera, Luigi Moretti and Giuseppe Vaccaro (graphic elaboration by the authors).



TSK	FOND	FONC	FONS	FONT	FONI	FOLS	FOLD	FOLB	FOLN
File Type	Name of the Archival Fund	Consistency	Description Content	Archival/ legal history	Conditions governing the access	Producer (own name)	Producer (collective body)	Qualification	Anagraphic data
A	**Accademia Nazionale di San Luca - CARLO AYMONINO**	drawings in various media ca. 500; documentation files 100; photographs ca. 300.	The Carlo Aymonino's Fund, donated shortly before his death by the architect, who served as president of Accademia Nazionale di San Luca from 1995-1996, collects extensive and exhaustive documentation (drawings, photographs, documents) on much of the design activity carried out since the fifties of the twentieth century	Donation before 2010	Since October 2020, the fund has been on loan for use at the Università IUAV di Venezia	Carlo Aymonino		Architect	1926 - 2010
A	**Archivi Digitali Olivetti - Fondo: Collezioni Olivetti - Carlo Aymonino**	29 drawings and texts - Olivetti Emeroteca (15) Olivetti Photo Library (14)	The Collezioni Olivetti collected uniform documentation by type, as was requested at the time by the Olivetti Company for easier access to the materials. The structure, where possible, has maintained indications of the provenance of the original archival collection (e.g., the Photo Library holds the Photo series of the Lodovichi Fund, etc.).	Since 1986	Viewable upon request, but present online descriptive sheet		Olivetti S.p.A.	Company	Since 1908 (fund 1986-2009)
	Archivi Digitali Olivetti - Fondo: Società Olivetti - Carlo Aymonino	"8 texts - Indexes Emeroteca (7) Centro Culturale Olivetti Milano (1)"	Consisting of documents and other materials related to the activities carried out over more than a century by the companies of the Olivetti Group, it represents the main component of the documentary heritage preserved by the Association. The records consist of over 70 archival series representing the corporate entities or the People who worked in them, responsible for producing that given documentary collection.	Since 1986	Viewable upon request, but present online descriptive sheet		Olivetti S.p.A.	Company	Since 1908 (fund 1986-2009)
A	**Archivi Digitali Olivetti - Fondo: Personalità della storia Olivetti - Adriano Olivetti**	1 mail	Includes holdings related to the great personalities in Olivetti history, starting with the Olivetti Family: Camillo, Adriano, Massimo, Arrigo, Roberto, Dino, Silvia Olivetti, and other family members, totalling 152.9 linear meters, and a chronological span from 1806-1986	Since 1986	Viewable upon request, but present online descriptive sheet		Olivetti S.p.A.	Company	Since 1908 (fund 1986-2009)
A	**Archivio Progetti IUAV - Collezione Archivio Progetti**	About 75 archival and documentary units (of 480 archival units)	The collection contains architectural documentation collected or produced by the Archivio Progetti: primarily photographic reproductions or heliographic, xerographic, etc., copies, but also original documents received in isolation at the archive and models made by the archive itself.	Since 1949	Viewable in digital format descriptive sheet and in some cases digital object (attached to the sheet)		Istituto Universitario di Architettura di Venezia. Centro di Servizi Interdipartimentali Archivio Progetti	University	Since 1987
A	**Archivio Progetti IUAV - Carlo Aymonino and Gabriella Barbini's Venetian study**		In the records of the Venetian firm's archives, one can find the plans for the Ristrutturazione del Campo di Marte, Venice-Giudecca (1984), the IMA project in Ferrara (1982), competition project for the arrangement of the Largo Firenze, Ravenna (1986), as well as the unrealized plans for the renovation and rehabilitation of the area of the former Royal Gardens at St. Mark's, Venice (1997) and the competitions for the Italian Pavilion and the Palazzo del Cinema on the Lido of La Biennale di Venezia	Purchase	Pending sorting		Studio veneziano di Carlo Aymonino e Gabriella Barbini	Architecture studio	
A	**Centre Pompidou - Architecture Collection - Architecture Drawings -Carlo Aymonino**	347 drawings, 4 models	With more than 13,000 works, the Musée National d'Art Moderne's collection of architecture is one of the largest in the world. Created in 1992 by Dominique Bozo, President of the Centre Pompidou, its purpose is to demonstrate the profoundly interdisciplinary dimension of modernity through its exhibitions and publications. The notion of the architectural project gives the collection all its cohesion, developed from planning to realization through all its forms, models, drawings, prototypes and written.	Donation 1996, Donation 2007, Purchase 2007	Available digitally at: https://www.centrepompidou.fr/en/recherche/oeuvres?secteurCollection%5B%5D=Architecture&artiste%5B%5D=-Carlo%20 Aymonino&display=Grid		Centre Pompidou	Museum	Since 1992
A	**Centro Archivi MAXXI - CARLO AYMONINO**	2 archival units	The collection consists of 10 plates depicting the Colosseum and the arrangement of the Roman Garden housing the Marcus Aurelius at the Musei Capitolini, a project carried out by Carlo Aymonino in 1993. The fund was kept by Carlo Aymonino in Rome and was acquired by the Ministero per i Beni e le Attività Culturali in 2009 for the collections of MAXXI Architecture	Purchase 03/03/2009	Available at the office by appointment or in digital format at: http://inventari.fondazionemaxxi.it/AriannaWeb/main.htm#128779_archivio	Carlo Aymonino		Architect	1926 - 2010
A	**FFMAAM - Collezione Francesco Moschini - Carlo Aymonino**	110 drawings	FFMAAM is the new acronym that brings together and presents the outcomes of Francesco Moschini's intellectual and cultural work from the mid-1970s to the present. Through the numerous relationships woven with multiple authors in different disciplinary fields, an extraordinary Collection has thus been formed, resulting from shared life excerpts and paths in common. Numerous works, including Art, Photography, Drawings and Architecture Projects, constitute the Francesco Moschini and Gabriel Vaduva A.A.M. Architettura Arte Moderna Permanent Collection. A corpus of medium- and large-format drawings and projects along with oils, letters and numerous notebooks and journals		Available digitally at: http://ffmaam.it/collezione/carlo-aymonino#carlo-aymonino		FFMAAM - Fondo Francesco Moschini A.A.M. Architettura Arte Moderna		Since 1970

Tab. 1. Virtual Fund record of the fonds related to C. Aymonino held in various conservatories (graphic elaboration by the authors).

related to its preservation, management, cataloguing and digitisation, as well as numerous critical issues that limit the search and identification of the contents, but also the information potential of these documents and their historical and professional connections.
In the field of content and the unity of the reconstruction of the professional production of the individual architect, the frequent fragmentation of the documentation of a single producer among various conservators and the absence of informative and operational relationships between the different partitions makes descriptive intervention complex. This is part of a context where the different types of documentation preserved in the fonds (from preparatory sketches to executive drawings, from textual documentation related to the definition levels of the project to correspondence, photographs, etc.), as well as the different physical analogue and digital supports, require specific and diversified descriptive models.
In the field of fruition, several factors highlight the lack of a standardised exposition model: the inhomogeneity of the data displayed and of the description languages, the absence, in some cases, of necessary data (such as author, title) and the absence and/or lack of technical data. It also emerges, following a further analysis that compared the data on use (front end) with the actual cataloguing data (back end), the need to deepen the relationship between the two areas to understand the methods of selection of the published data.
In summary, it turns out that for a better valorisation of architectural drawings, a standardised model for collecting descriptive data and a uniform cataloguing layout (already initiated by archivists) is necessary. However, it must be supplemented by the contribution of digital analyses and reconstructions and links with the built work.
It was therefore considered valuable to analyse in-depth the existing layouts developed in the institutional context of the ICCD, starting from the OA form (Scheda opera d'arte of the disciplinary sector of historical and artistic heritage) and the D form (Scheda disegno). According to these analyses, a proposal is elaborated that can integrate the existing OA sheet and defines a conceptual model for new accessibility (in terms of content and use) of drawings of architectural works.
This model places the drawing as the primary source, endowed with specific characteristics and susceptible to

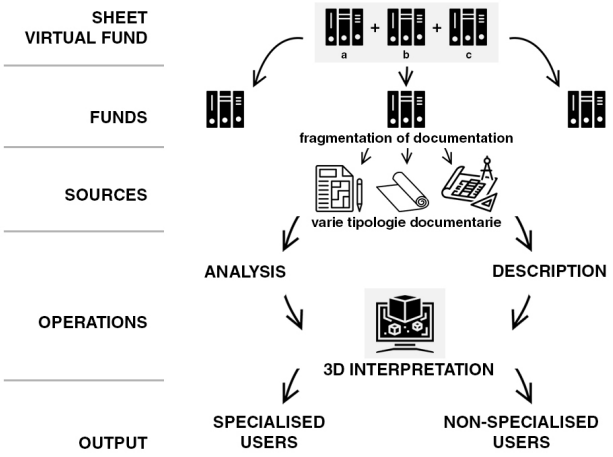
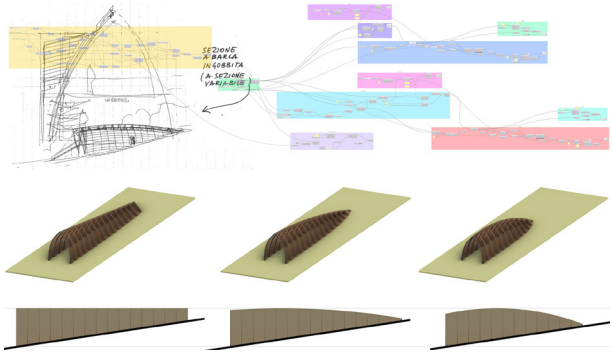


Fig. 2. Diagram of the scientific process from the analysis of the fonds of architectural drawings to the creation of new contents for different users (graphic elaboration by the authors).

reproducibility. It is linked to the OA form, where the scientific quality of the drawing itself is defined through informative data that integrate the descriptive contents regarding the signs present, the graphic codes used, the different graphic weights, the representation methods, the graphic composition, the semantics of the signs and elements, and the recognised graphic strategies. This model provides the connection between the drawings, fragmented in the documentation of the fonds, and the information present in the different documentary typologies, both to be subjected to analysis and description, which will be helpful for the 3D reconstructions diversified in the outputs for the considered users. The aim is to highlight all the potential that an architectural drawing offers, to multiply the contents with respect to an original, depending on the time and the way it is read, and to reveal the architects' poetics and design intentions. The overall objective of the model is to reinforce actions aimed at contrasting the dispersion and fragmentation of contents and to promote awareness about the preservation and valorisation practices of architectural archives (fig. 2).

Experiments in three-dimensional digital reconstruction of architectural drawings and visualisation of interpretation reliability

The practice of reconstructions of significantly altered, lost [Trizio 2021] or never realised architectural contexts and artefacts and their analysis has always been pursued by scholars and has received a strong impetus from the advent of digital techniques [Muenster 2022].
In the context of current research, the results of three-dimensional digital interpretations of projects by architect Francesco Cellini [Cellini 2016] and the Roman studio ABDR [Costi 2015] are presented. The former were an opportunity to experiment with modelling and visualisation techniques, addressed to the analysis and interpretation of the projects. At the same time, the latter were also an opportunity to experiment with different outputs aimed at implementing accessibility and valorisation.
In the case, for example, of the Rowing Club (TR) designed by Francesco Cellini, the parametric modelling tools offered by the Visual Programming Language (VPL) [3] were used to understand and reveal the parameters on which the author intended to imprint his design strategies and thus the formal, functional and constructive characteristics of the project, exploring the possible variations hypothesised by the author dynamically and interactively. The experimentation was inspired by the preliminary sketches where the architect hypothesises the adoption of a curved line for the ridge of the pavilion, a hypothesis that differs from the rectilinear solution that was later definitively adopted. The developed algorithm enabled us to experiment, on a synthesised model, with the dynamic transformation of the pavilion's shape as the ridgeline curvature changes and the transformation of the cross-sections to the slope of the land on which it stands. Thus, the intuition of the sketch was translated into the unambiguousness of an interactive 3D model with controlled geometric properties (fig. 3).
The high standardisation of architectural drawings and the different uses those architects make of them in their design process, even with expressive intentions, has also led to reflection on how to represent the connection between graphic drawing, 3D model and architectural spatiality.
For this reason, the projects for an indoor swimming pool in Baschi (1995) and the Pentecost church in Milan (2001) were opportunities for augmented reality (AR) [4] experiences. They are aimed at the perceptive investigation of the figurative three-dimensionality expressed in the two-dimensional codes and, therefore, to establish a closer link between the



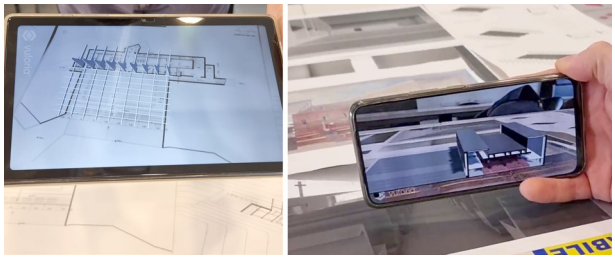
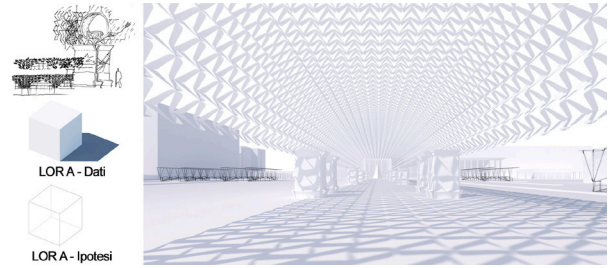
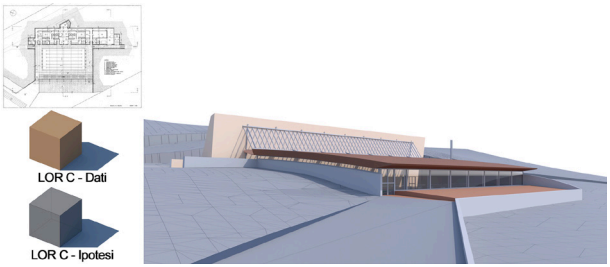


Fig. 3. Experimentation on project drawings by Francesco Cellini, Iuav Drawing Archive, realized by Lorenzo Pinti, Giulio Solito, and Francesco Tomei.

Fig. 4. Augmented reality applications on project by Francesco Cellini. Experiments conducted by Federico Lo Re, Daniele Marcotulli, Luca Pellegrini and Riccardo Scisciola.

sources, their redrawing and the 3D reconstruction, which, in the hybrid augmented space, find a clear continuity of the interpretative process. The relationship between sources and reconstructions led to a reflection on the scientific foundations on which to elaborate critical choices. The technical process of producing the AR is accompanied by a critical process of choosing the drawing to which the 3D visualisation is to be entrusted and matching it with models developed to highlight the main qualities of the analysed projects (fig. 4).
The *London Charter* and the *Seville Principles* references to the sources and procedures transparency have led scholars to search for methods to assess the reliability of the proposed reconstructions and their visualisation. A research line has been directed toward the definition and representation of the ontological link between sources and 3D reconstructions [Demetrescu 2015; Apollonio et al. 2021], while an autonomous but converging path has been started in the field of Heritage Building Information Modeling (HBIM) with the emergence of the need to define the level of approximation and knowledge of the model compared to the actual artefact [Bianchini, Nicastro 2018]. Researches that emphasise the qualitative process of interpretation, and data extraction from sources used to create models that can, with reason, be defined as «source-based» [Demetrescu 2015], belong to the first strand. An intermediate position between these main strands exploits the possibilities of assigning qualitative textual attributes to parts of 3D models in modelling environments other than purely BIM ones [Campofiorito, Santagati 2020].
Concerning the visualisation through the model of the previously defined accuracy/reliability levels, the general orientation shared by researches is to adopt a symbolic language through the characterisation of the model with a chromatic scale in false colours.





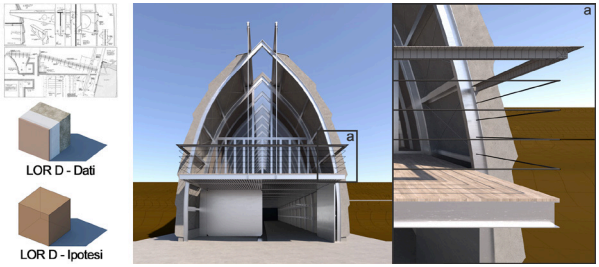


Fig. 5. Application of LOR A to the project for Piazza dei Cinquecento in Rome by Francesco Cellini (1982), Iuav Drawing Archive (graphic elaboration by the authors).

Fig. 6. Application of LOR B to the project for the Accademia Bridge in Venice by Francesco Cellini (1985), Iuav Drawing Archive (graphic elaboration by the authors).

Fig. 7. Application of LOR C to the project for a covered swimming pool in Baschi by Francesco Cellini (1995), Iuav Drawing Archive (graphic elaboration by the authors).

Fig. 8. Application of LOR D to the project for the Rowing Club in Baschi by Francesco Cellini (1995), Iuav Drawing Archive (graphic elaboration by the authors).

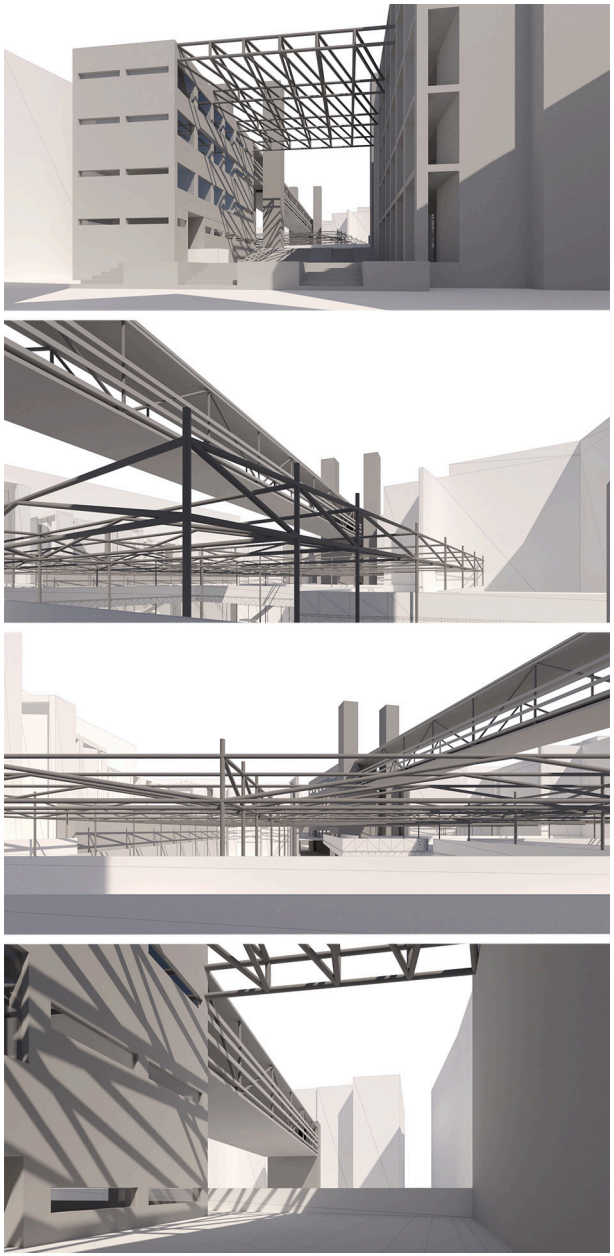


Fig. 9. Application of LOR B to the project for the redevelopment of the Crypta Balbi in Rome by ABDR (1985), MAXXI Archive (graphic elaboration by the authors).

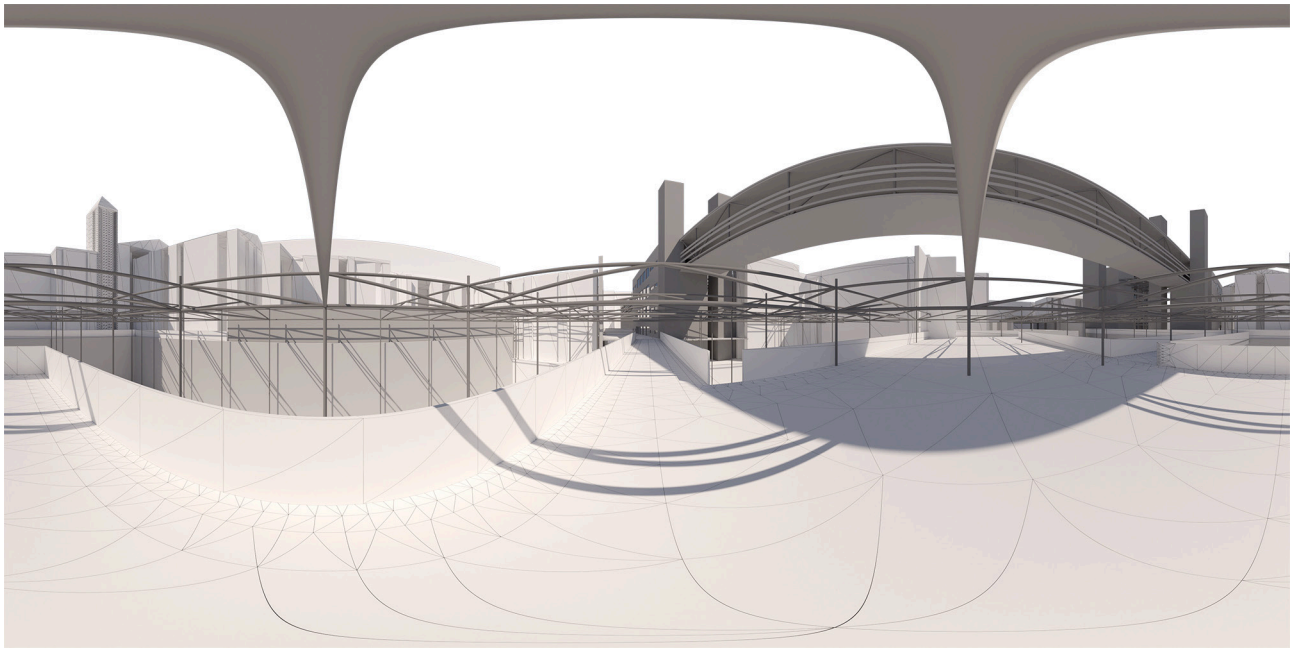
It is precisely the aspect of graphic visualization of the classification that appears to be the possible ground for further study and research.
In the latter direction, we have already proposed the use of graphic codes characterized by variable levels of iconicity according to the accuracy of the reconstruction [Farroni, Mancini 2019]. In particular, the proposed Level of Reconstruction (LOR) synthetic parameter is directly related to the different phases of the design process - preparatory, preliminary, final, executive - and their different characterization in terms of metric accuracy and completeness of information developed in the drawings. The proposed LOR identifies four possible reconstruction levels (LOR A, B, C, D), each defined by a double graphic code: the first to be assigned to the parts of the reconstruction directly based on the drawings and the second dedicated to characterize the parts deduced on hypotheses (figs. 5-8).
The hypothesis of not exceeding, in the three-dimensional modelling, the level of reconstruction permitted by the considered drawings and, therefore, of adopting a visualization style characterized by a level of verisimilitude commensurate with the amount of information contained in the archive drawings, lies at the basis of the definition and application of this parameter and the relative graphic codes.

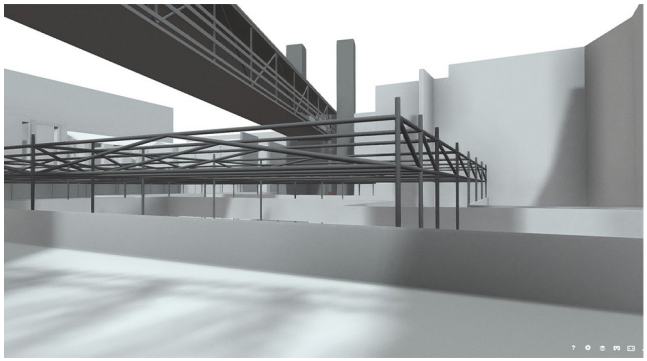
On the accessibility and use of digital products

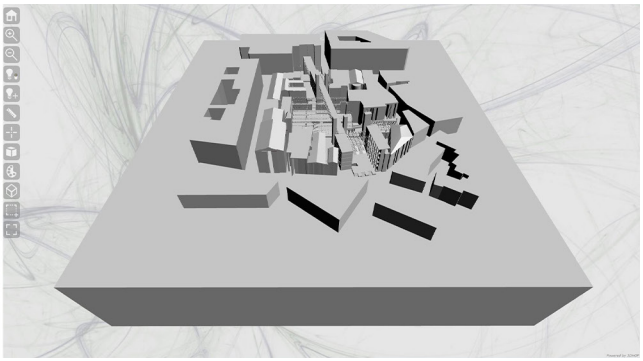
Numerous pilot projects have been implemented in recent years with "Universal Accessibility" [Cetorelli 2018], and the different degrees and types of accessibility are the subjects of continuous experimentation (e.g., the online portal *Cultura Italia* of the Mic, Europeana). Within this theme, experts in drawing are continuously experiencing scientific studies for the fruition of different types of audiences through the production of digitised physical data and the design of cultural experiences that can also predispose new ways of using physical spaces. Unwittingly, an "economy of accessibility" of cultural heritage has been launched, which projects from the local scale to the networked dimension and vice versa, and is

Fig. 10. Spherical panorama with LOR B of the project for the requalification of the Crypta Balbi in Rome, Studio ABDR (1985), MAXXI Archive (graphic elaboration by the authors).

Fig. 11. 3D reconstruction on Sketchfab and 3DHOP platform of the project for the Crypta Balbi in Rome, Studio ABDR (1985), MAXXI Archive (graphic elaboration by the authors).







Output	Simplicity of implementation	Quality of the visualisation	Level of user interaction	Available tools	Main target user
Rendering	•••••	•••••	•	-	Generic
Animation	•••••	•••••	•	-	Generic
360° Panoramas	•••••	•••••	•••	••	Generic
3D - 3DHOP	•••	•••	••••	•••••	Specialized
3D - Sketchfab	•••••	••••	•••••	•••	Generic

Tab. 2. Table summarising the evaluations of the different technologies tested: the higher the grade, the better the result.

declined on two fronts, a real one, on-site, and a virtual one, remotely [Farroni, Tarei 2021].
The creative aspect of content production concerns the concept of reproducibility. The digital product of a physical asset can be understood as an original content of a digital transformation process of the primary source in which, in a dynamic flow, references, memories and cultural contaminations that originated the source coexist. For this reason, a phase of the research was dedicated to the experimentation of technologies that would allow obtaining from the 3D model different digital products able to guarantee various levels of accessibility and fruition of the reconstructions while keeping, where possible, records of the reliability levels of the reconstructions themselves [Scopigno et al. 2017; Statham 2019; Fanini et al. 2021].
The experiments were conducted on the rehabilitation project of the Crypta Balbi (Rome, 1985) by the ABDR firm, described by documentation corresponding to reconstruction level LOR B. The techniques and tools used for the visualisation and sharing of the reconstructions were different: static renderings and dynamic animations, spherical renderings and web platforms for the publication of the 3D model and its fruition without specific software on local devices.
The different types of renderings –static, dynamic and spherical– were realised with software that allows a high control of framing, lighting and definition of material properties [5]. Static (fig. 9) and dynamic renderings represent the minimum level of interaction for the end-user who is guided through partial views of the 3D reconstruction chosen at significant points in the project. The spherical renderings allow for a greater involvement of the user, who can explore the entire space around him by turning his gaze in all directions (fig. 10). The possibility of joining different spherical panoramas in sequence also allows the creation of virtual tours that further increase the level of user interaction, allowing the viewer to choose which direction to take within the 3D model.
In addition to the generation of images from the model, two web platforms for model publication have been experimented with, allowing a high level of user interaction, free to move in and around the reconstructed architecture. The two tested solutions were the commercial platform *Sketchfab* [6] and the open-source tool *3DHOP* [7] developed by ISTI-CNR in Pisa (fig. 11). They allow interactive navigation but have different strengths: Sketchfab has a higher quality of visualisation and broader availability of outputs (VR and AR, the latter only through the mobile app), while *3DHOP* has tools for model interrogation, such as measurement tools, and interactive editing, such as the possibility to place section planes at significant points. The different solutions were evaluated according to several parameters –the simplicity of implementation, quality of the visualisation, level of user interaction, presence of querying/information enrichment tools– and a target user was defined (tab. 2).

Conclusions

The conveying of analogical contents in the digital system with scientific criteria is the challenge that the area of Drawing has to face in the digital transition in the field of architectural archives. The previous paragraphs aim to show the state of the art about the preservation process where the creation of computer systems, industry software, platforms, portals and document management systems has been the focus of research in the field of cultural heritage and, progressively, also in the field of technological development, in order to respond to the strong and rapid demands deriving from the content digitisation and the public and massive use of technologies for research and dissemination. The state of the art of the interpretation processes and access to architectural drawings is also part of the survey. The authors have proposed to include the contribution of the drawing through the theorisation of a unitary conceptual model. The development of digital products is the result of investigation of the methods and technologies used for the elaboration of new descriptive contents that can place the considered image on a scientific level, identifying standardised parameters. The scientific construction of new contents will be an added value to the original source, initiating a new process of knowledge of architectural work and reconnecting different knowledge related to the figurative arts, techniques, economy, culture of places and development of representation tools. Moreover, a process of use of technologies, which are constantly evolving, has started and for this reason the funds will only become richer. The user can be more or less expert, because the contents can be declined in different ways.
This is an open field that concerns digital curators of archives. The first mandatory step for the disciplinary scientific field is understanding that the paths that can be followed by the drawing disciplines in the field of conservation and valorisation of drawings are numerous and on several levels of intervention.

Credits

The authors thank: the architects Francesco Cellini and Michele Beccu (Studio ABDR) for allowing the use of their drawings; Federico Lo Re, Daniele Marcotulli, Luca Pellegrini, Lorenzo Pinti, Riccardo Scisciola, Giulio Solito and Francesco Tomei for the models used in the experiments; DM Cultura as technological partner and support for the archival part of the research.

Notes

[1] The International Standard for Archival Description was elaborated between 1988 and 1993 by the Ad Hoc Commission on Description Standards of the International Council on Archives (ICA), and revised during the following five years. Based on proposals sent by 25 countries, a second version was elaborated, approved in September 1999 in Stockholm, and made public during the ICA Congress in Seville in September 2000.

[2] The International Standard for Archival Authority Records of Entities, Individuals and Families was drafted between 1993 and 1995 by the Ad Hoc Committee on Descriptive Standards of the International Council on Archives (ICA) and then revised during the four years 2000-2004. Based on the proposals submitted, the second edition was drafted, discussed and approved in Canberra (Australia) in October 2003 and subsequently published and presented at the ICA Congress in Vienna in 2004.

[3] The experiments were performed with *Grasshopp*er in the McNeel *Rhinoceros* 7 software environment.

[4] Experiments were performed with the *Unity Game Engin*e.

[5] The renderings were executed in Maxon *Cinema4D* software environment with *Corona Renderer*.

[6] <https://sketchfab.com> (accessed 20 April 2022).

[7] <https://www.3dhop.net/index.php> (accessed 20 April 2022).

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For a Digital Archive of Interactive Models by Marcello D'Olivo

Alberto Sdegno, Veronica Riavis

Abstract

For the centenary of the birth of Marcello D'Olivo (1921-1991) we started an activity of geometric analysis and reconstruction of some of his important works with the aim of establishing a digital archive –interactively explorable both in presence and at a distance– to tell the multifaceted production of the Friulian professional in the national and international architectural panorama. A first result was presented at the exhibition Homage to Marcello D'Olivo. Geometries, tactile models, virtual reality *organized at the Polo Scientifico Tecnologico of the University of Udine in December 2021. Based on drawings kept at the Gallerie del Progetto of Palazzo Valvason Morpurgo in Udine, which houses most of the architect's drawings, and belonging to private collections, the research has been oriented to the digitization and three-dimensional modelling of realized and unfinished architectural complexes, with a triple purpose: on the one hand to reveal and document the intimate geometric system of volumes as a fundamental teaching tool; on the other hand, to use these models to experiment with new technologies of interactive navigation and dynamic exploration through virtual reality interfaces; a third aim is dissemination on the territory, creating physical models in rapid prototyping, to allow the user a haptic perception according to the directives of the "Design for all" that provide to replace the imperative prohibition to tactically use the models in museums the most inclusive 'forbidden not to touch'.*

Keywords: Marcello D'Olivo, digital documentation, geometric analysis, rapid prototyping, interactive models.

Introduction

The work of Marcello D'Olivo –a significant architect working in the second half of the 20th century– is now widely documented, both in monographs by the author and in a series of analyses of his figure. Prolific figure both in the conception of architectures –author of about 400 design proposals– and for the material production of sketches and graphic elaboration s, however he occupies a unique position among the authors of the second half of the twentieth century. Only a few critics mention him as a significant designer when he was alive, including Bruno Zevi [Zevi 1957, 1965] and Francesco Tentori [Tentori 1957, 1992]. Despite his work on a national and international scale, his works reported in the publications are few and repeated: in reality, most of his drawings are in various archives and, in many cases, without cataloguing and therefore difficult to consult. The aim of this research, therefore, is twofold. On the one hand, we want to expand knowledge about this author by analyzing the autograph design heritage to try to provide new tools of investigation to those involved in drawing, history of architecture and architectural and urban design. On the other hand, using specific representation tools, we intend to present the works studied –both in the scientific and popular field– using advanced tools of digital modeling and virtual simulation. The intent is to transform the documentary heritage into content with a strong dynamic impact on the user, in the now widespread 'digital twin', or the digital reproduction of analog artifacts, with high informative value.

Marcello D'Olivo architect

The figure of Marcello D'Olivo (1921-1991) is very complex: architect, urban planner, artist, but also a professional mindful to the structural problems that in forty-five years of career created many projects for worldwide public and private works.
Leonardo Sinisgalli defines his work as the "Architecture of the future" [Sinisgalli 1954, p. 38]; today we can identify D'Olivo as a forerunner and exponent of organic architecture in Italy. Author of numerous writings and architectures of great importance, in both size and quality, his elaborations pose us with great questions about the diachronic relationship between anthropic and natural, as well as the possibility of creating innovative projects in pre-existing and stratified urban contexts.
The Udinese architect applied his multiple interests – always aimed at the sciences as well as mathematics, physics, chemistry, but also at the natural sciences and cybernetics– to find his poetic identity and motivate the forms he experimented: spirals and mathematical figures, vegetal, and animal morphologies, which constitute the archetypes of his compositional language [Ferrieri 2008, pp. 144-145]. In fact, he argued that: "Nature is dominated by curves. I am a pencil worker, and my trace must be an architecture of curves. To respect nature and architecture". Indeed: "Each curve" –he said– "gathers within itself a powerful mathematical formula dictated by nature" [D'Olivo 1972, p. 57], preferring in this way more complex geometric shapes to replace pure ones, now insufficient.
For D'Olivo the architectural project is an opportunity to restore the now lost balance between man and nature. However, to achieve this purpose, it is necessary that the project act emulates the geometries holding harmonic rules that can be inferred from the natural context.
The constant interest in experimentation is evident in his many drawings, but also in theorizing and disseminating his own thought, which deviates from the Italian cultural panorama of the time. To promote his thinking, in 1972 he published in three volumes *Discorso sopra un'altra Architettura* [D'Olivo 1972] [1]. The monograph is a collection of drawings of great evocative ability and projects drawn up from 1948 to 1971, which narrate and investigate the question of the relationship between architecture and the physical-natural world. For D'Olivo "Every construction, once completed (and deliberately here neglecting to frame it in its aesthetic canon) is first of all an artificial element destined to fit, with greater or lesser resistance, in the whole of a natural framework" [D'Olivo 1972, p. 18].
However, only the integration between natural presence and technological aid can lead to an architectural structure with the same harmony as a "Tree of a primary forest" [D'Olivo 1972, p. 19].
Specifically, the organic form allows the designer to derive interesting considerations, deductions, and analogies: like nature, even architecture must find the most suitable solution to fit into an environment. Moreover, it must be considered as a single organism that can be conditioned also by the presence and density of the other entities of the whole, such as ecosystems.
D'Olivo also clarifies his project idea for the home and living of contemporary man by identifying a double analogy between the tree and the city (fig. 1), and between the leaf and the house, in an ideal world in which artificial reality can finally be assimilated to nature because it is regulated by the same laws [D'Olivo 1972, pp. 55-56].
In his poetics, the architecture must observe nature and from it understand its functioning, the static principles, the ability to modify and the balanced environmental control.

Graphic elaboration s by Marcello D'Olivo

Drawings, paintings, models, geometries, calculations and notes of incredible charm and interest, document a 360° design approach of a professional who draws to build, however, remaining at the same time elaborations sometimes difficult to understand. In fact, his drawings show the close relationship between design and construction practice, as well as the research for a dialogue between the center and the periphery in Italian architectural culture.
An all-round demiurge architect, able to conceive for each project its own feasibility from the territorial scale to the constructive detail, applying to architecture and urbanism the same organic and mutable laws of nature, according to an intense generative force of geometric matrix. D'Olivo's ideas are independent of schools and

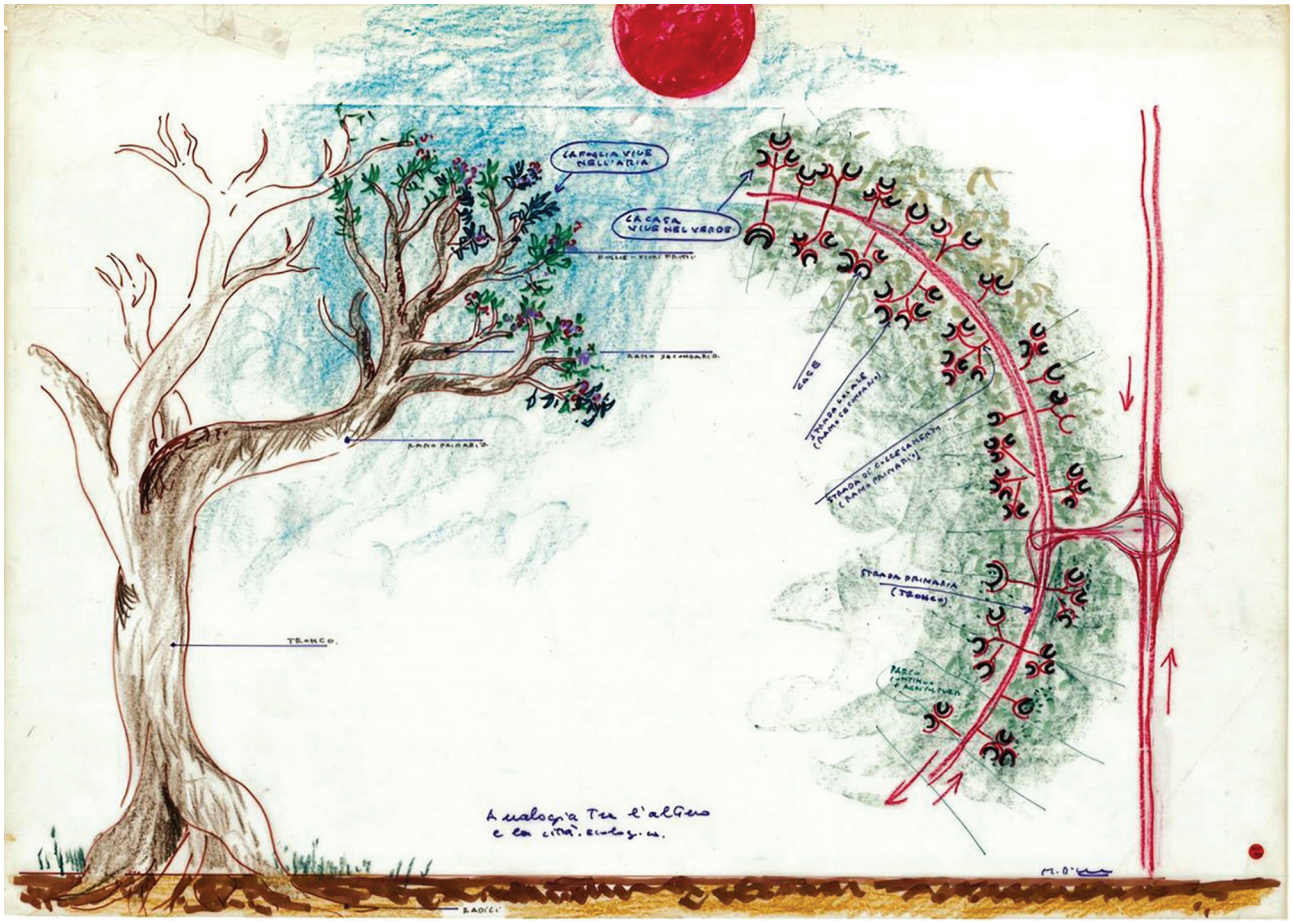


Fig. 1. Marcello D'Olivo, "Analogy between the tree and the ecological city" (Archivio D'Olivo).

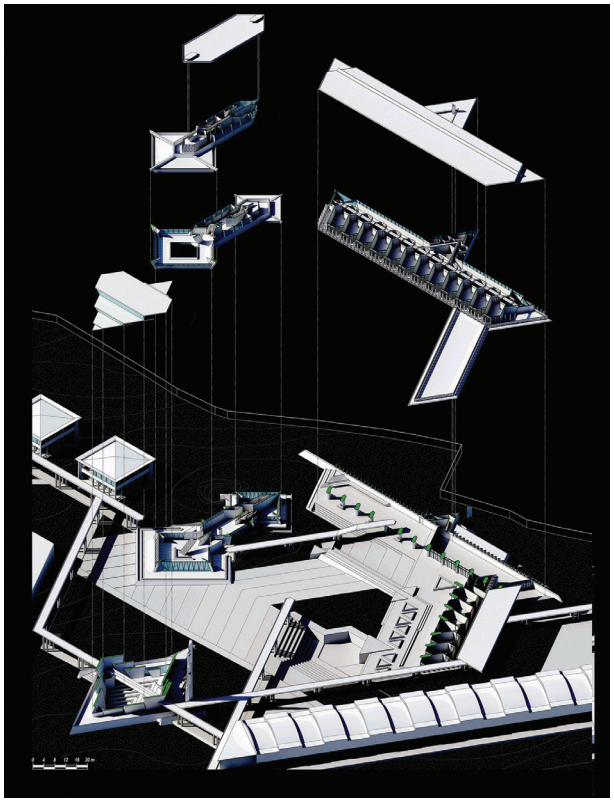
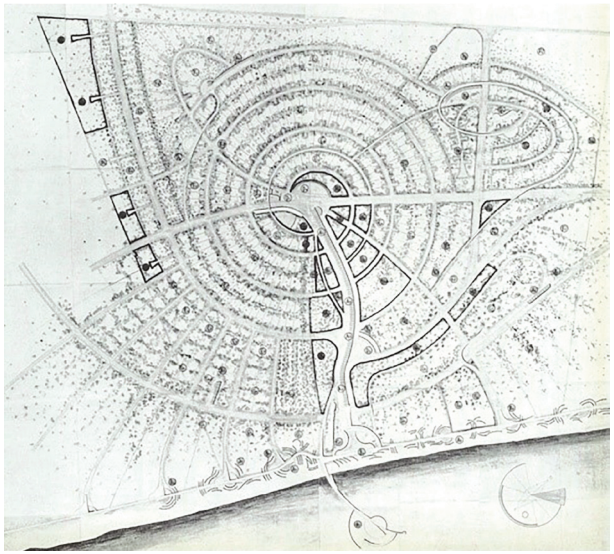


Fig. 2. Exploded axonometric reconstruction of the Villaggio del Fanciullo in Opicina (graphic elaboration Elda Amatruda).

predetermined categories, and experiment declinations of the Usonian and structuralist language in realizations oriented to the territorial scale and characterized by an absolute constructive originality.
Works not easy to interpret built transversely throughout the Friuli Venezia Giulia region overcoming the parochialism, show determination and diplomacy that allow him to build also in Africa and the Middle East. In fact, the architectural and urban ideational dimension frequently finds its concrete and effective realization abroad –especially in Gabon– in contexts in which the pre-existing and stratified human structure is almost absent.
We also add that, from the analysis of the archival iconographic documentation, emerges a professional figure willing to combine alternately geometries from the very rigorous rectilinear plant to incursions in figurations of curvilinear type, depending on the context in which he works.
A careful investigation conducted with the disciplinary tools of drawing on a plurality of complex forms reveals interesting interpretative novelties on this important personality in the field of architecture.
We cannot overlook his own words about some singular figures mentioned in a critical essay: "The triangle is the most solid figure known […] the most bound, three knots only. The circle is the fullest, a single center and infinite radiii" [Lacorazza 1952, p. 38]. These words highlight his predilection for the two geometric figures that, in alternating phases, he proposes as design matrices both for architecture and for urban structures and plans.
In fact, we find that at the basis of every project, the architect makes an almost obsessive recourse to geometry. This aspect is very evident in the planimetric drawings, but also in the profiles of elevations and sections: circles, equilateral triangles, and through the application of more complex graphic-mathematical expressions such as spiral, parabola and hyperbole.
Some of his works, realized and unfinished, have been investigated with the aim of obtaining informative models useful for physical and virtual translations. In this way, the digitalization –as acquisition of analog material from archive sources– becomes the main tool to initiate analytical operations and create 2D-3D reconstructions oriented to the documentation and dissemination of cultural heritage.

a



b

Fig. 3. Aerial photo of Lignano Pineta with the definition of the traffic spiral (a); Marcello D'Olivo, Plan of the project for Lignano Pineta (Archivio D'Olivo) (b).

Analysis of some case studies

We chose the case studies for the D'Olivo's digital archive evaluating the different intended use and scale, as well as for the generative matrix of the geometric plan. Among them, we examined the Villaggio del Fanciullo in Opicina (1950-1957); the two versions of the Mobilificio Tolazzi in Tricesimo (1954-1955) and the two solutions of the coeval villa Mainardis attached to the urban spiral of Lignano Pineta (UD) planned by himself and where he designed several variants for the square on the sea (1985-1986); the residential proposal for villa Morandotti in Meduno (PN) never realized (1962-1963); the project for the headquarters of TV Libya in El Beida, Benghazi and Tripoli (1966-1967); finally his last build work, the multi-purpose school in Gorizia (1987-1991).

We acquired and digitalized the iconography preserved in large part at the Archivio D'Olivo, sometimes resorting to photographic straightening procedures, while we extracted other documentation from textual repertories of D'Olivo and from photos taken on the site for his realized buildings.

Starting from the original drawings, we transferred the geometric outlines from the analog to the digital extension –first two-dimensional and then three-dimensional– also exploiting the dimensional and angular specifications noted by the architect in his drawings. The digital extension has also allowed us to better understand and quantify the compositional genesis of the projects, which confirms a specific morphological structure in triangular, circular or sometimes spiraliform definition.

The first project analyzed concerns the Villaggio del Fanciullo in Opicina (TS), a work that will make D'Olivo well-known in Italy and abroad [Luppi 1998; Luppi, Nicoloso 2002, pp. 102-104; Reale 2005]. Built between 1950 and 1957, the center was built to give support and a future to children orphans of the Second World War. The intention of the complex was therefore to provide food and accommodation to young people, but also a professional education that would guarantee them a job. The structure includes a multitude of buildings used as dwellings and spaces for community, education and leisure. In fact, in addition to the residences, D'Olivo designs a restaurant, a church, pavilions for general services, workshops and printers, also providing an outdoor theater, a farm, sports fields and a gym (fig. 2).

Thanks to this experience on the karst plateau, D'Olivo measured not only with the theme and the architectural dimension, but also with the structural intention and the specificity of urban planning. The analysis carried out on the definition of the buildings revealed the use of overlapping grids and the use of the equilateral triangle of side 1.5 m, which defines a variety of environments at different altitudes [Prandi 2008, p. 222]. The various traces compose hexagonal, square and triangular basic architectures according to different combinations, whose inclined walls and long ribbon windows define elevations. The complexity and the articulation of the neighborhood clearly draws inspiration from Frank Lloyd Wright's Taliesin West, albeit preferring reinforced concrete as a construction material instead of local one. Buildings and open spaces gathered within the grid make up a neighborhood of jagged polygonal layout, completely devoid of sinuous lines and curvilinear paths. Having defined the basic module and its size, in detail the three-dimensional reconstruction involved the buildings used as restaurant and general services, the general pavilion, the housing module and the church not realized.
During the construction of the complex on the Trieste plateau, D'Olivo was commissioned to design the seaside town of Lignano Pineta (1952-1963): for its spiral configuration, it is certainly one of the most important contemporary urban planning experiences in Friuli and an undoubtedly unique example in Italy (Fig. 3). The intent of the Udinese architect was to integrate the infrastructure and architectures defined by pure geometric shapes through the urban layout into the lagoon and maritime environmental context. In this context, the choice fell on the tracing of a very large arithmetic spiral, whose lines of the plan merge with the landscape as huge territorial excavations in which it becomes explicit the analogy between tree and city. A principle that has always distinguished and guided D'Olivo to geometric-figurative results of great interest for the emulation of the functioning mechanisms of nature [Di Biagi 2002, p. 13]. The Archimedes spiral is that curve described by a point whose distance from the center (pole) remains proportional to the amplitude of the angle covered during the displacement. The whole city is based on this involute construction type. The distance between the loops is constant, with a progression of 3 meters every 10° of displacement, while the band between the loops extends for a width of 100 meters to connect

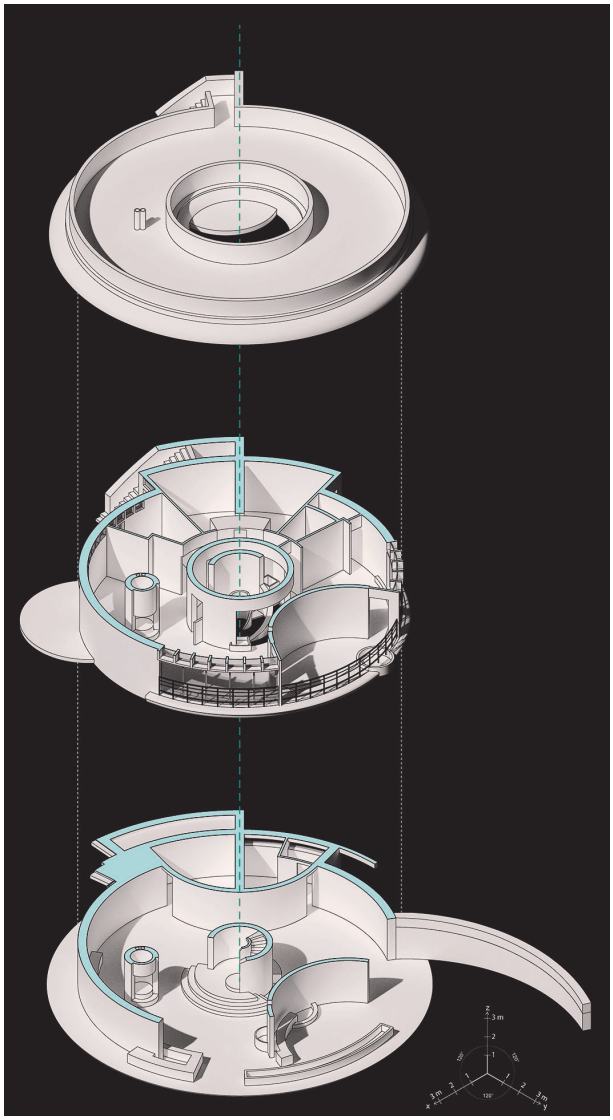
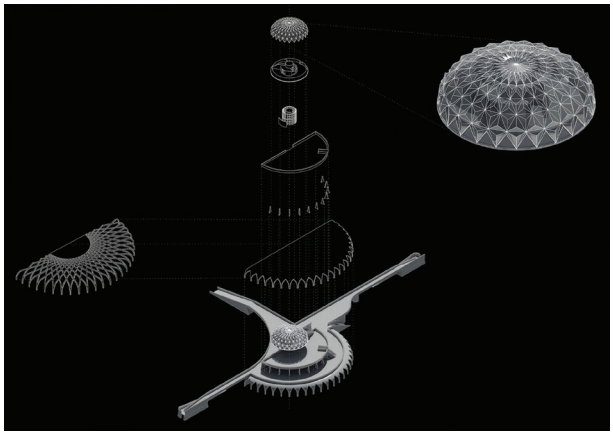


Fig. 4. Exploded axonometric reconstruction of villa Mainardis (graphic elaboration Veronica Riavis).

the 50-meter-deep lots, and to respect the natural landscape and harmonize the architecture to the environment [Barillari 2014].
Another significant example investigated is Villa Mainardis in Lignano Pineta [Nicoloso 1998, p. 41; Luppi, Nicoloso 2002, p. 118], where curved geometry is once again the dominant element. Like the urban plan of Lignano, villa Mainardis (fig. 4), adopts a similar criterion of insertion in the existing landscape. In fact, the holiday homes in Lignano Pineta had to be set back 20 meters from the road to be confused with the ground, vegetation, must not exceed two floors, and their covered area must not exceed 20% of the lot [D'Olivo 1972; Nicoloso 1998, p. 36; Luppi, Nicoloso 2002, pp. 107-109, 112].
The spaces of the building are defined according to the boolean principles of intersection, union, and completion of the circular elements. The architecture has a largely centripetal geometry: starting from the central spiral staircase, it spreads throughout the rest of the plan. In particular, the perimeter walls are all curvilinear –like arcs of circumference having the same center– while the radius elements always start from the same point and head outwards, to create connections between arcs and segments of a straight line. It is no coincidence that even the road system of the entire small town, replaces the classic 'streets' with the name of 'arches' and 'rays' as systems of classification of urban routes. 'We identified this villa, due to its peculiar morphology, as an architecture particularly suited for analysis with new technologies. In fact, as we will better discuss later, we reproduced the stereometric geometry both with a rapid prototyping system and with 3D viewers of interactive virtual reality, for a highly informative use of this architecture. The data derived from traditional archives, therefore, have been implemented for the digital determination of the new archiving system.
In addition to the analysis of the main shape of Lignano, as mentioned above, we studied the architect's design hypotheses of completion towards the sea (fig. 5). Inside the large urban spiral, in fact, there is a sinusoidal backbone. Inside the large urban spiral, in fact, there is a sinusoidal backbone, which houses commercial activities and houses. It extends for about 600 meters, starts from the geometric center of the involute and heads towards the sea. Called the "train" because of its connected wagon shape interspersed with short pedestrian crossings, the building was to conclude with a large marine round-



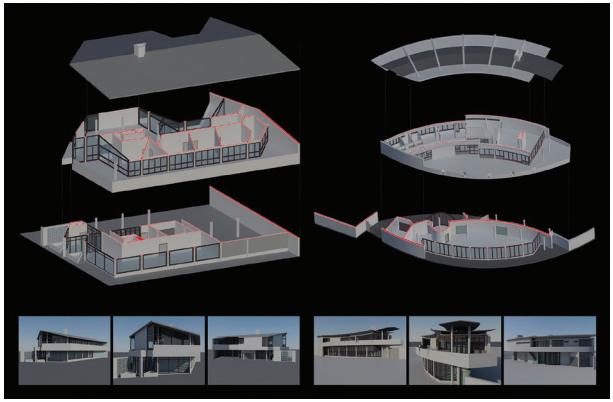
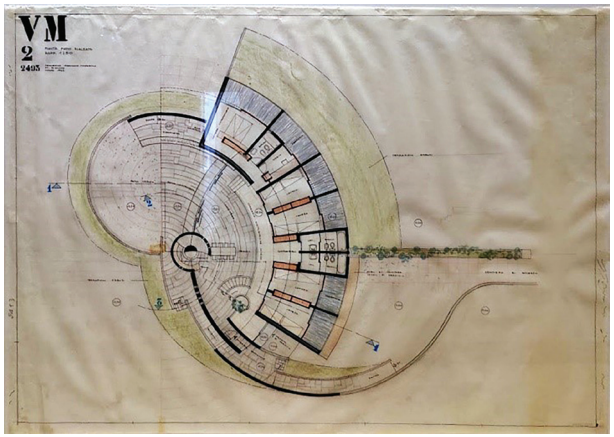


Fig. 5. Exploded axonometric reconstruction of the sea square project in Lignano Pineta (graphic elaboration Andrea De Lorenzo).

Fig. 6. Mobilificio Tolazzi, Digital reconstruction and comparison of the two projects versions (graphic elaboration Roberta Callegari).

a



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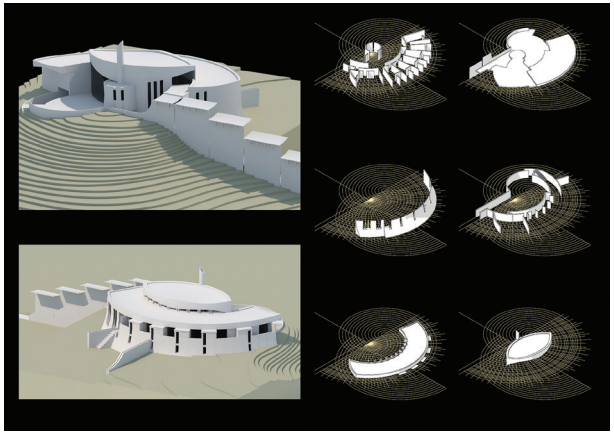

Fig. 7. Marcello D'Olivo, Plan of first floor of villa Morandotti (Archivio D'Olivo) (a); Digital reconstruction and geometric genesis of villa Morandotti (b) (graphic elaboration Giovanni Toninelli).

about, containing services for bathers [Borella, Luppi 1998, p. 112; Luppi, Nicoloso 2002, pp. 110-112].
For this project proposal there are various planimetric and altimetric drawings, which offer graphic representations of great communicative effectiveness, reinforced by significant chromatics in the elaboration of the tables. We carefully analyzed and compared the five solutions conceived by the architect. The study carried out reveals a clear interest of the designer in spiral matrix geometry. This almost seems to seal the compositional process of the entire urban system with this last solution –also in temporal terms, since he proposed it more than thirty years after the preliminary project of Lignano Pineta– which once again testifies to the great processing capacity of the architect in the use of unusual forms. We point out that the spirals of the all five projects of the square at the sea are Archimedean, which are generated by reconstructing matrices of concentric circles, to which are associated control points that allow to identify the spiral-shaped genesis. The planned functions essentially concern pedestrian paths, alternating with terraces, and ancillary rooms for the restaurant and parking, all modeled on the logic of curvilinear spaces.
However, these solutions are clearly different from the tectonic structure of the "train", which had a much-defined articulation and a pagoda roof quite characterized on the expressive plane. He also proposes this solution for other architectures built in the same period, including the villa designed for Leonardo Sinisgalli (1954-1955) and especially the second version of the Magazzini Tolazzi in Tricesimo (1954-1955) [Borella, Luppi 1998, p. 114; Luppi, Nicoloso 2002, pp. 123-125]. In fact, in these buildings we find the same upper articulation, in an "almond" space that from a geometric point of view, like the juxtaposition of two opposing circumference arches. The last work just mentioned is particularly significant because it expresses the double interest on the part of the designer for the use of geometries composed of straight-line segments and curved matrix figures, the latter identified by the architect as optimal design solutions. In fact, the first solution dated 1954 recalls the triangular geometric setting that can also be seen from the Trieste experience, as well as from the Wall House designed by Wright in 1941. Otherwise, the 1955 version seems to recall the architectures of the hemicycle houses, always designed by the American architect, such as the Jacob House (1944), the David Wright House

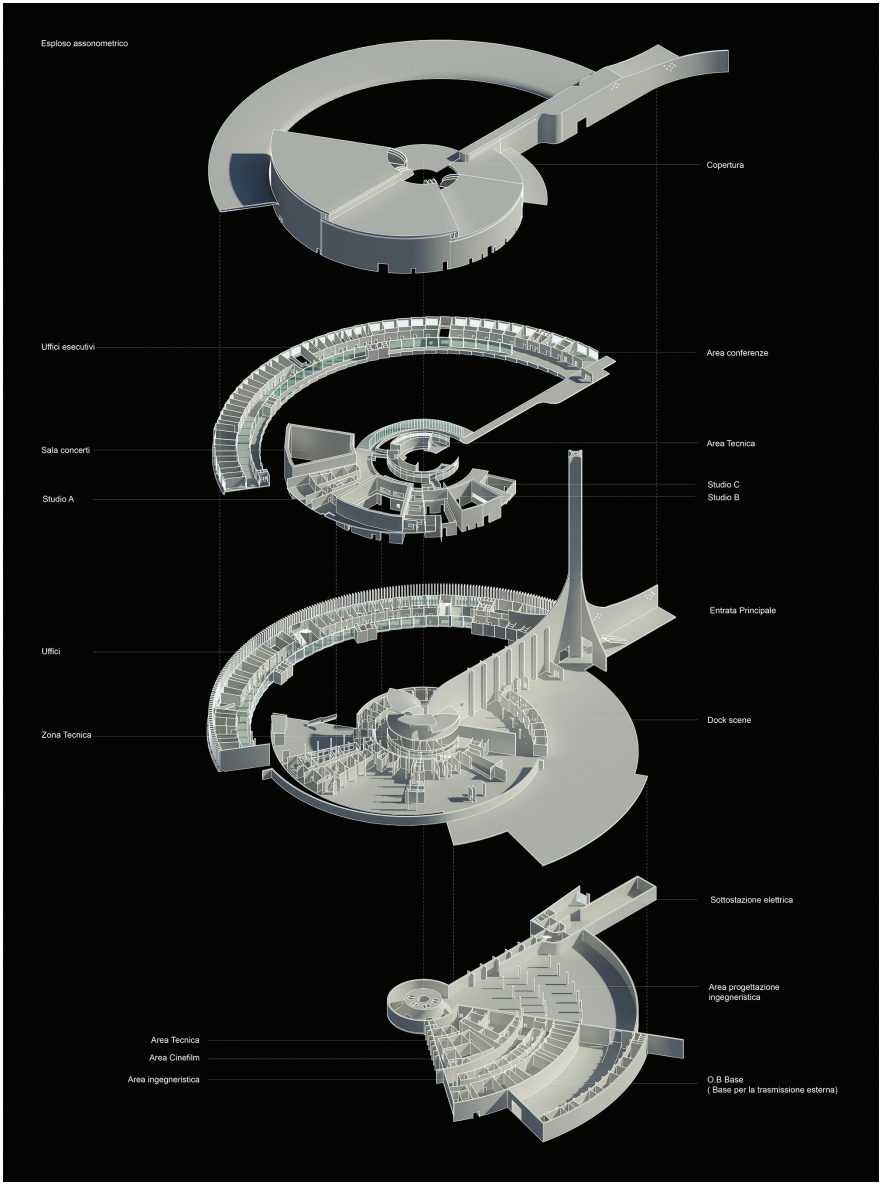

Fig. 8. Exploded axonometric reconstruction of the project for TV Libya (graphic elaboration Houssam Jaber).

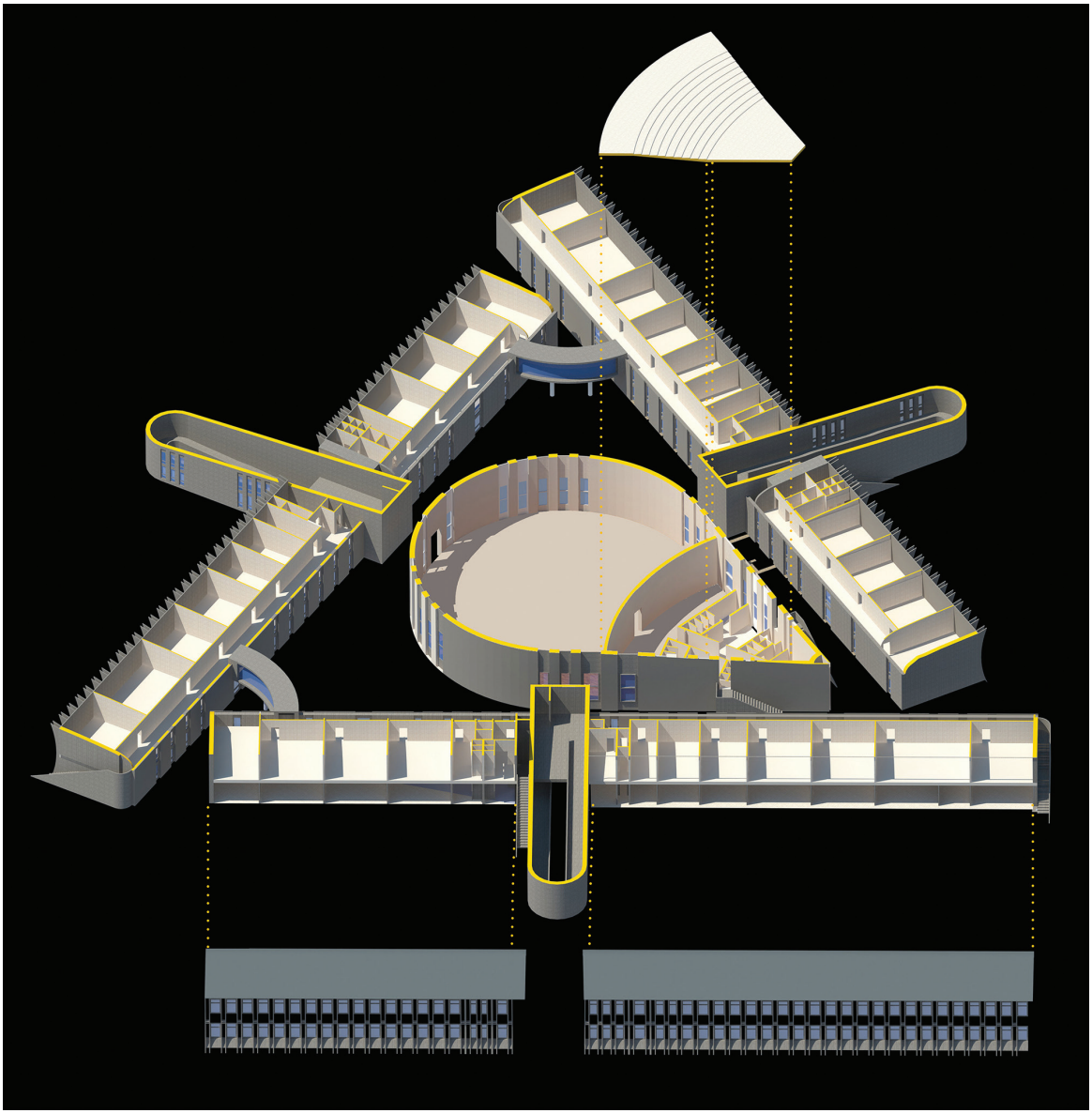

Fig. 9. Exploded axonometric reconstruction of the Slovenian School Center in Gorizia (graphic elaboration Giovanni Lutman).

(1950), but especially the Robert Llewellyn Wright House (1953) of which the architecture is contained in the intersection of two different circumferences, just like the dolivian solution. The distribution of the spaces of the Mobilificio takes place on two floors, the rooms are obtained from the radial subdivision of walls, pilasters, and circular elements, and as we mentioned above, the roof is of the 'pagoda' type.
The spiral geometry is still recurring in other projects: on the one hand to the small residential architecture –as in the case of the villa Morandotti in Meduno (PN)– on the other to the much larger building, suitable for hosting a service center such as TV Libya.
In particular, Villa Morandotti (fig. 7) [Borella, Luppi 1998, p. 131] integrates the spiral-shaped construction to the principle of intersection of two circumferences, like what developed in 1955 at the Mobilificio Tolazzi, with a clearer distribution of the radial interior spaces. For this building, D'Olivo also designed the systems of walls and slabs, similarly exploiting the intersection of circles. The geometrical setting recalls, even with further developments, the first version conceived by the architect for Villa Mainardis. The construction of the 3D model, and its arrangement in the hilly context, made it possible to understand more explicitly, the complex configuration system proposed by the architect. In fact, the spiral of Morandotti differs from the one proposed for Lignano in that its genesis is logarithmic. As the carapace of the nautilus, often figuratively described by Le Corbusier, it has a curvilinear dynamism on an exponential basis, so it also happens in the planimetric geometry of Morandotti, which has in common with TV Libya a similar syntactic articulation (fig. 8).
In fact, the headquarters of TV Libya was to be built in three important cities in the Middle East: Tripoli, El Beida and Benghazi. D'Olivo presents several project tables and related models, to better understand the composition of the large telecommunications headquarters [Zucconi 1998, p. 16; Borella, Luppi 1998, p. 137; Luppi, Nicoloso 2002, p. 163]. He prefers the use of the logarithmic spiral, whose matrix is evident above all at the planimetric level. Thanks to it, we find full and empty spaces defined by volumetric subtractions, and the introduction of a vertical element that from the central core of the shell roof grows plastically in height. We must remember that the spatial articulation of this kind of spiral is particularly complex to manage architecturally, compared to an Archimedean one (not present in nature). For example, in the second case from the structural point of view, a supporting system with pillars or partitions can be sufficiently regular, unlike a geometry that changes with each turn. It is no coincidence that Le Corbusier also prefers the Archimedean one –as in the 'square spiral' solution of the unrealized project of the Museum with unlimited growth of 1931– while evoking the shell of the aforementioned mollusk.
Finally, we delved into the last work created by the Udine architect, namely the multipurpose school complex in Gorizia (fig. 9), now Slovenian institute IIS "Simon Gregorčič, Primož Trubar" [Borella 1998, pp. 79-85; Borella, Luppi 1998, p. 169; Luppi, Nicoloso 2002, p. 187]. For this architectural complex, D'Olivo created innovative geometric solutions, among which some never experimented before. In a similar way to what previously realized, the plan is clearly perceptible only from above. Three long distinct volumes, intended for educational classrooms, compose a triangular geometric envelope. These elements are connected to each other at two points by a circumferential arched aerial bridge, while a teardrop-shaped building containing auditorium and gymnasium is created in the inner courtyard. D'Olivo inserted a system of covered inclined ramps to go up to the first floor of the buildings. Particularly interesting is the design of the double reinforced concrete walls that mark the elevations of the classrooms volumes and recalls the similar solution adopted many years before for the residential and hotel complex Zipser of Grado (1960-64).

For a digital archive of D'Olivo

The results of this advanced digitization were compared and presented within the exhibition *Homage to Marcello D'Olivo. Geometries, Tactile Models, Virtual Reality*, (December 21, 2021-March 22, 2022) held at the University of Udine (fig. 10). On this occasion, we proposed a selection of historical photographs and reproductions of the architect's drawings, and we wanted to narrate the projects described above in the form of a multiplicity of processing tools. In fact, we exhibited wireframe drawings, geometric analysis and three-dimensional restitutions, haptic perception tactile models, and finally visitable models thanks to a 3D consultation system that uses virtual reality (VR).

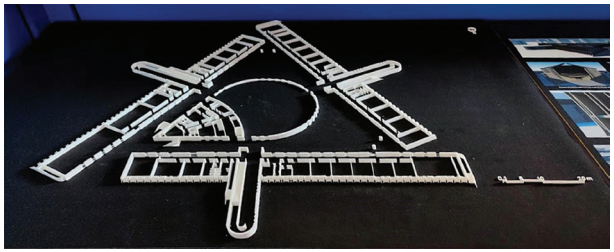

Fig. 10. Inside the exhibition "Homage to Marcello D'Olivo" at the Polo Scientifico Tecnologico, University of Udine.

Fig. 11. Tactile model of the Slovenian School Center in Gorizia.

Fig. 12. Immersive experience with the VR headset by a visitor in the exhibition.

In this way, we can experience the potential of the technological tool that allowed a first phase of the preparation of the advanced digital archive on the works by Marcello D'Olivo.
For the plastic modeling part, we obtained the physical translation of the shape by choosing different scales of reduction or sectioning by Fused Deposition Modeling (FDM) rapid prototyping. We produced scale models of the headquarters of TV Libya and the third variant of the Piazza sul Mare in Lignano Pineta, whose volumetric articulation –understood together in its planimetric and altimetric extension– is better understandable. Otherwise, we defined in a reduced scale the volumetric section of the restaurant building of the Villaggio del Fanciullo, to make understand at the same time the plan and the interior of the architecture, associating it with a module of a living volume.
The tactile model of Villa Mainardis is reproduced in scale 1:100 and it can be explored by levels. Through the manual intervention, the visitor can discover the architectonic structure and its interiors, including the central spiral staircase, and the way the house fits into the natural dune.
Instead, for the perception of the Slovenian school in Gorizia we chose the solution of the tactile map of place in scale 1:150, sectioning the building at the height of 1 m from the ground. The installation has the maximum extension of about 120 cm. Standing in the extension of the arms –as required by the regulations for museum accessibility–, the model allows the user to understand the geometries of the structure, but also it shows him how to orient himself inside and identify the openings. We integrated the tactile plan by also inserting the graphic scale expressed in meters and the symbol of geographic north (fig. 11).
We created these models with a functional reproduction scale to the perception of the shape and the tactile threshold of the details. We hived off the models intended for 3D printing into solid elements, and we adjusted them according to the machines and the prototyping process. We removed seams and staircase effect of the assembled parts to eliminate sharp elements and uniform surfaces to ensure a better perception to the sense of touch.
We have also prepared some virtual models for immersive exploration, to highlight even the unrealized variants as well as the most symbolic architectures. The

visit allows the visitor to appreciate the exterior of the buildings but also to walk them inside them thanks to a headset and manual controllers available to the system. Specifically, are accessible in virtual reality (VR) the two variants of the Mobilificio Tolazzi in Tricesimo –to compare the first version from the second one then built–, the never built complex and extensive headquarters of TV Libya, and the two different solutions for the centripetal villa Mainardis in Lignano Pineta (fig. 12).
Finally, in the case of the not built Villa Morandotti, based on the documentary material provided by the Archivio D'Olivo, we experimented the spiraliform growth of the building through parametric and computerized modelling software applying to the complex geometries the material stratigraphy of reinforced concrete, which the architect often employed to give shape to his architectures.

Conclusions

The study aimed at collaborating with the Archivio D'Olivo, aims at digitizing and understanding the architecture of the prolific Friulian architect. The will is to continue in the future with the study and advanced acquisition of his projects so as to support public bodies to the dissemination of his thought and his applications in architecture, also thanks to advanced forms of representation with high information content. The traditional archive of drawings and documents of the singular architect from Udine, therefore, is amplified by a digital reinterpretation of his work, such as to constitute –in the logic of the 'digital twin'– the numerical interpretation of its multiple compositional plurality, such as to constitute a further deepening for all the scholars of his work.

Note

[1] The second monograph dates back to 1986 [D'Olivo, Mainardis de Campo 1986].

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The Digitization of the Photographic Archive of Museo Egizio: Strategies of Interpretation and Communication

Davide Mezzino, Beppe Moiso, Tommaso Montonati,
Francesca Valentina Luisa Lori

Abstract

The article presents the study, interpretation and organization process of the photographic archive of the Museo Egizio, Torino to support research and dissemination. Within this framework, the digitization process played a crucial role designing customized documentation and representation strategies to implement the consultation and management of the museum archive. This article highlights the role of the archive as historical memory able to communicate the transformations of methods and techniques for the documentation and representation between the XIX and the XX century. The archive provides information on the excavation process, as well as on the survey and representation tools.
This material allows a better understanding and a correct interpretation of the documents produced in a given historical period on specific buildings, by allowing the identification of interventions of restoration and reconstruction, as well as displacement and excavations. The management of the digitized archive material was implemented thanks to a dedicated software, which automated and streamlined the work. The publication of the photographic archive was achieved through the customized web platform "The Photographic Archive of Museo Egizio". In this process, the role of representation discipline has been fundamental in investigating, interpreting and communicating this rich and little-known archive, activating further knowledge processes that may enrich our understanding of cultural heritage.

Keywords: digitization, representation, interpretation, communication, archives

Introduction

The role of archives is slowly acquiring a new dimension, thanks to the digitization processes. The promotion and dissemination of an archive is relevant for researchers and specialists, as well as for the preservation of the community's memory for a better understanding of our present and future. An archive reflects the way in which people or individuals decides to organize and arrange their own production [Cencetti 1939; Pavone 1970; Valenti 2000]. This shared definition stems from the debate, that took place in the second half of the twentieth century [Duranti 2020, p. 21], concerning the meaning and structure of an archive. The result of this organization is a filtered knowledge of the past, sometimes even rather subjective (especially in private archives) or "tampered with" [Pavone 1970], but necessary for the preservation of knowledge [1].
For Museo Egizio, the study of its own archive allowed to improve the knowledge on its collection with a wider awareness of the historical backgrounds of the museum objects, including both tangible and intangible aspects. More specifically, these aspects include the events that took place in the almost two hundred years since its foundation, the people who shaped it and the intertwined relationships with cultural, academics and political environments. The study of the photographic archive of the Museum included also its dissemination and promotion, through the support of digital tools.

The photographic archive of Museo Egizio

The Museo Egizio of Torino owns a remarkable photographic archive. It is the result of the sensibility and foresight of the directors who have succeeded one other over the time. Unfortunately, we do not know when photographs started to be used and collected in specific archives for study purpose, as we do for paper archives. The variety of materials preserved and the heterogeneity of the subjects represented in the photographic archive of Regio Museo di Antichità and Egizio, as it was called in the XIX century, suggests a random formation, due to impromptu unplanned acquisitions.
The first signs of interest for photography by the museum are reported by documents dating back to 1885, when the director at that time, Ariodante Fabretti, reported to Cavalier Luigi Cantù the realization of some shots and drawings related to the "monuments of Castelletto sopra Ticino" [2].
The photographic interest towards Egyptian monuments is documented by the activity carried out by the inspector of Museo Egizio Ridolfo Vittorio Lanzone (1834-1907). He was able to combine Egyptology with his passion for photography, employed as a work tool, as attested from some plates on glass, depicting museum antiquities [3]. The photographic archive of Museo Egizio also preserves a valuable album of fifty prints, related to Egyptian landscapes and monuments, reporting his signature.
From the beginning of the 20th century, the use of photography became systematic for Museo Egizio. This happened under the direction of Ernesto Schiaparelli (1894-1928) and then Giulio Farina (1928-1945) with the production of over 25.000 images on glass plates and then celluloid, which document moments and activities developed over the years by Museo Egizio. The awareness of the strength of photography and its use as a work tool allows us to familiarize with the archaeological activity conducted in Egypt for over thirty years, by visualizing unique images depicting the moments of some extraordinary discoveries. Additionally, the archive contains a widespread photographic campaign focusing on individual objects conserved at Museo Egizio. These photos are useful for the inventory aspects, as well as to document the status of conservation of the photographed objects. The photographic archive also documents the changes in the museum set up and the collection displacement during the Second World War, when it was transferred to the Castle of Agliè [Moiso 2016]. Since the '60s, the archive has been enriched with over 15.000 slides, mainly in color. These slides are the result of planned photographic campaigns. Additionally, in the same years thousands of images shot in Egypt, mainly the result of private donations, were included in the archive (fig. 1).
A last section of the archive is dedicated to about 4.500 prints on paper. Many of these are related to the archaeological activity carried out by Museo Egizio. The other prints of the collection, gathered in the last century, includes nineteenth-century and twentieth-century photographs on albumin paper and may be attributed to well-known photographers such as: A.Beato, F.Bonfils, H.Béchard, G.Lekegian and the brothers C. and G. Zangaki. Unfortunately, the acquisition dates of the latter group of images are unknown [Moiso, Montonati 2021].
Until 2009, the materials of the archive were stored in different rooms of the museum. After 2009, the photographic archive of Museo Egizio was moved to the photographic archive of the Superintendence for Archaeological Heritage of Piedmont and the Egyptian Antiquities Museum. In 2016, the archive was officially passed to Museo Egizio and all the materials returned to the museum premises in 2018. All the photographic documents have been placed in a suitable air-conditioned environment in order to ensure their preservation (fig. 2).

Study, interpretation and organization of the photographic archive

The difficulties in consulting and interpreting the photographic documentation of the archive and the need to obtain fresh information and suggestions for further research, led Museo Egizio to undertake a reflection on the study and the reorganization of archival materials. One of the first conclusions was the need to digitalize the entire archive and to identify the subjects of the images.
The digitization of the archive, or rather, the rendering in digital format the analogical archive, is motivated by several reasons. Firstly, a more effective use and interpretation of the archive and, secondly, its conservation.

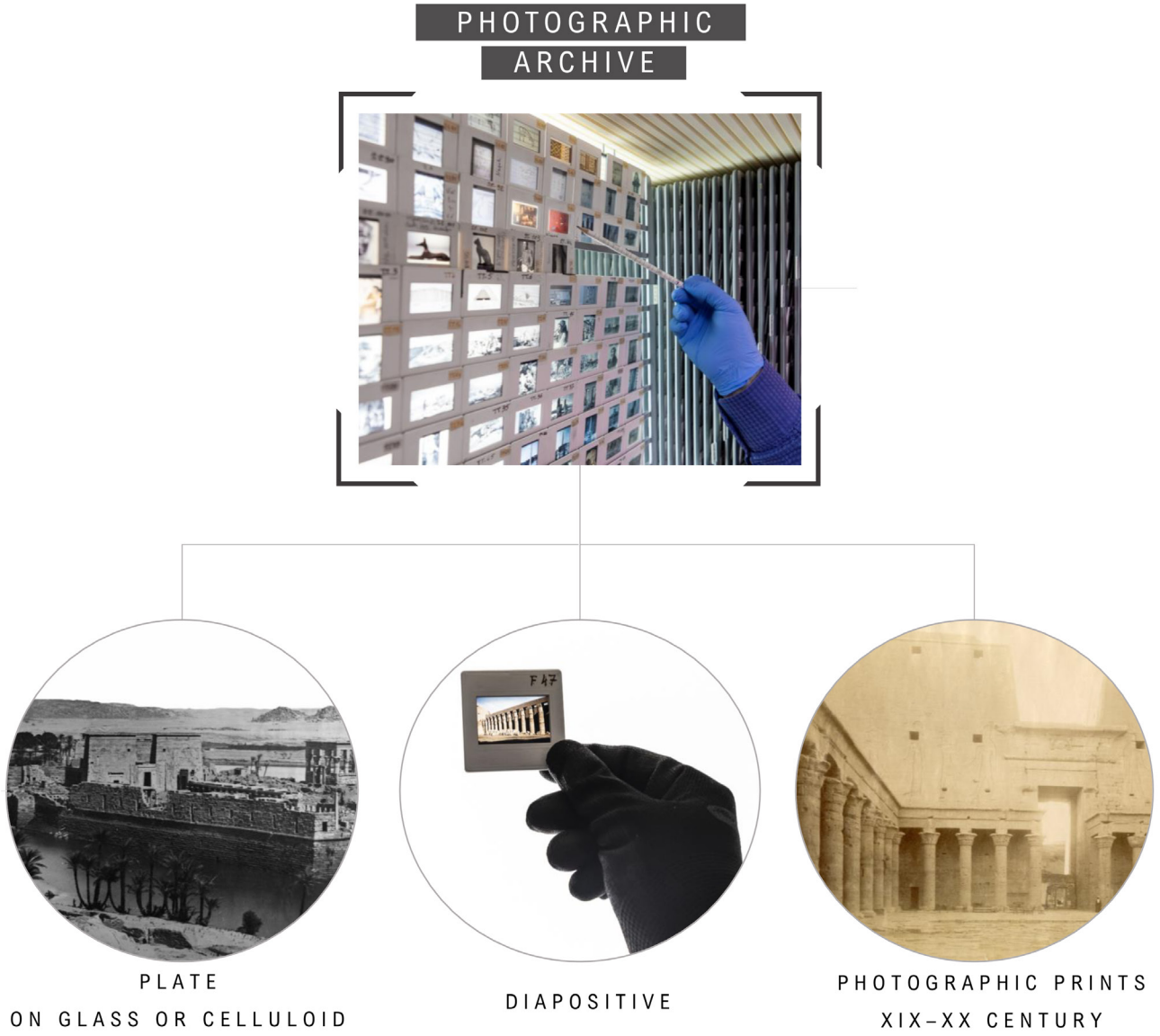

Fig. 1. Contents of the photographic archive of Museo Egizio. Image source: Photographic archive of Museo Egizio, (graphic elaboration by Davide Mezzino).

Fig. 2 Photographic archive of Museo Egizio (graphic elaboration by Davide Mezzino).

The identification of the represented subjects bases its motivations on the complete lack of organization in the starting data. A lack that is reflected in various inventory registers, compiled starting from the 1950s, when these stated assets began to be inventoried for the first time.
The photographic plates that are still present in the museum have therefore been listed in the registers. Many of them were used at the beginning of the twentieth century, and had never before been inventoried. Unfortunately, these volumes turned out to be inadequate and unreliable, especially for the recognition of photographic archaeological subjects [Moiso e Montonati 2021, p. 90]. The project, launched in September 2018, immediately focused on scanning of the material as well as on performing an inventory check of the newly-arrived archive [4], starting from the photographic background paper and then continuing with the background plates and finally with the slides. Following the completion of the digitization of the Plate Fund, in 2019, it was decided to fill the gaps and inaccuracies relating to the first inventory registers through a study and recognition of the subjects, while maintaining the inventory number and the object number attributed to the plate in negative [5]. A limited part of the plates was initially examined, that is, only those relating to the archaeological activity conducted by the museum in Egypt between 1903 and 1937 [Moiso 2008; Moiso 2016], consisting of over 1.500 shots. For this homogeneous group (but uneven in terms of inventory and physical arrangement in the Fund), which includes different localities, it was therefore decided to proceed with a correct recognition of the places represented. Considering the lack of references, the selected methodology was based on

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Fig. 3. Wall of the tomb of the sculptor Ipuy (TT217), who lived during the reign of Ramesses II (XIX dynasty) in the village of Deir el-Medina. This detail of the wall no longer exists. Archive , C00083

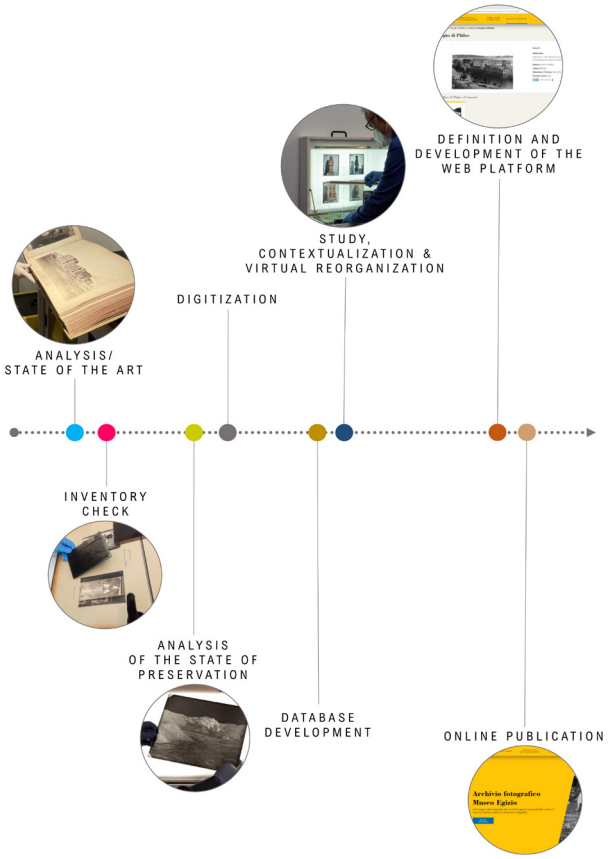


Fig. 4. Process of interpretation, study, analysis and digitization of the material preserved in the photographic archive of Museo Egizio. Image source: photographic archive of Museo Egizio, (graphic elaboration by Davide Mezzino).

the material to be studied. Firstly, a subdivision of the images based on the location was carried out. Secondly, the specific recognition of the subject exploiting the available bibliography as well as the modern images of the sites. These images have been useful to understand the transformations, both in terms of architecture and landscape, which occurred over the course of a century and to confirm the exact attribution of a photo to the supposed archaeological site.
An attempt to connect the individual images, one to another, was also tested through the use of significant reference points in the geography of the site. Although with several difficulties, it was possible to attribute a geographical and contextual framework to most of the photographs.
While the physical order has not changed, it was instead possible to implement a digital reorganization, adopting a geographical criteria. A series of folders and subfolders made possible to group images taken at a short time distance from each other in the same site. For example, during excavation phases images, but also photographs of the same object, taken in different years (fig. 3).

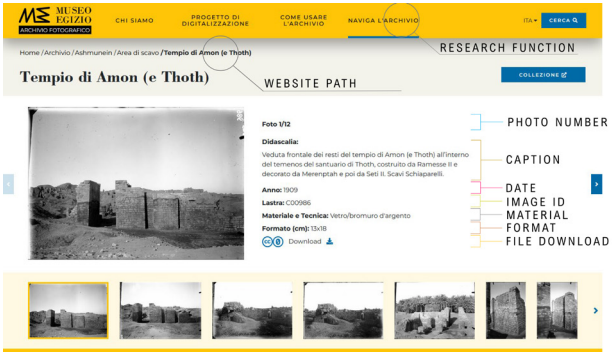
The digitization process

In the XXI century digitization is proving to be a determining factor for the knowledge and dissemination of an archive and stored material [6]. This applied also to the photographic archive of Museo Egizio [7], which was therefore able to open its doors to the wider public: without the intervention of digital tools and channels of communication, it would have been difficult to make it accessible, both for the necessity to identify suitable spaces for this initiative, and because of the fragility of the material. Past publications have, on numerous occasions, exploited the potential of the archive, but its use has always been limited to a few elements [Donadoni Roveri et al. 1988, 1994; Donadoni Roveri 1989; Robins 1990; Tosi 1994]. However, their use has not been systematized, to the point that over the time the files have been lost, or they never arrived to Museo Egizio.
Only starting from 2010 a large digitization campaign started with a selection of a thousand plates. This was then included in the general project of study of the archives, that opted for a complete digitization, which

took place between 2018 and 2020 (fig. 4). The images were scanned at a resolution of 1.200 DPI (Dots per Inches) in .tif format, to be then further processed with computer post-production software (Adobe Photoshop). They were also converted into .jpeg format, in order to have two formats, useful for different purposes. The files has been named through the alphanumeric code of the plate support. This operation was accompanied by the drafting, initially in Excel format, of a database where to insert the information obtained from the frame and from the subject represented.
For an optimal management, two macro-folders were created, one with the progressive order of the files, the other with the order by geographic locations, as they were progressively identified.
Thus, from Giza to Nubia, the photographic archive of Museo Egizio documents important phases of excavation, as well as landscapes and temple complexes still *in situ*, allowing on the one hand to better understand the Museum excavation campaigns in Egypt and, on the other, to identify the state of conservation, cleaning and restoration of the tombs and temples already known, especially those in the Theban area. It is important to underline that in some cases photography has also been fundamental to document walls and architectural elements that no longer exist, providing crucial information for further studies.
From the completion of this part of the project, the common desire to enhance and share the archive with the community emerged, and the best way to achieve this was identified in the creation of a new *ad hoc* website.
To ensure the maximum dissemination of the information and digitalized data of the historical-photographic archive to a large and heterogeneous audience, the text files were saved in .pdf, while the image files were saved in .jpg format.
In terms of interoperability, the SiME Media Gateway software, thanks to its modularity, can potentially post-produce all formats that will be deemed necessary in the future. Despite the constant diffusion of AI techniques to categorize images and files of different nature, no use was made of intelligent algorithms as the amount of data available turned out to be relatively small. Furthermore, the low quality of the images required a considerable interpretative effort which, if performed by an algorithm, would have led to an unacceptable degree of error.

From the digital archive to online content sharing: the SiME Media Gateway

Whenever a content is disseminated, it is necessary to filter and organize the material available according to the information that one wishes to convey, the target and the type of medium used.
In the case of the historical archive, the decision was taken to use a universal medium, such as the website, in order to allow a wide audience to access the material, even if it was clear that the public target would be relatively small. As for the contents, the choice was made to reveal, almost without filter, all the images associated with the excavation areas and to show them organized by geographical area, navigable on different levels of detail. The decision was also taken to provide them with captions that describe the subjects or landscapes illustrated. Following the policy of the Museum, the images on public sites can be freely viewed and downloaded via download without limitations (Public Domain - CC0), a decision also adopted for the historical archive site.
As already mentioned, the digital material has been organized into folders according to a geographical order. In detail, the organization of the "Historical photographic archive" folder is nested, that is, it starts from the macro geographical areas passing through the folders dedicated to historical excavations up to the detail of the excavation areas.
Normally, populating a website is obtained through several manual steps of optimization and insertion of the selected contents. Moreover, usually great efforts are made to organize the materials in different ways, first in the folders of your repository (internal server or NAS), then on its management software, and finally on a dedicated site.
In the case of Museo Egizio, these efforts were avoided by opting to automatically and centrally manage the publication of images from the historical archive, directly from the archive folders to the online site.
This goal was achieved thanks to a specific software, the SiME Media Gateway where SiME stands for Sistema Museo Egizio. The SiME Media Gateway software is part of a larger system, SiME [Mezzino, Lori 2021], which manages all the media files of the Egyptian Museum and allows them to be published and organized on the web platforms connected to it, such as the historical archive itself (https://archiviofotografico.museoegizio.it/ it/) (fig. 5), the site of the Museo Egizio Online collection (https://collezioni.mus-



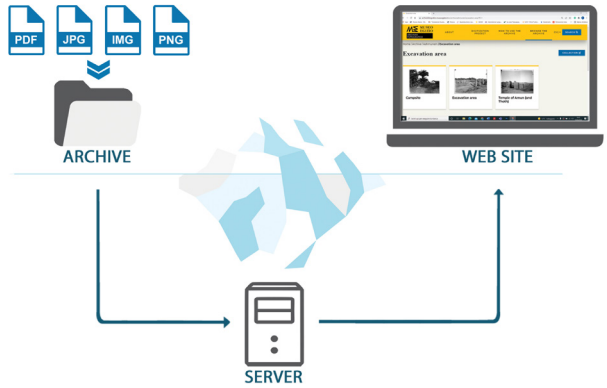


Fig. 5. Internal page of the "Photographic Archive" website. The image shows the interface of the "Browse the Archive" section, highlighting its structure (graphic elaboration by Francesca Lori, Davide Mezzino).

Fig. 6. Functioning scheme of the online photographic archive which includes three main phases: 1) archiving digital material; 2) back-end processing by the SiME Media Gateway software on the server3) sharing material on the photographic archive website (graphic elaboration by Francesca Lori, Davide Mezzino).

eoegizio.it/), the site dedicated to sharing studies on papyri (https://collezionepapiri.museoegizio.it/it-IT/) and other applications still being conceived and developed.
From an Operational point of view, the SiME Media Gateway software automates the production of all useful formats starting from the archive images while the SiME management software integrates a user control panel for the centralized association of the different formats to each platform of publication. The operators of the Egyptian Museum, from the SiME panel, can choose the formats of the "media" files to be created, modify the TAGs associated with the images, view their information including the publication status, the date on which they were taken, and view the copyright.
The development of the SiME Media Gateway became fundamental in a moment of transition of Museo Egizio from one management system to another. The passage of the contents from one system to another would have required a massive manual intervention by the staff of the museum to upload and associate the images to each object information sheet. Given the Museo Egizio's renewed wish to reach its public on different platforms and share digital material on a collection management system, it was essential to centralize and automate the processes so that all the operators of the different departments of the museum, including that of "collection and research" and "collection management" could collaborate without delay and loss of material.
In conclusion, the automated approach saves not only many hours of data entry but also disk space, since the material is produced, without unnecessary steps, in reduced dimensions for the WEB (fig. 6).
The relevance of this approach is even greater in this case, as the digitalized material is bound to grow exponentially over time.
To avoid the loss of digitized information, a virtual server service external to the museum endowed with a backup on cloud was activated.

Conclusions: the role of the online archive of Museo Egizio

This contribution presents through the empirical experience of the "historical photographic archive" a methodological approach and a workflow for the study, interpretation and organization of the photographic archive material of Museo Egizio.

Within this framework, the digitization of the photographs played a crucial role. It started from different physical supports, defining methods for documentation and representation to implement the consultation and management of the archive.
To address these objectives it was necessary to recognize the subjects represented, digitalize the entire archive, define a method of archiving and displaying information and identify the dissemination strategies.
Thanks to the online historical photographic archive of Museo Egizio it was possible to share the outcomes of this research activity. The online publication of the historical photographic archive has implemented the accessibility and interaction of this part of the Museum collection with specialists and general public.

The process of digitization and subsequent publication of the photographic archive material is important both for the dissemination of this part of the Museum collection, which has not been known so far, and to encourage other museums and cultural institutions to start the same procedure with their own archives.
In this process, the role of representation disciplines has been fundamental in investigating, interpreting and communicating this rich, complex and little-known archive, activating further processes of knowledge able to enrich our understanding of cultural heritage. This project will proceed by extending the same approach to the other portions of the archive, with the final aim of making the entire historical photographic archive public and available for free

Acknowledgments

This research is a cumulative work that had the fundamental support of two institutions: Fondazione Museo delle Antichità Egizie di Torino and the Politecnico di Milano. First and foremost, we would like to thank Christian Greco, Director of the Fondazione Museo delle Antichità Egizie di Torino and all the dedicated staff that contributed to the feasibility study of the project. A special thanks goes to Corinna Rossi, Professor of Egyptology at the Politecnico di Milano. She helped to build the site user interface and SiME itself.

Notes

[1] This is the case of funds that were dismembered among several institutions or merged with other funds. Emblematic from this point of view is the paper archive of the Museo Egizio, that includes documents hosted since 2008 in the Torino State Archive, in three different sections. The photographic archive, despite having been conferred to the Museo Egizio in 2016, left small traces in other institutions, such as the Torino State Archive and the Anthropology Museum at the University of Torino, which preserve numerous images from shots taken during the excavations by the Italian Archaeological Mission in Egypt.

[2] Archivio di Stato di Torino, Fondo Museo Egizio, I vers., m. 240.

[3] A box with numerous glass plates by Lanzone was recently found on the antiques market, concerning images of steles kept at the museum. Unfortunately, acquiring them was not possible.

[4] The photographic archive of the Museo Egizio was given to the museum in 2016, and physically transported to the museum premises in August-September 2018.

[5] In full compliance with the reorganization through the so-called historical method, inaugurated by Francesco Bonaini in the mid-nineteenth century.

[6] See for example the case of the photographic archive of the Alinari Foundation, which placed its photographic heritage on an online site (https://www.alinari.it/it/), or the Griffith Institute of Oxford (http://www.griffith.ox.ac.uk/gri/carter/gallery/) with the digitization of photographs by photographer Harry Burton, taken during and after the opening of Tutankhamun's tomb starting in November 1922.

[7] Before digitizing the photographic archive of Museo Egizio, between 2016 and 2019 the staff of the museum concentrated on the digitization of about 80,000 documents that are part of the paper archive, kept in the State Archives of Torino. The aim of the project was to make their archive accessible to the researchers of the museum directly on their computer devices. A mutually beneficial collaboration was born, culminating in the "Maps of Egypt" study day, held on November 27, 2019. In 2019, the scans were also officially delivered to the State Archives, the owner of their copyright, which then uploaded to their official website, and are now available to anyone. funds | State Archives of Torino (beniculturali.it)

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Collections

MAXXI Architettura between Museum and Archive. Protection, Research and Valorization of Architects' Archives in the 21st Century

Margherita Guccione

Within its premises, the MAXXI (National Museum of 21st Century Arts) of Rome houses the first Italian museum of architecture. Conceived since its genesis as a place of synthesis capable of activating a reciprocal and uninterrupted dynamic between research, documentation, conservation, production and exhibition, MAXXI started its activities in 2010 reflecting on the archive/museum model experimented in various international institutions.
The binomial archive/museum –a binomial that always alludes to coordinated and to a certain extent overlapping functions (conserving, consulting, exhibiting, promoting, disseminating)– has characterized the cultural project of the Museum of architecture since its inception, defining its physiognomy and identity.
With regard to architecture, the relationship between archive and museum is in many ways central. This is because architecture, absent in physical terms from the museum, in architecture exhibitions, as has been noted by many authors [1], is instead evoked, narrated, described or variously interpreted by drawings, models, photographs and every other form of representation, description, conceptualization, often starting precisely from archival documents.
The mission of MAXXI Architettura is twofold because it is, at the same time, a historical museum and a contemporary museum. A historical museum because it addresses the twentieth century, with the task of representing Italian architecture of the 20th century, turning its attention to the works, personalities and stories that have traversed the last century. A contemporary museum because it looks to the present, to the most interesting and innovative experiences, to the emerging

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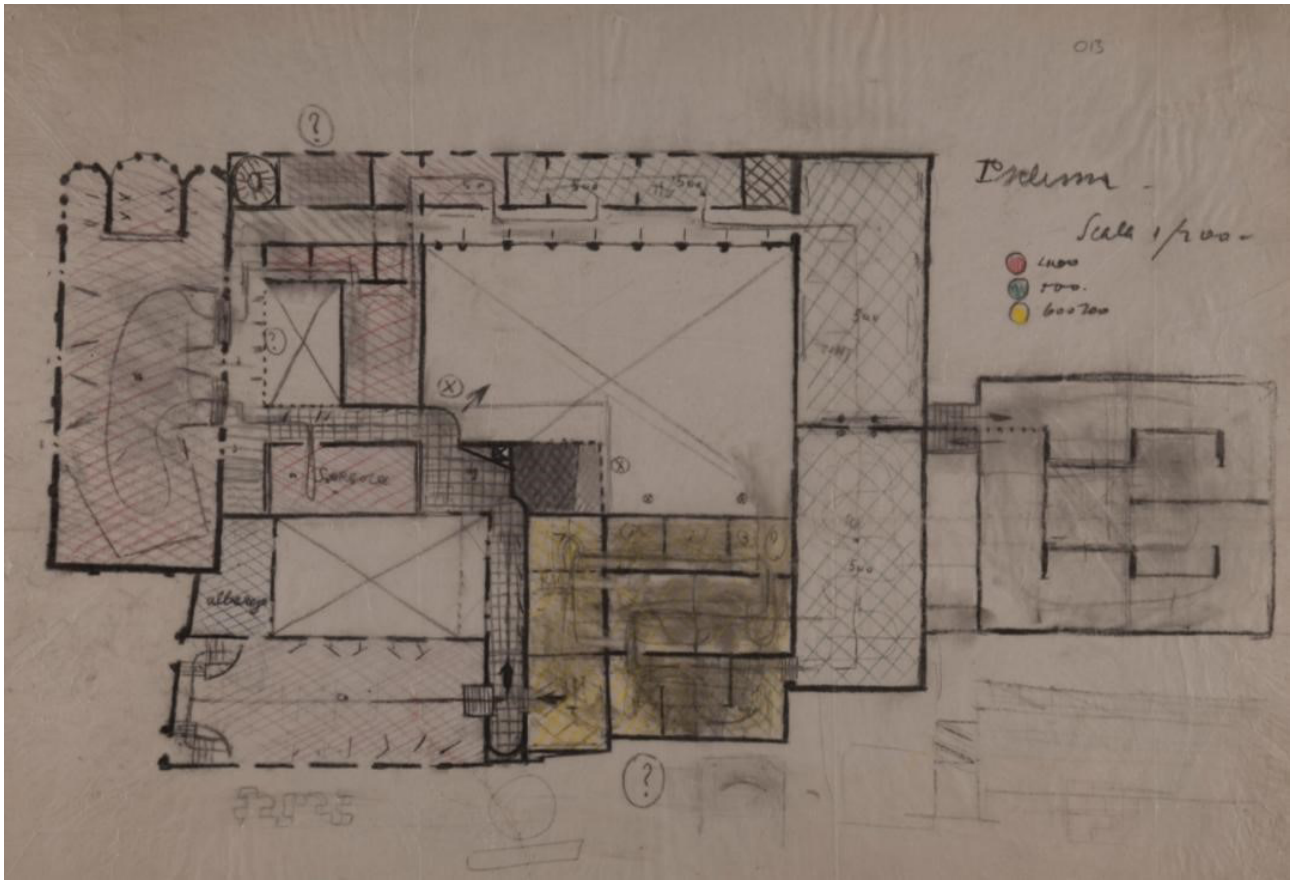
Fig. 1. MAXXI Architettura, Repository for the collections (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).

themes of architecture in its wider relationships with the modern world.
The Museum does not have permanent displays: it presents exhibitions that reveal to the public its cultural program, developed on the basis of its acquired collections and activities of research and in-depth monographic or thematic studies. The strong idea is to encourage a continuous osmosis between exhibits and collections, between exhibitions and archival research in order to develop critical thinking and foster the knowledge of architecture as a complex and multidisciplinary activity.
Returning to the relationship between archive and museum, it is worth remembering that the MAXXI Architettura collection is essentially made up of projects divided into personal fonds (that is, the professional archives of architects) or thematic fonds (which include projects centered on a single theme or produced on a specific occasion).
The definition of the methods of acquisition for enhancing the patrimony of MAXXI Architettura has represented a largely innovative experience for the Museum. The very structure of this patrimony fully reflects the history of the Museum, which is characterized precisely by the intrinsic relationship between collection, research and exhibition activities. Being a single entity that promotes research and at the same time exhibits architecture has determined the absolutely original character of the collection and of the position that MAXXI Architettura holds in the international panorama.
The permanent collection refers to two distinct areas, with specific characteristics: the *20th Century Collection*, which testifies to the culture and activity of architects and engineers of the 20th century, and the *21st Century Collection*, which documents current production and research, also in logical and chronological symmetry with MAXXI Arte, with a close look at the entire system of cultural institutions.
For the sake of completeness, it should be mentioned that, given the role that photography plays in the understanding of architecture and landscape, the *Photography Collection* also forms part of MAXXI Architettura.
The collections are managed by the MAXXI Architecture Archives Center, which can be considered both a physical place for access to the documentation and the consultation of projects and, at the same time, a conceptual place for specialized research.
In the Museum's intentions, and following the tradition of archival science, the archive is conceived as a compen-

Fig. 2. MAXXI Architettura, Repository for the collections (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).

Fig. 3. Archivio Carlo Scarpa, renovation of the Gallerie dell'Accademia. Venice 1946-1959 (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).



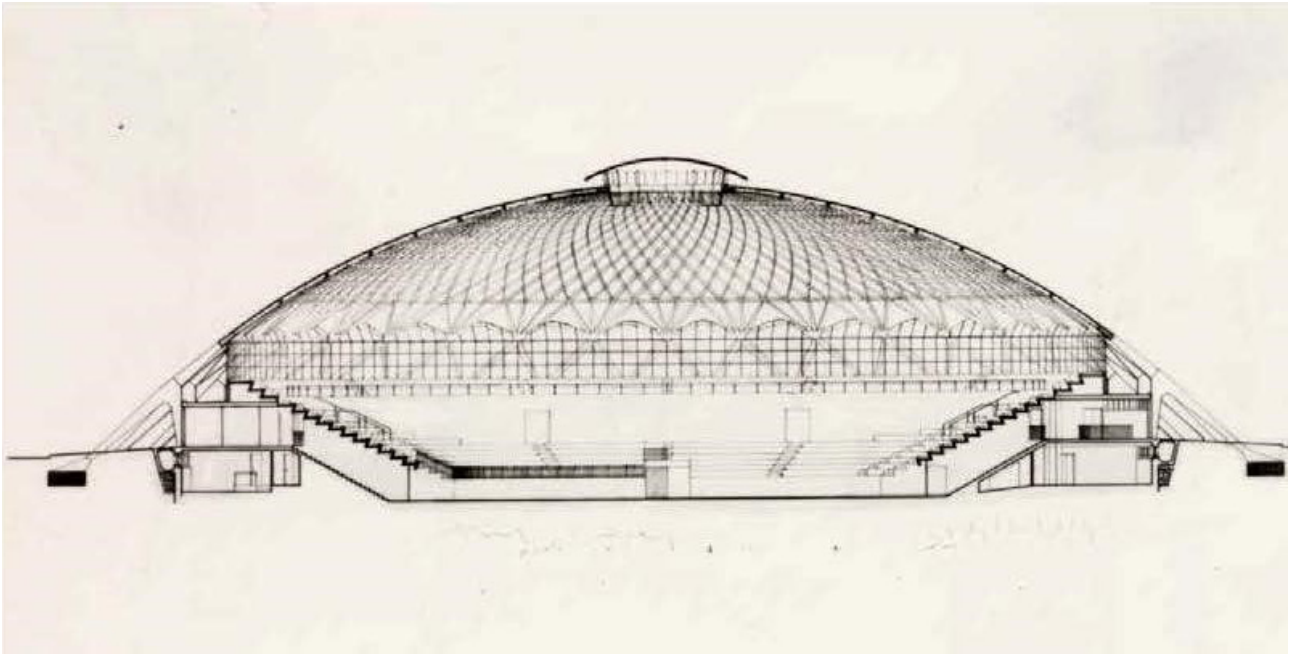
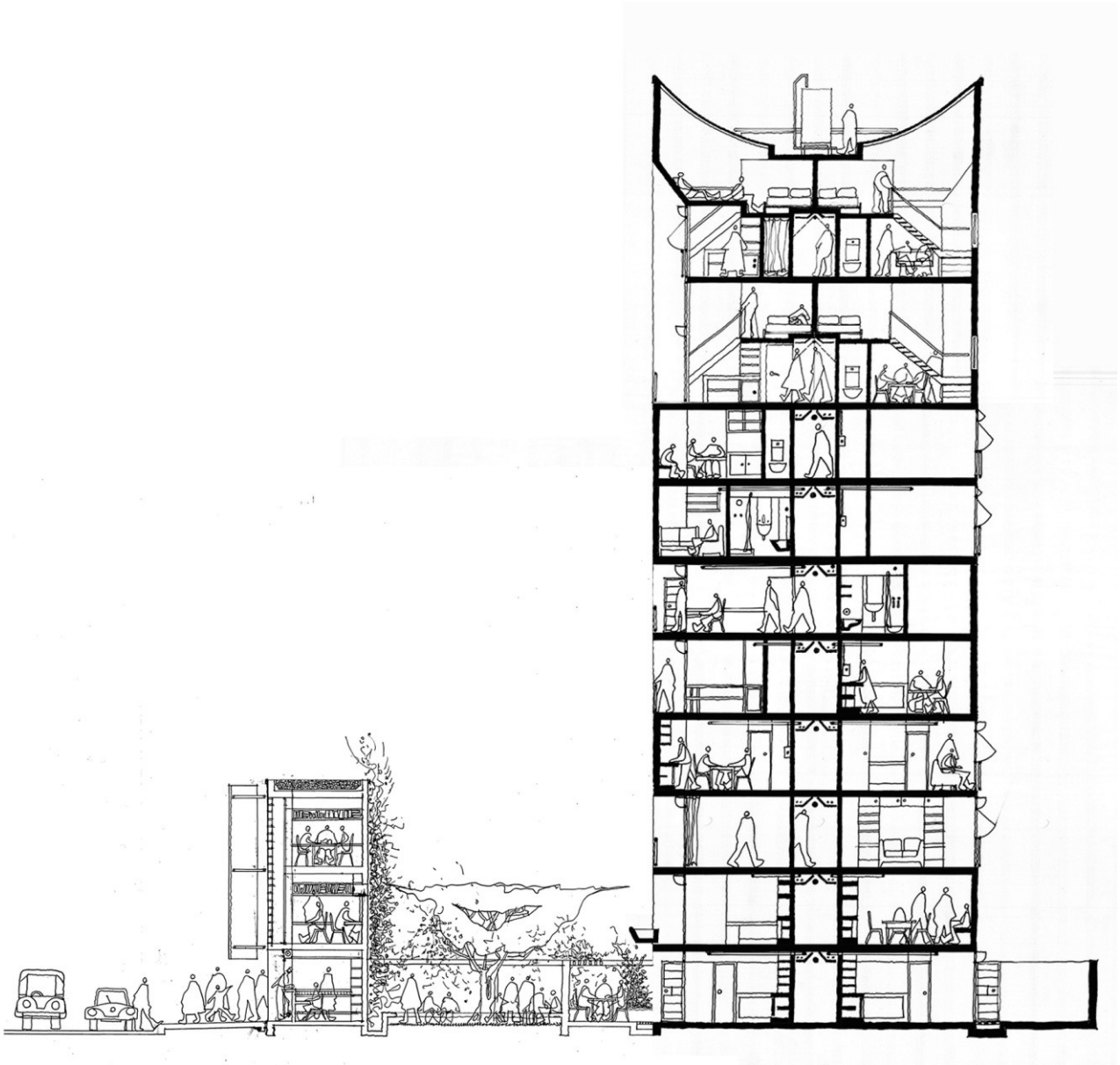


Fig. 4. Archivio Pierluigi Nervi, Palazzetto dello sport, section. Rome 1960 (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).

dium and contains all the material that revolves around projects, not only those pieces, those products, to which a sort of "artisticness" is recognized and that are therefore more effective for museum fruition. The archive is, therefore, also conceived as a repository, and constitutes the memory of the entire process revolving around architecture, from the initial idea to the realization.
For this reason, the MAXXI Architecture Archives Center is a research center open to scholars and, at the same time, to a wider public. The possibility of constructing one's own critical path through archival documents sets aside the idea of a museum presenting a single vision, the epic narrative of a History (with a capital "H"). The fortunate relationship between archive, research and exhibitions expresses and gives form to the great potential for the transmission of knowledge.
At exhibitions, it is seen how archival materials enable direct or indirect relationships within the same archive or between different archives, activating the most varied paths of research. A cultural approach that seems to refer to that idea of freedom suggested by the architectural conception of the building, designed by Zaha Hadid (1950-2016).
It should also be emphasized that the archives/museum binomial well explains the decision to place the *Sala Studio* [2] of the Archives Center in the heart of the exhibition spaces, thus making it the spatial manifestation of the centrality of the archives in the Museum's architecture collections and programming.
The Archives Center makes it possible to approach architectural records and exhibition documentation in a continuous succession of references and updates, also thanks to the use of wide-ranging digital tools. Its activity is not limited to the aspects strictly related to its documentary nature, but invests all aspects of data protection, conservation, restoration, management and processing, thanks to the standards adopted and the tools specifically developed in recent years. The path of document digitali-

Fig. 5. Jo Noero, Rivers of Steel, Maboneng, cross-section. Johannesburg, South Africa, 2018 (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).



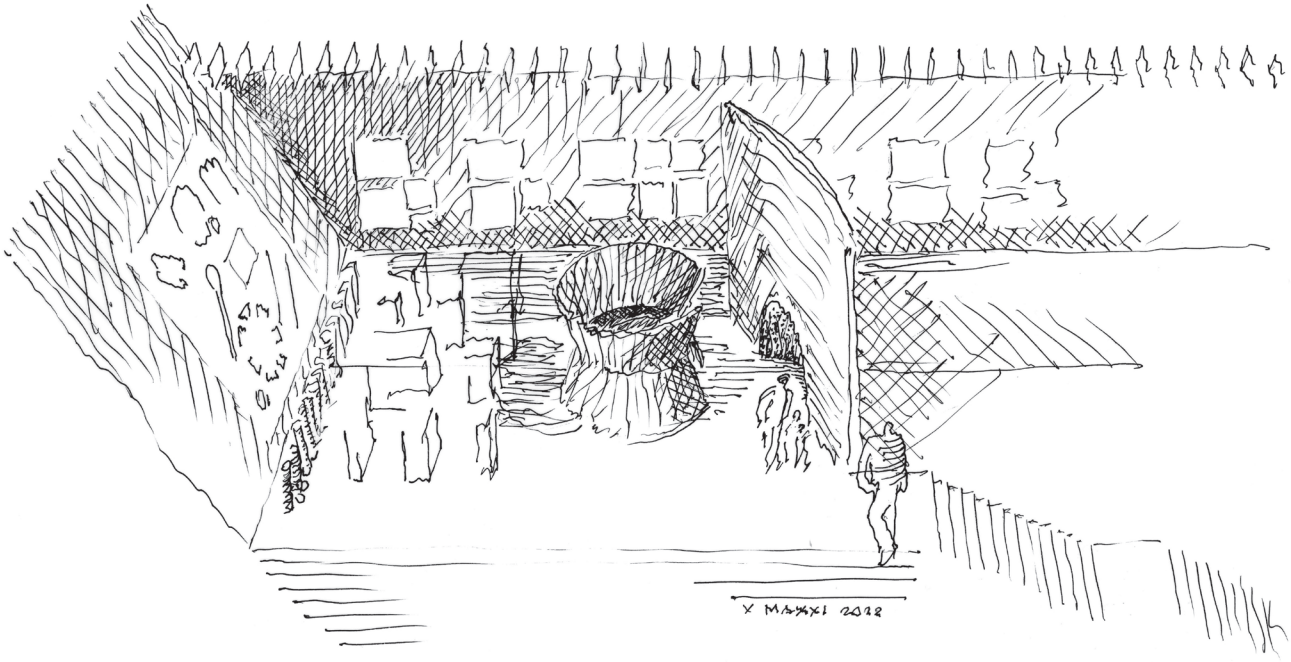


Fig. 6. Mario Botta, exhibition Sacred and Profane, MAXXI, sketch of the exhibition project, 2022 (MAXXI_Museo nazionale delle Arti del XXI secolo. Collezione MAXXI Architettura).

zation that has been undertaken responds to the need for protection and conservation of the papers because it primarily allows digital copies to be consulted while safeguarding the originals. Digitalization also responds very well to the need to expand the possibilities of accessing and navigating the structure of the archives, through consultation and research in situ or online.
The MAXXI Architecture Archive Center is also an exhibition space, a place for reflections and debates, a venue for seminars and in-depth studies on specific themes of a purely archival or a more wide-ranging architectural nature. In any case, the intention was to maintain the identity of a place that, deliberately, does not have a grandiose dimension, as do the other spaces of the museum, despite the deep conviction of the importance, in a museum, of the dimension of spectacularity. The idea of a space that is a device for accessing the complexity of documents and their relationships evokes the words of Giuliana Bruno, who, referring to the concept of museum-archive or museum-atlas, reminds us that we are beginning to imagine an internal organization of the Museum that is very different from the linear and static one to which we are accustomed, and the concept of the archive, which might seem outdated, allows us instead to organize and redefine historical documents in a freer and more mobile manner [3]. This brings us to the concept of "dynamic museum," associated by Bruno herself with the moving images of cinema, because the museum coincides with an archive of images and, more specifically, an archive of moving images, if we think about the way the exhibition space is used, the relationship of gaze and movement between the visitor, the arrangement of the works and the container itself when this is as particular as that created by Zaha Hadid with the MAXXI.
The Archives Center [4] conserves entire or partial fonds that attest to the professional activity of some of the greatest representatives of the Italian architecture and engineering scene of the last century, from Carlo Scarpa

to Aldo Rossi, from Pier Luigi Nervi to Sergio Musmeci, just to name a few [5]. Conserved alongside these fonds are smaller ones, with drawings, models, sketches and documents related to a project or a single theme, which do not possess the organicity of an entire archive or a substantial part of it, but nevertheless attest to important moments or milestones in the history of architecture starting from the 20th century.
The 21st Century Collections mainly conserve the products of activities (exhibitions, commissions, workshops) arising from the museum's own cultural projects or related to prestigious examples of contemporary architecture: these are thematic fonds, within which projects related to a specific subject, such as materials from design competitions, are collected. The latter also include material related to the construction of the MAXXI building itself. This section of the archive contains various materials in digital format that reflect the mode of production of today's architectural thinking. The issue of digital production is a major challenge today: confronting this aspect is absolutely necessary in order to structure collections and archives of the future and to conserve them effectively.

Notes

[1] See Polano, S. (1998). Archivi e (musei) di architettura: e l'Italia non li merita?. In *Casabella*, n. 655, p. 7; Calabi, D., et al. (2004). *Musei d'arte* e *di architettura*, a cura di F. Varosio. Milano: Bruno Mondadori.

[2] In the *Sala Studio* one may access, for reasons of study or research, the museum's entire holdings, offered for consultation in original or digital format.

[3] See Guccione, M. (2009). *Intervista a Giuliana Bruno*. Roma: MAXXI.

[4] The Archives Center conserves, manages and curates the collections and archives of MAXXI Architettura, which comprise approximately 90 fonds to date. The architecture collections are entirely published on the online database with over 200,000 catalog records, accompanied by over 30,000 images: <http://inventari.fondazionemaxxi.it> (accessed 24 May 2022). Building on its own methodology for inventorying and cataloging architectural fonds, the Archives Center has developed a service also addressed to external, public and private archives. Since 2012, it has been curating and managing the project of archival intervention on the entire documentary complex of the ENI patrimony, for the purpose of achieving a full knowledge of the extensive historical archive and allowing easy access to it by scholars as well as the general public.

[5] The acquisition of personal archives has been an important starting point for the Architecture Collection, with the understanding that the content of architects' private archives represents something fundamental, but at the same time partial. The presentation of an individual architect's cultural production is important but not exclusive. One need only think of their intertwining with the public and private archives of central and local patrons, the photographic and moving image, the testimonies of material culture, and products related to architecture in the literary and artistic sphere, etc.

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The Italian *Album dei fari*: between Knowledge and Digitization

Sonia Mollica

Abstract

It is now well known that digital production has almost completely supplanted the traditional drawing practices in the architectural process. If on the one hand the use of digital representation has interrupted traditional graphic production, on the other, it makes possible an increasingly effective and immersive dissemination of ancient architectural projects that are not sufficiently known, if not unpublished or, still, imagined. In this sense, this contribution aims to investigate and develop the digitization of one of the most important coastal projects put in place by the Ministry of Public Works and concretized through the drafting of the Album dei fari illustrato dalle notizie intorno ai loro caratteri e posizione*, in order to make all those projects fully or partially realized for the growth of our coasts usable. The project proposed in 1873, the day after the unification of Italy, provides for the design and construction of four hundred and sixty-two maritime signals for the eight thousand kilometers of the Italian coast. The digitization of the* Album dei fari, *that is a cornerstone for the history of the construction of these coastal architectures, is therefore configured as the fundamental action to undertake a path of knowledge and digital comparison of past and present coastal structures, according to the dictates interdisciplinarity [Albisinni, De Carlo 2011].*

Keywords: Album dei fari*, Unity of Italy, digitization, enhancement, fruition.*

Introduction. History of the architecture archives

Hand in hand with the vast territorial diffusion of cultural heritage, we can include the immense legacy left to us by the past regarding the architectural archival heritages of our territory. This type of support of material culture represents a fundamental imprint for the memory of history and the past, inherent in both built and never built architecture. In this sense, the public disclosure of architectural archives is configured as a fundamental action for knowledge that is increasingly accessible to all types of users, exponentially multiplying attention to all types of buildings, even the most neglected. In this sense, it is starting from the 1980s that the architecture archives, up to that moment kept in public archives, museums and libraries, became the object of particular attention, with the consequent birth of new centers dedicated to the collection of archival material. The birth of specific cataloging systems entails indisputable benefits for the knowledge related to the places and their history, albeit in turn generating excessive fragmentation and dispersion of data [Tonicello 2014]. It should also be emphasized that, together with databases that are still too fragmented, the often incomplete architecture archives should be mentioned, that is, with only excerpts of the compositional memory: 'silent' fragments awaiting their recognition as examples of the succession of architectural history over time [Albisinni, De Carlo 2011]. For fifteen years now, however, it has been possible to witness a new archival recomposition, thanks to a wide-

Fig. 1. Cover Album dei fari [Regno d'Italia/Ministero dei Lavori Pubblici 1873].

Fig. 2. Map of the Kingdom of Italy indicating the geographical position and maximum range of light from the lighthouses [Regno d'Italia/Ministero dei Lavori Pubblici 1873].

spread collaboration between various Italian institutions, which is responsible not only for the safeguarding of the archives themselves, but also for their sharing through methodologies and access tools and use [1]. The protection and conservation of architectural imprint appear to have a prominent future in the digital world, although the approach for digital cataloging and how this process can interact with the material archives is still not well defined. Moreover, the relative greater fragility of digital data compared to paper documents must be considered, forcing the major international institutions, as well as small museums, to choose how and what to preserve from the immense material that has come down to us [Audisio 2011].
Finally, it should be emphasized that the enhancement of the archive, in addition to its use, depends on the critical interpretation of the documentation, allowing the forward projection of one's past towards a future present [Culotta, Sciascia 2008], by means of transposition techniques digital that can develop a renewed interest in architecture inextricably linked to history. In this sense, it is clear that historical events have clearly conditioned the visions and planning of time, for this reason it is impossible to separate the project from the historical, political and technological context in which it develops and to which it belongs. It is precisely in the connection between history, technology and politics that one of the most ambitious coastal enhancement projects proposed in 1873, after the unification of Italy, is inserted, with the intention on the one hand of strengthening the coastal signaling system, on the other hand, to affirm the power of the nation through monumental and clearly visible structures. In the following section, therefore, we want to define and analyze an archival document that is an example of the magnificence of one of the most fascinating and characteristic military architectures of the Mediterranean and Italian territory: the lighthouses.

Birth of a coastal network: the *Album dei fari illustrato dalle notizie intorno ai loro caratteri e posizione*

The lighthouses, despite the succession of new technologies, have represented and still represent the main navigation tools, as well as being an important example that is part of the coastal military heritage. The lighthouse, like our civilization, was born in the Mediterranean context, heirs of ancient ancestors who, with the fires at their top, lit up the nights and indicated the way to sailors [2]. At the beginning of the nineteenth century, many states felt the need to make navigation along the coasts safer, a consequence of a dense network of increasingly defined and growing commerce [Zanelli 2008]. Furthermore, with the advancement of naval hegemony by England, the nineteenth century became the period of birth and flowering of farology, spectator of technological and engineering miracles, especially along the coasts of England, Scotland and Ireland. The vast production of light towers of significant architectural and engineering interest can be traced back to the considerations made from the late XIX and early XX century regarding the stability and constructive principles of these architectures, creating towers according to the theory of bending, i.e., considering the lighthouses as bodies embedded in their foundations. In the years in which various static analysis tools and construction types follow one another, there is a very strong interest in strengthening the structure of the lighthouses both in an architectural-structural sense and in the territorial landscape. It is precisely in the Italian context that one of the most important and dense networks of coastal lighthouses is created. Already equipped with a network of lighthouses organized by the Kingdom of the Two Sicilies [Radogna 1982, p. 149], it was in 1860, with the unification of Italy, that the Italian State armed itself with all the tools to organize a timely lighting system along eight thousand kilometers of coastline: it goes from fifty lighthouses and maritime signals present in 1861 to five hundred and twelve existing in 1916. This modernization strategy is documented in the first Italian publication dedicated to the governance of lighthouses on all points of view, from the construction their maintenance and organization, in order to create a single signaling network that could unite all the Italian coasts.
The project takes shape with the formalization by the Ministry of Public Works of the *Album dei Fari illustrato dalle notizie intorno ai loro caratteri e posizione non che da quelle intorno alle spese di costruzione e impianto e di annuo mantenimento ed illuminazione* [3] (figs. 1, 2), still available today in the Na-

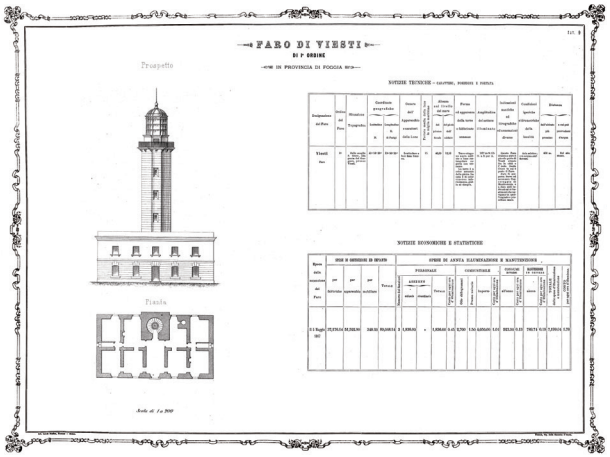

Fig. 3. Table belonging to the Album dei fari bearing the details of the Vieste lighthouse (FG) [Regno d'Italia/Ministero dei Lavori Pubblici 1873, table 9].

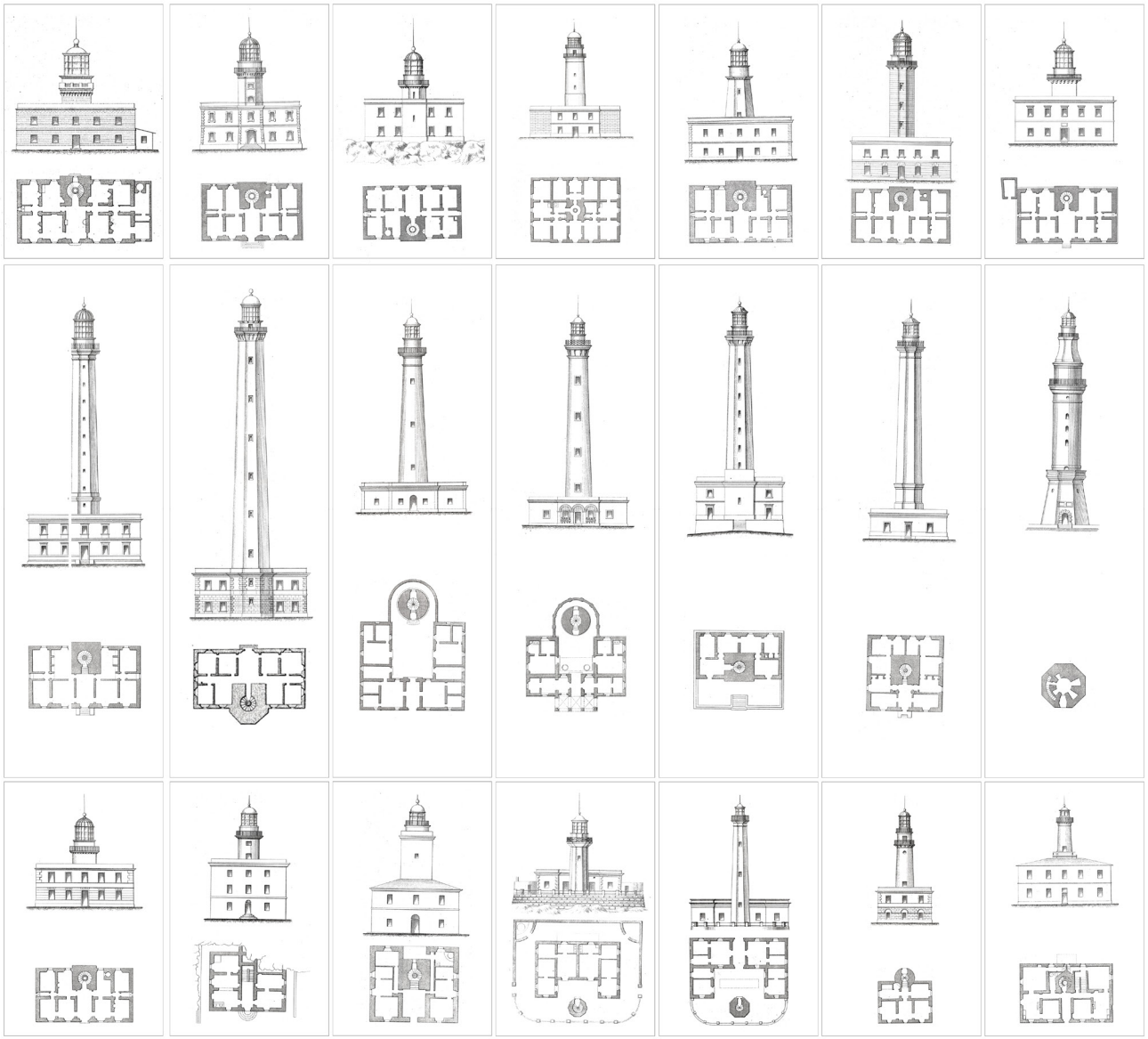

Fig. 4. Summary of some representations belonging to the Album dei fari [Regno d'Italia/Ministero dei Lavori Pubblic 1873] (graphic composition by the author).

tional Libraries and in some State Archives, symbol of the birth of a new era of modern and technologically advanced structures and architectures for coastal signaling [Fatta 2002]. If until that moment the function of the lighthouse had been fulfilled and incorporated by the towers, bastions, fortresses and defensive towers, with this program we begin a new era of modern and technologically advanced structures and architecture. The ambition of this project is to "make known the increase and progress brought about in this service after the constitution of the Kingdom" [Curti 2002, p. 45]. Finally, the greater interest in the construction of lighthouses to the detriment of ports should be considered, probably because, as reported in the same *Album*, the "monuments of general interest and undoubted pledges of the civilization of a people" are identified in the lighthouses [Curti 2002, p. 45].
The *Album* is configured as a collection of drawings depicting the project of numerous lighthouses, developed in plan and elevation, accompanied by the technical characteristics of the systems, maintenance and the economic plan necessary for their construction and management (fig. 3). The geometric-architectural setting of most of the projects featured in the *Album* follows recurring and precise geometries, alternating with sporadic neoclassical style lights with local materials and ornaments such as frames and ashlar, still in use today. Despite the accuracy of the projects, the construction strategy was not completed by the post-unification government: only some of the projects presented came to light, partly modified from the original project or built much later. Nonetheless, the publication makes clear Italy's actual willingness to invest in technology and this type of identity buildings, through which to express the degree of civilization achieved [4].
The illustrations, therefore, are based on the manual representation of all the details corresponding to the building to be built, with related metric ratios and the reduction scales adopted. The projects put in place present for the most part an architectural language in neoclassical style and often recurring geometric-compositional relationships: the regency is characterized by a number of levels not exceeding three; the tower develops in plan according to octagonal, square, circular or hexagonal geometries; the lantern is always circular and proportionate with respect to the dimensions of the rest of the structure (fig. 4). It is therefore possible to outline a real semantics that defines a connection line between all the projects in the *Album dei fari*, designed with the same style of representation. Together with the proportional relationship of the building organisms, the *Album*'s lights are

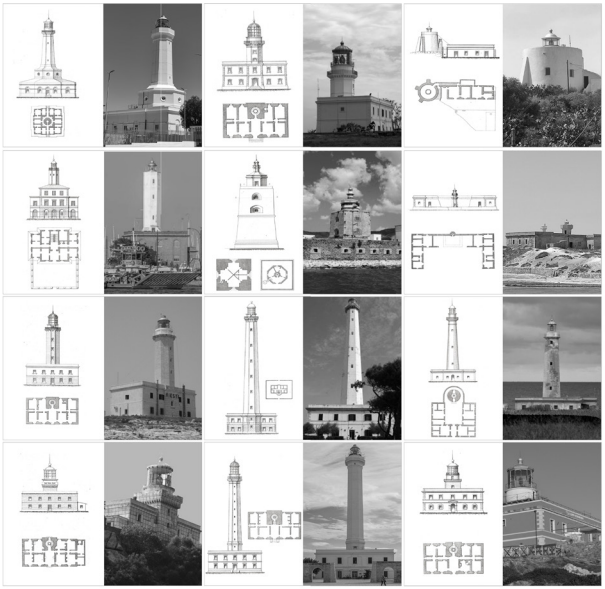

Fig. 5. The existing lighthouses with an architectural composition consistent with the projects in the Album dei fari [Regno d'Italia/Ministero dei Lavori Pubblici 1873] (graphic composition by the author).

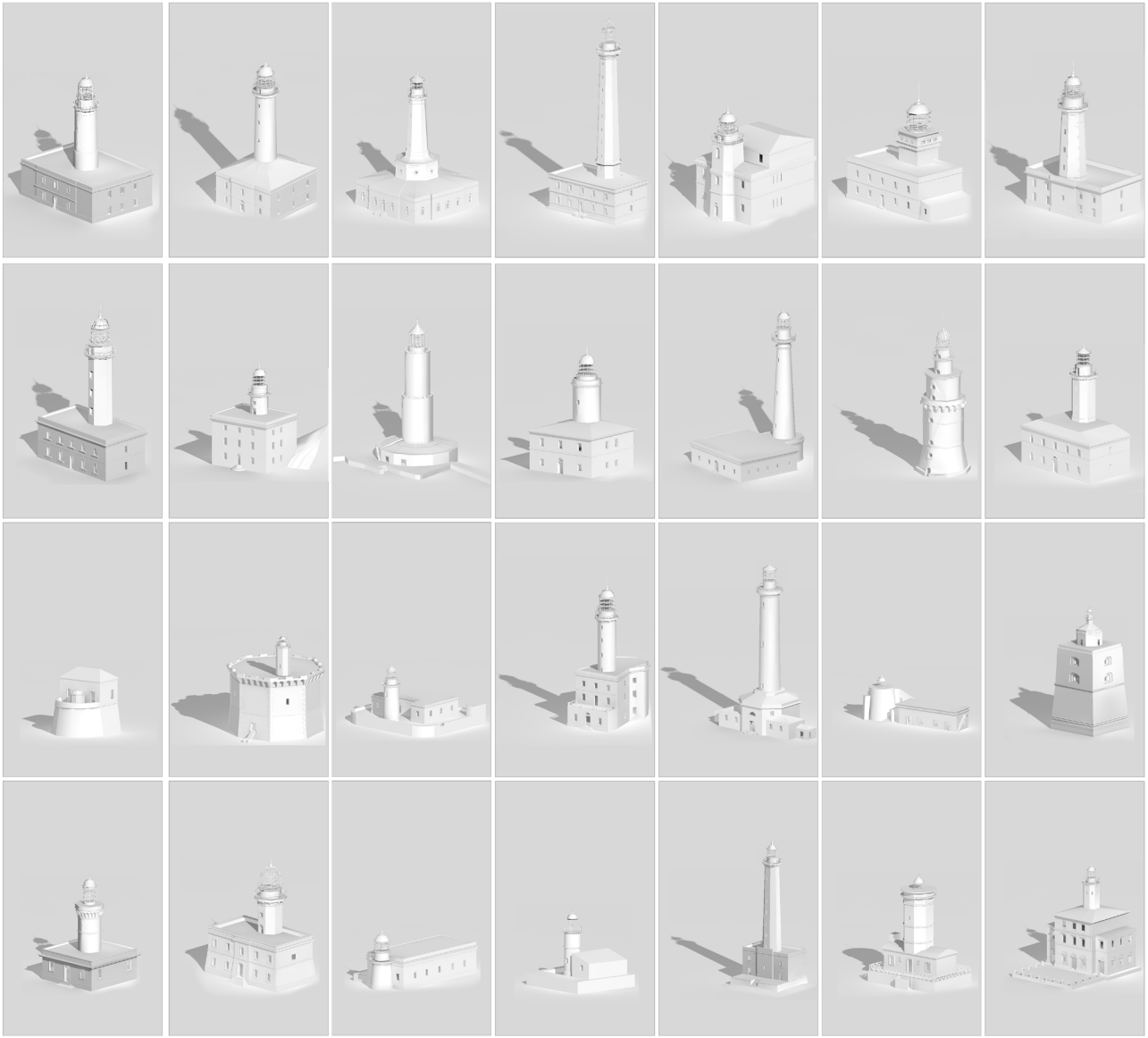

Fig. 6. Three-dimensional models of the lighthouses belonging to the Album dei fari (graphic elaboration by the author).

designed following the morphological characteristics of the territory on which they stand, as well as being classified and divided into six "orders", depending on the range reached by the light emission. As for the compositional typology of these buildings, if the height of the tower depends exclusively on the coastal rise on which the turreted structure is positioned –a low tower corresponds to a high height above sea level, a high tower corresponds to a 'low height above sea level– the height of the building does not depend on external sighting factors, as much as on the use of the lighthouse by the guardians. In fact, as is well known, in the past these buildings have always been inhabited by the lighthouse keeper or several lighthouse workers who, together with the family, maintain and monitor the correct functioning of the light source. The structure of the building, therefore, expressly depends on the spatial needs of families and the area dedicated to offices. In this sense, in fact, starting from the 1970s it is increasingly difficult to witness a coastal construction that includes a building used as accommodation since, with the advent of automation, monumental coastal constructions are being stopped, yielding the step to the construction of lighthouses on metal trusses, with the least economic expenditure and simpler maintenance.
To date, these structures are still present along the entire coast of our territory, although they are in conditions of extreme deterioration. In this sense, in fact, the maintenance of the architectural apparatus is often reserved solely for the tower, as a structure supporting the light emission and the lantern. With regard to the architectural composition, a substantial number of lighthouses find its genesis in a subsequent period with respect to the *Album dei fari,* while maintaining its characteristics and style. Another part of them, on the other hand, is structurally configured in a coherent way with respect to the project of the *Album* of the headlights, confirming the magnificence of this programming, with extremely current geometries and enormously efficient geometric-structural relationships. With regard to the lighthouses still existing today in which the geometric and architectural structure can be traced back to the period forming part of the Unification of Italy, it is possible to mention some of the most significant lighthouses including the lighthouse of: Cozzo Spadaro (SR); Capo Bellavista (CA); Capo Colonna (CZ); Capo Granitola (TP); Capo Milazzo (ME); Capo Santa Maria di Leuca (LE); Capo Spartivento (CA); Della Formica (TP); Isola delle Correnti (SR); Livorno (LI); Porto Corsini (RA); San Cataldo (BA); Capo Spartivento (CA); San Rainieri (ME) and Vieste (FG) (fig. 5).

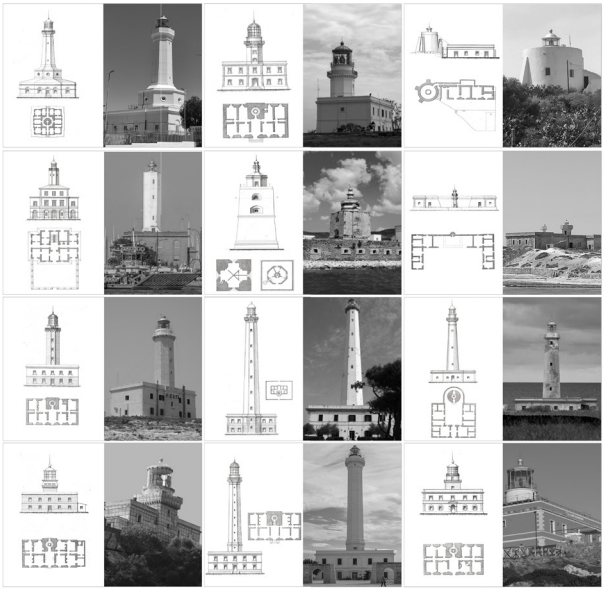

Fig. 7. QR-code for the three-dimensional and interactive use of the three-dimensional models of some lighthouses belonging to the Album dei fari (graphic elaboration by the author).

The digitization of coastal archives

Recent years have seen the intertwining of increasingly innovative and pressing dynamics in the field of cultural heritage, often subject to sudden changes in the field of use and dissemination. In this sense, cultural institutions, in order to overcome the gap existing between fruition and proposed offer and to create ever new and imaginative visions, can use ICT, which is a valid tool for digitization and the connection between hard science and soft science. The latter are configured as fundamental in the connection between knowledge [5], in order to improve accessibility, communication and understanding. The issue of accessibility [6] and of the enhancement applied to art and cultural and artistic heritage are today columns brought into the context of the different topics relating to the main regional and national programs, among which we recall the 2030 Agenda [7] and the main ERC sectors. In order to effectively implement all the actions proposed for the protection of the archival heritage, the figure of the archivist is born today, necessary for the cataloging of the asset, equipped with the knowledge and fundamental skills for the use and management of cataloging and historical knowledge, to be supported by the subject or group of people in charge of digitizing historical material [Audisio 2011].
In fact, digitization proves to be a great inspiration for initiatives capable of making projects usable, through which to generate tourist-cultural flows and give voice not only to silent fragments but also to projects that have never been realized or partially realized according to archival configurations. This is because the three-dimensional transposition of archive projects makes it possible to imagine and visualize in an immersive way excerpts of past and present memory, or the testimony of the succession of countless unique and characterizing architectural styles. Therefore, the cataloging and digitization of architectural archives are fundamental assets for the conservation of historical memory, in which the perfect synergy between the figure of the archivist and that of the modeler architect becomes fundamental. It is in fact known how the digitization of cultural assets in the museum and library context is configured as the flagship of European strategies in terms of enhancement and communication of the same assets. In this sense, communication and mediation between more or less fragmentary archival sources can be identified as the right strategy to involve the public, establishing a greater interest in culture and its relative safeguarding, enriching the common identity [Niccolucci 2006].
The intent of digitizing the *Album dei fari* is explicit with the implementation of a coastal reinterpretation based on the two-dimensional redesign of the geometries making up the ninety-four lighthouses present in the official documentation. The redesign, on the basis of archival documents and photographic supports of the projects carried out and in part still existing, turns out to be a preparatory action for the development of three-dimensional models through which to understand the volumetric and spatial relationships that existed belonging to the coastal military architecture of the post-unitary period according to unprecedented perspectives (fig. 6). The three-dimensional models reproduced according to a faithful trace of the official documentation –whether they have been created and no longer exist, created and still exist or never created– can be enjoyed three-dimensionally and immersively by all types of publics, by uploading them to an open source website or app to be used by means of a QRcode or by simply searching by type of lighthouse (fig. 7). The three-dimensional models, in addition to being an interactive object of knowledge for the user, lend themselves to different uses aimed at the dissemination of architecture in their historical and archival configuration. It is in fact possible to project the three-dimensional model of the architecture obtained from the three-dimensional digitization of the archive drawings on the prospect of the existing lighthouse-architecture, generating as a result a perfect *continuum* between virtual space and real space, between ancient and contemporary history.
In a hypothetical museum context, on the other hand, the preparatory creation of three-dimensional models makes it possible to print 3D objects, ensuring use and accessibility not only from an intellectual point of view but also for people with sensory-perceptive disabilities or children (fig. 8). In this sense, it should be remembered that "cognitive activity cannot be understood except by taking into account its plasticity, its becoming interactive, its continuously redefined relationship with the environment" [Lévy 1992, p. 5]. It is precisely in compliance with what Lévy argued

that, through the three-dimensional production of the lighthouse models belonging to the *Album dei fari*, it is possible to develop a type of knowledge resulting from concrete events and experimentation, facilitating the analysis processes, enhancing learning and facilitating the sharing of ideas and social space [Mori, Niewint-Gori 2019], towards the consequent dissemination of otherwise silent archival material. The construction of three-dimensional 'decomposed' models to be subsequently recomposed can, for example, be configured as one of the effective tools to ensure the knowledge and dissemination of historical archives, in full compliance with the rules on which edutainment is based, as well as a suitable solution for all types of museum structures as low cost, for museum structures of all sizes and for all types of users.

Conclusions. The importance of archival sources: between past and present

The *Album dei Fari illustrato dalle notizie intorno ai loro caratteri e posizione non che da quelle intorno alle spese di costruzione e impianto e di annuo mantenimento ed illuminazione* it still appears to be a virtuous example in the context of the theme of architectural archives. The interest on the part of the Kingdom of Italy in strengthening the coastal network of Italian lighthouses in an architectural and structural sense, through the design and partly construction of four hundred and sixty-two maritime signals for the eight thousand kilometers of coastline, is an example of the political importance technology reserved for this type of coastal architecture. The eighty-one tables of the *Album dei fari*, still available today in the National Libraries and in some State Archives, are configured as the prerequisite through which to start a new reinterpretation of the archives and the lighthouses themselves, towards an indissoluble union between history and innovation to be implemented according to the dictates of interdisciplinarity. The question of the dissemination and analysis of archives in architecture, in fact, in addition to being a mere cataloging carried out by architects, today opens up and is understood as an anthology of the architectural stylistic process to be implemented in a multidisciplinary context, though not only architects but also computer scientists, experts' conservation,

Fig. 8. Plate for the use of the three-dimensional model of the lighthouse in the museum context (elaboration by the author).

digitization, graphics, etc. [Albisinni, De Carlo 2011]. The dissemination of the lighthouse through the study and archival dissemination becomes today the key element through which to undertake a path aimed at the historical and technological knowledge of the entire Italian coastal system, or a privileged asset for the innovation and development of the entire community. In accordance with the guidelines promoted by the European community and UNESCO [8], in fact, the culture-oriented growth models have the objective of increasing the value of the common good in its multiple characterizations, aimed at the development of devices and systems of conjunction capable of re-connecting communities through knowledge. The digitization of the archival heritage, therefore, represents the only escape route for the protection of the same heritage [Audisio 2011], although it should not be forgotten how the authenticity and importance of the archival document is configured as the only source original and original from which to draw information for cataloging and digitizing it. In this context, the dissemination of data through digital and figurative support represents the ideal tool through which to organize and disseminate this vast cultural heritage, allowing it to adequately legitimize its value-utility, incorporating its validity into contemporary ways of life and giving voice to otherwise silent archival fragments [Montella 2009].

Notes

[1] The National Association of Archives of Architecture, founded in 1999 with the specific intention of grouping archival material in a single system, and MAXXI, developed in 2002 with the same intent, are part of the organizations aimed at safeguarding and sharing archives.

[2] Already Homer, in the 19th book of the Iliad, compares the Achilles' shield shimmering to one of those fires that rise from heights and make the way safe for seafarers, but the concept of a "lighthouse" did not arise until 300 B.C. with Colossus of Rhodes and lighthouse of Alexandria [Simonetti 2006, p. 3].

[3] This is how the introduction of the *Album* reads: "If there is a country where lighthouses can be said to be indispensable more than anywhere else, it is certainly Italy, not so much for its topographical position, but for the development of its so rugged coast" [Regno d'Italia/Ministero dei Lavori Pubblici 1873].

[4] In the field of archival design of lighthouses, we recall the projects and surveys of the *Historic American Buildings Survey* (HABS) and the *Historic American Engineering Record* (HAER), which document the successes achieved, not only in the farological field, by the United States [Amoruso 2005, p. 81].

[5] The profoundly pervasive ICT technologies have a direct impact on expanding our real experience of space, be it physical or digital.

[6] It should be emphasized that accessibility does not merely mean the physical use of the archival source but also the sense-perceptive one. In this sense, there are numerous projects carried out by MiBACT aimed at overcoming these barriers for universal accessibility, as highlighted by point 8 of the *London Charter*: "knowledge, interpretation and management of cultural heritage". To know more: <http://www.londoncharter.org/index.html>(accessed 13 February 2022).

[7] The 2030 Agenda defines the points for sustainable development to be achieved by 2030, identifying 17 Sustainable Development Goals (SDGs) and 169 targets.

[8] UNESCO, World Conference on Cultural Policies, Mexico City, 26 July-6 August 1982. For further information: <https://unesdoc.unesco.org/ark:/48223/pf0000052505> (accessed 16 February 2022).

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Digital Translations of Paper Architectures

Vincenzo Bagnolo, Raffaele Argiolas, Simone Cera

Abstract

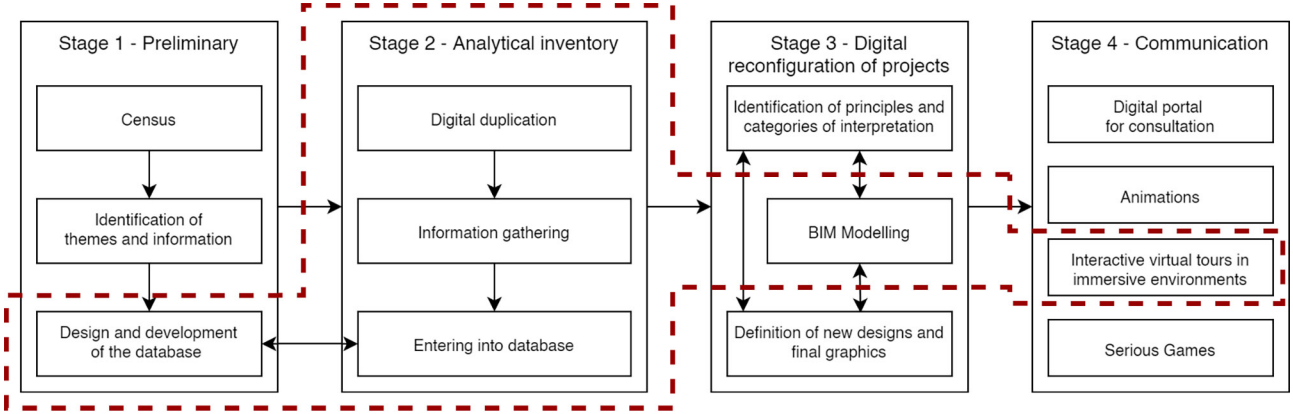
The digitization of architectural archives has opened an evaluation on the contributions that the digital medium can provide in the production, consultation and dissemination of the archival heritage. The Department of Environmental Civil Engineering and Architecture (DICAAR) of the University of Cagliari holds a large collection of drawings and photographic materials that testify the didactic activity of the School of Architecture and reveal the names of generations of architects and engineers trained in Cagliari. Studying and preserving this heritage means first conserving and transmitting the memory of the school in Cagliari, but also exploring new ways to investigate and communicate the hidden meanings of drawings on paper. The paper analyzes the development of a workflow aimed at the digitization, enhancement and dissemination of project drawings carried out by 41 students at the Royal University of Cagliari to be declared a Civil Architect. Made under the supervision of Gaetano Cima, one of the most important figures in the culture of nineteenth-century architectural and urban design in Sardinia, the 41 projects offer the opportunity to investigate the potential of the digital medium in the construction of personalized and multimedia knowledge paths. Through the definition of narrative segments, the study is oriented towards the construction of an archive that becomes a virtual museum, capable of accompanying the public in the 'visit' of never built architectures.

Keywords: architectural archives, paper architectures, Gaetano Cima, BIM, VR.

Introduction

With the advances in the world of technologies for the communication of cultural heritage, archives have taken on an unprecedented role with an enlarged audience that is no longer just that of expert users. Today the archives try to give answers to the growing demand for generic seekers who are guided and accompanied in consulting the databases thanks to the tools of the digital medium. The new interest shown by the general public has forced a reflection on the functions to which today an archive must and can perform. Online inventories, digital reproductions, research guides to navigate the documentary system of the archive are some of the most popular tools among the structured resources normally offered to remote users. But the digital medium is certainly not sufficient to guarantee an effective digital migration of knowledge and the traditional archival tools made available remotely sometimes prove to be lacking, especially in relation to the descriptions that often prove not very usable and effective for users [Alfieri, Feliciati 2017]. Today we are all aware that, in the enhancement of documentary heritage, it is no longer sufficient to offer the description of archival collections and producers through guided research tools on predefined themes and paths. The consultation should present the heritage allowing the construction of personalized paths of knowledge by proposing different levels of analyticity. Archives accessible remotely have so far experienced the transition to digital mainly in terms of purely quantitative extension of the materials made available online, leaving in the background the advan-

Fig. 1. Workflow for the digitalization and communication process of paper architectures [graphic elaboration Raffaele Argiolas, scientific coordinator Vincenzo Bagnolo].



tages that ICT (Information and Communication Technologies) can give not only in terms of remote access to documents but also in terms of "cognitive accessibility" to the multiple latent information inherent in the different types of documents. If this is generally true for all types of archives, undoubtedly the strength of the digital medium and of the possible reconfigurations manifests itself even more effectively for architectural archives [Armstrong 2006; Chiavoni, Diacomitri, Di Pietro Martinelli 2019; Palestini 2017; Vernizzi 2020; Willis 1996].
The adoption of new languages that take advantage of ICT both in production, with the construction of a range of information that is increasingly expanding, and in consultation, with diversified dynamic research paths, can allow a digital migration of the documentary heritage that amplifies relations with the public. The documentary heritage of the archives is no longer just something to be preserved and described but something to be 'exhibited' by weaving a 'narrative'. Feeding on a wide range of possible interactions, the remote visitor today is eager to build his own itinerary of knowledge. By avoiding exceeding in interpretations that undermine the path of knowledge transforming it only into a technological circus, at times the research can also disregard the hierarchical descriptions of the documentary units.
The 3D modeling process, implemented in digital archives with a process of reading and interpreting the paper design, reveals those meanings of architecture, often hidden even from the expert eye, that the public is unlikely to appreciate. The narration, as well as according to the two targets 'expert seeker' and 'casual seeker', can also be declined according to characterizing thematic sectors structured according to the different age groups, with not only informative but also didactic purposes.
The DICAAR, Department of Environmental Civil Engineering and Architecture of the University of Cagliari, houses a large collection of didactic tools used in the teaching of Drawing. Photographic collections of architecture, plaster casts, physical models and drawings tell the story of the didactic activity of the disciplines of drawing at the University of Cagliari in a period between 1843 and the 1970s, providing valuable evidence on academics training in this time frame [Chiavoni 2014].
In the study of a varied and articulated whole such as the DICAAR collection of drawings, it was decided to start with a first census of the architectural design drawings of the nineteenth century. The digital reproduction of paper drawings and the collection of some information directly related to the description of the individual architectural projects are the first steps in building a database. The database is designed to load not only a drawing section but also other different sections dedicated to all the other teaching tools for drawing kept at the DICAAR, as in the case of the collection of plaster casts which played a fundamental role in the exercise of the design for the training of architects [Bagnolo, Argiolas, Cocco Bellumori 2021].
For 19th century projects, among the documentation accompanying the digital raster reproductions of the draw-

ings, it was decided to include also some digital models that help to document, study, represent and communicate the reasons for the project and its results.
A first phase of the research aims to identify and define some key points for understanding and communicating the so-called 'paper architectures' in a digital environment. To test the database of the 'drawings section' and identify the categories of information to be associated with the documents, it was decided to build a workflow starting from the study of a selection of design documents. Graphic analysis of geometric and compositional matrices, critical interpretation, cognitive accessibility, 3D modeling, application of VR systems to AR and a web strategy to be adopted are just some of the possible approaches that must be part of the workflow (Fig. 1). This strategy is in line not only with the new research and dissemination needs of the scientific community but also with the demand of a wide audience.
The research aims to explore the potential of some categories of digital tools which at the same time can lead to two objectives: the construction of meanings strictly connected to the case study of the School of Gaetano Cima and some possible reconfigurations in the ways of enhancing and communicating architectural archive drawings.
The workflow is outlined through the study of the drawings selected between the 41 architectural projects for the final exam of Civil Architect taken by the students of Gaetano Cima (Figs 2-4). This is a project from 1859 which is divided into 5 tables, 4 of which are on a scale of 1:200: the drawing of the main facade (Fig. 2), the drawing of the general plan (Fig. 3), the drawing of the floor plan of the upper level in scale 1:100, the drawing of the longitudinal section (Fig. 4) and finally the drawing of the cross section. The 41 projects of the students of Gaetano Cima allow us today to investigate the architectural project design under many aspects: in the particular form of graphic drawings developed for a final examination, which today we could define as Thesis, in the role of design project of neoclassical architectures, in the reading of the characteristics of the is-

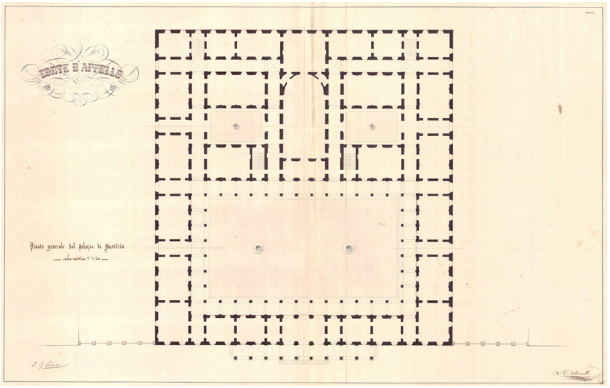


Fig. 2. Luigi Arthemalle Persi. Court of Appeal, drawing of the main facade of the building in the metric ratio 1: 200.

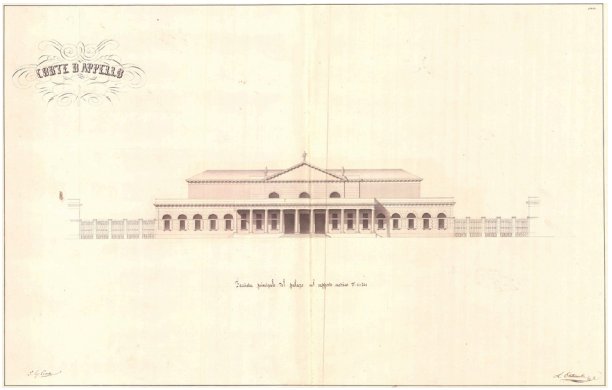


Fig. 3. Luigi Arthemalle Persi. Court of Appeal, drawing of the general plan of the courthouse, metric scale of 1: 200.

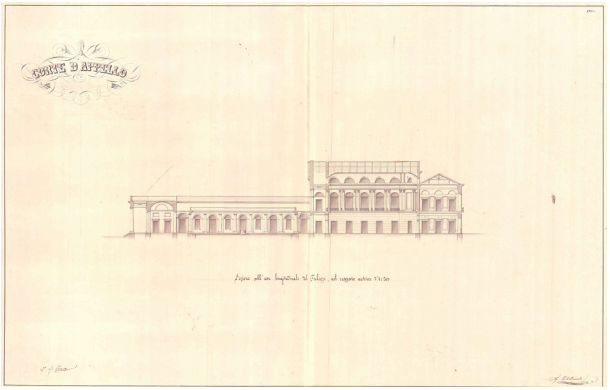


Fig. 4. Luigi Arthemalle Persi. Court of Appeal, longitudinal section of the building in the metric ratio of 1: 200.

land's architectural culture imparted by Cima in his teaching, in the critical reading of the graphic and compositional aspects of the projects, in the analysis of geometric matrices and in the possible 2D and 3D digital reconfigurations.

The pupils of Gaetano Cima

Gaetano Cima is certainly the most important exponent of nineteenth-century architectural and urban culture in Sardinia Born in Cagliari in 1805, he became a 'civil architec' at the Faculty of Sciences and Letters of the University of Turin where he studied between 1826 and 1830 as a pupil of Ferdinando Bonsignore. In the following three years he perfected himself at the Accademia di San Luca in Rome. Back in Sardinia, he began to work for the Genio Civile until he became Chief Architect of the city of Cagliari [Del Panta 1983]. His experience as a university professor began in 1840. In 1863 he was confirmed full professor of architectural drawing, becoming dean of the Faculty of Physical, Mathematical and Natural Sciences of the University of Cagliari. He died in 1878. If the figure of Gaetano Cima as architect and urban planner is well known [Del Panta 1983; Sanna 1996; Serra 1995], the same cannot be said about Gaetano Cima's role as professor at the University of Cagliari and his teaching activity [Masala 2002a; Masala 2002b].
The drawings made by 41 students of the Royal University of Cagliari at the end of their studies to be declared a "Civil Architect" correspond to 41 projects now kept in the Disegno section of the DICAAR. By addressing and developing some typical themes of nineteenth-century architectural and urban culture, these projects testify to the profound economic and social transformations of the time.
The 41 'Theses' offer a unique opportunity to study a body of projects carried out between 1843 and 1864 and to deepen the knowledge on the academic training of the students of Gaetano Cima. Among the drawings we find mainly the projects of large public buildings and some representative residences that enhance the functionalist aspects of nineteenth century 'rationalism'. Cima assigns to his students a series of buildings destined among other things to library, theater, stock exchange, school, public archive, town hall, court, bank, orphanage, hospice for the poor, meteorological observatory, or botanical garden to name a few [Bagnolo 2011]. The final exam for Civil Architect involved the design of a project to be developed on a theme assigned by Gaetano Cima.
Cima himself in 1852 in his notes kept at the Historical Municipal Archives of Cagliari (Archivio Storico Comunale di Cagliari - ACC), in relation to the program of his lessons, writes that the students of Architecture, after having received the approval in the third year exam, must take a public experiment on all the subjects taught in it and on the composition of an architectural project, with related drawings, calculations and written dissertations, according to the theme proposed, a few months before, by the professor to each of the candidates [A.C.C., Carte Cima, No.26].
The 41 projects are accompanied by the original text of the theme dictated by Cima with precise indications on aspects such as the geometry of the building, the morphology of the site, the principles and architectural models of reference, the level of richness of the decorations. In the indications given by Gaetano Cima, the description of a design theme expressed both from a formal and substantial point of view reveals the "*caractere convenable à chaque genre d'édifices*" [Blondel 1771, p. 318].
The historical-cultural context of the 41 projects and their nature of design proposals for important public buildings and residences, led to the choice for an expansion of the database structure with the integration of BIM models.
In addition to the advantages made possible thanks to the immediacy of the graphic coding of 3D visualization, the integration of BIM models offers several advantages in the modeling procedures and in the communication of projects.
To test a workflow, the study of a sample of projects allowed the selection of formats and standards of digital models. The examination of the projects began with the identification of one of the 'Theses' to be used as a model for the development of the workflow. The construction of the BIM model allowed an initial verification of the hypotheses made regarding the choice of the digital modeling environment [Spallone 2016; Spallone, Natta 2022], with the subsequent implementation of a virtual tour in immersive environments [Osello, Lucibello, Morgagni 2018].
The chosen project is the theme proposed to the candidate Luigi Arthemalle Persi for the public examination of Civil Architecture on 13 October 1859 (Figs. 2-4). The theme assigned to Luigi Arthemalle Persi envisages the design of a Court of Appeal whose main façade overlooks a rectangular courtyard surrounded by architraved peristyles and rooms for the guardhouse and minor offices. Cima defines all the different functions of the rooms of the building, providing precise indications on the maximum dimensions of the fronts, on the size of the surfaces, on the number of floors, on the difference in level of the ground. A prostyle decastyle on a base

of seven steps adorns the external front and leads to the primary vestibule. The main hall, with galleries around it, is placed in the middle of the building, rising with a double height; the width should be eleven meters, and the length should be one and a half greater than the width, not counting the radius of the grandstand that is on the side opposite the entrance. Cima also emphasizes the character that architecture must communicate: the solidity of the construction and the choice of decorations help to excite the concept of stability and equality of laws, and the patronage that it offers to every class of citizens. The robustness of the architectural order, the simplicity of the right symmetries, must express the idea of a sanctuary of justice entrusted to the care of upright and wise magistrates [Archivio Disegni DICAAR, Allievi Cima, n.26].

The database

In order for information to be exchanged effectively, it needs to be organised and classified by means of shared and understandable encodings; this makes it possible for the same data to be used by users with different skills and purposes [Schweibenz 2019]. In the digital sphere, one of the most widely used data structures is undoubtedly that of databases, particularly relational databases, in which information is organised in tables linked together by means of data relations, allowing targeted searches by setting filters or search parameters. The development of a relational database is therefore one of the most logical solutions for cataloguing, archiving and subsequently communicating information, whether extracted from the original documents or resulting from subsequent processing; this also allows dialogue between the database containing the general information and the BIM models to be generated, thanks to the organisation of the latter in databases. The structure of the database is schematised in Fig. 5. Consultation of the database takes place by means of query cards in which it is possible to view the main information relating to the individual works, enter new information or carry out searches. Each sheet is formatted according to the type of element displayed, and in the specific case of the works by Cima's students, information is available on the author, the physical support, the technique used and so on [Chiavoni 2014]. As it can be noticed, inside the database there are data related not only to the final elaborations of Cima's students, but also regarding other materials in possession of the Drawing Laboratory of the Faculty of Engineering and Architecture of Cagliari; among these there are photographic and video materials, the elaborations produced during the years in the Drawing courses or even the plaster casts used for teaching purposes purchased by the Laboratory at the beginning of the last century [Bagnolo, Argiolas, Rocco Bellumori2021a]. Similarly to what is foreseen for the plaster casts, also for the drawings of Cima's students the database foresees the insertion of links to digital elaborates and in particular to 3D models; in the case of the produced BIM models, their consultation can be structured through HTML pages specifically developed for the visualization of IFC models that, directly exported from *Revit*, contain univocal IDs that would allow the exchange of data between *Revit* model, database/archive and web interface.

BIM modeling for paper architectures

3D modelling of designed architecture provides the possibility of considerations and studies that would be difficult to achieve with the analysis of 2D drawings in paper form alone, allowing new studies of spatiality or building coherence. Digitisation, and in particular the modelling of a project starting from the paper, thus excluding a design intervention, has as a fundamental requirement the interpretation of the drawings according to a logic not dissimilar to that used in the survey of the built environment. The design choices and the techniques used to implement them are analysed and validated to produce drawings that tell the story of the architecture surveyed.

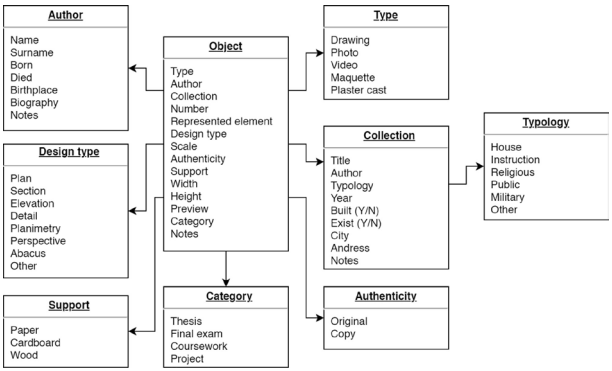


Fig. 5. Structure of the paper architectures database [graphic elaboration Raffaele Argiolas, scientific coordinator Vincenzo Bagnolo].

While this is true for classical modelling, there are tools that can expand these possibilities by parallel modelling of both geometric and physical-constructive information.
In this sense HBIM processes, and in particular their practical implementation called Scan-to-BIM, are of increasing interest for the collection and management of information related to historical heritage. The so-called 'as-built' approach, however, cannot be applied to architecture on paper, if not through a change of paradigm; while the need for a conscious and interpretative reading remains unchanged, a further step must be taken when the information gaps cannot be filled for obvious reasons through a direct reading of the built architecture.
Recent researches analyze and demonstrate how HBIM processes, if properly applied to architectural drawings, can offer interesting potentialities for their analysis and communication [Spallone,Natta 2022]; in this contribution the potentialities of HBIM in terms of digital reconfigurations of architectures on paper aimed at the generation of elaborations necessary for the understanding of the architectures but not present among the original documentation are addressed. In the specific case of the final works of the Cima students, united by the school to which they belong, the BIM methodology, based on the use of 'families' of reusable elements allows the identification of possible invariant objects within more than one project.
Another important advantage of using BIM is the possibility of associating each object with an attribute indicating the level of deduction required to model the object.
Notwithstanding the potentialities exposed by the BIM methodology, the use of BIM software still requires that these are supported by other tools for a better expressive and graphic management, aspects that often transcend the normal BIM logic.

The BIM model

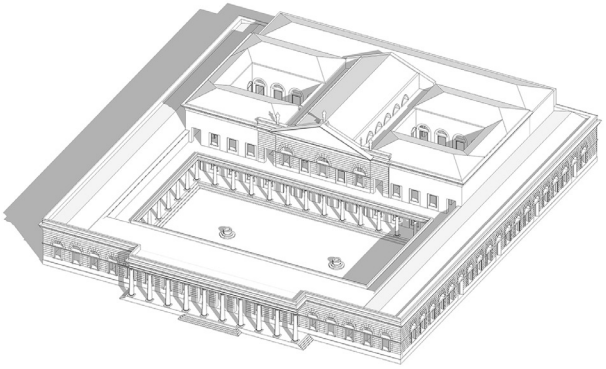
As we know, in the approach called HBIM [Murphy 2009], the development of the intelligent model comes after an initial and fundamental phase of research and critical reading of archival and design sources. The modelling is based on geometric information extracted from point clouds obtained through survey methodologies of the existing such as laser scanning and photogrammetry. The result of the modelling of the built environment is therefore a digital model that is as congruent as possible and geometrically consistent with the work carried out. The model obtained is also enriched with semantic information deriving from in-depth documentary and archival analysis.

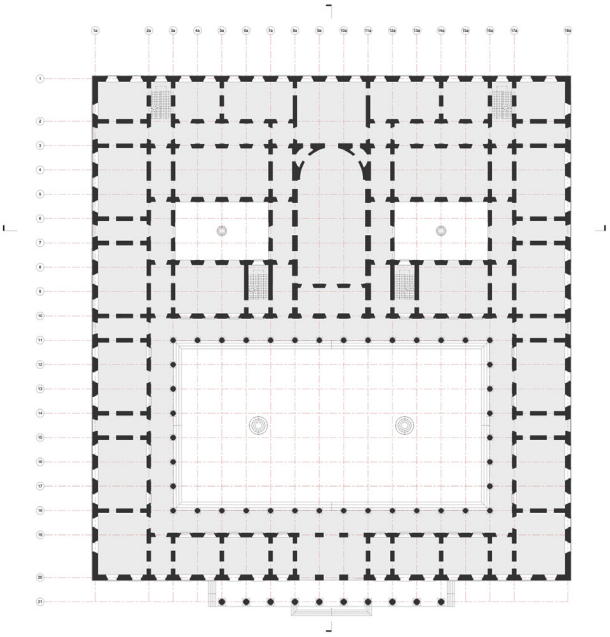
Tab. 1 Some of the characteristics of the three main categories of software involved in the process database [graphic elaboration Raffaele Argiolas, scientific coordinator Vincenzo Bagnolo].

	Vectorial drawing	3D modelling	BIM
Raster to vectorial	✓	✓	✓
Advanced custom graphic	✓	×	×
3D modelling	×	✓	✓
Parameterisation	×	✓	✓
Models for virtual environments	×	✓	✓
Data adding	×	×	✓
Automatic drafts generation	×	×	✓

In the case of architecture on paper, a different approach is required. The digital reconfiguration in this case represents an interpretative tool that from the paper supports the reading and understanding of the project.
On the one hand, the overabundance and heterogeneity of information and details makes it difficult to be read, also because of the disunity of the various documents; on the other hand, it makes it possible to gain greater knowledge of the work and to better read, understand and translate its latent meanings. There are therefore substantial differences in approach compared to the modelling of the existing. These differences are due to the existence of a more complex process of critical interpretation resulting from an approach that admits and maintains the existence of different levels of uncertainty. This is a circular process that does not end with the initial process of reading the drawings but is also reiterated in the modelling phase whenever a new meaning is encountered, even if potential and not clearly represented or communicated. Based on what has been previously written, it has been decided to conduct the digital reconfiguration of the paper documents of the thesis project for a Court of Appeal through the identification and classification of three different levels of information: overt information, inferred information and latent information.
Obvious information is that which is clearly and directly evident from the drawings.
Deduced information, on the other hand, is not explicitly stated, \but can be interpreted and deduced through reasoning on the drawings of the project itself. An example is the interpretation of the design of the side and rear elevations. The case study has in fact some information gaps regard-

ing the three elevations, which do not appear in any of the drawings. However, it was possible to hypothesise the design during the modelling phase, based on the scanning of the elements that make up the main elevation. Through the comparative reading of the main elevation and the recognition of common elements in the plan, it was possible to hypothesise the vertical scanning of the smooth basement - facade treatment with continuous horizontal strips and crowning with projecting moulded cornice. It was also possible to hypothesise with a good level of certainty the scansion of portals and windows, associating each time style, geometry and position of mouldings and string-course cornices, based on compositional logic already explained by the author. The axonometric view in figure 6 shows the result of this interpretation.
Through the redesign of the plan, it was also possible to trace the primary compositional matrix. The planimetric composition is in fact based on a regular grid with a square module of four meters on each side (Fig. 6).
The latent information is also information that is not clearly explained in the drawings but, unlike the deduced information, it can be deduced indirectly through the study of the historical and cultural context in which the work is inserted, the comparison with historical treatises, with other works by the author or with works that are similar in terms of time, culture and territory to the case study.
An example is given by the interpretation of the design of the capitals of the columns that mark the galleries of the central vaulted hall, visible in the axonometric cross-section in figure 8. The level of detail of the author's original longitudinal section did not allow the exact design of the capitals to be read.
It was certainly possible to identify a Corinthian-style capital, but it was not possible to have a more detailed geometric description of its components.
In the modelling phase it was therefore chosen to refer to the parametric modelling of the typical Corinthian capital exposed by Aubin [Aubin 2014].





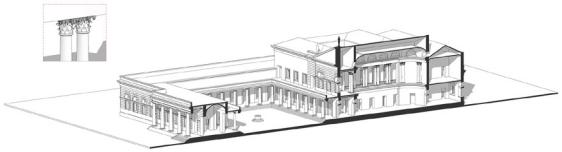


Fig. 6. Axonometric view database [graphic elaboration Simone Cera, scientific coordinator Vincenzo Bagnolo].

Fig. 7. Digital reconfiguration of the general plan of the Palace of Justice with the modular grid [graphic elaboration Simone Cera, scientific coordinator Vincenzo Bagnolo].

Fig. 8. Longitudinal axonometric section. A detail of the model of the Corinthian capitals of the second order of the main hall [graphic elaboration Simone Cera, scientific coordinator Vincenzo Bagnolo].

Another example is that of the Tuscan-style columns framing the central courtyard, which are also repeated in giant order on the main façade. In the interpretation of these elements, it was decided not to model the entasis of the shaft. Even though the Tuscanic order provides for this optical device of the shaft, it was decided to carry out the modelling in coherence with the original design of the author who, for reasons probably linked to time and the level of detail of the work, decided to neglect its representation. One of the interesting future developments is certainly that of assessing the typological and stylistic consistency of the elements through comparison with the most important reference treatises.
Through the study of the project, a methodological approach like that formulated for the survey of the existing, which we know is a process of awareness of the work. The process is therefore the result of choices and interpretations guided by a critical judgment capable of offering one or more keys to interpreting the case study.
The approach to the digital reconfiguration of the case study was conducted through the *Autodesk Revit* software, with which it was possible to create a model from which to extract various types of drawings that allow to extrapolate and relate a series of information in graphic or tabular format.
It was also decided to create special instance attributes, applicable to objects and rooms, which would allow the 4 degrees of deduction used in the parts modelling phase to be kept track of. Grade 0 is assigned to objects and environments for which no interpretative effort was required, as they are clearly and completely evident from the drawings. Grade 1 indicates that the object or environment is present and certain in the drawings, but not evident in its representation. Two examples of the assignment of this parameter are the functional program and the diagram of the hierarchy of serving and served environments. Grade 2 is assigned to objects and environments represented in the drawings but lacking in information for various reasons such as the scale of representation. Grade 3 is assigned to objects and environments not represented in the drawings and modelled based on deductions from information extracted from the project drawings and external sources. Any other graphic elaboration and analysis will be based on the model and the drawings produced through *Revit* but will be developed through the search for interoperability with other more suitable tools.
The analysis will then focus on further available documents

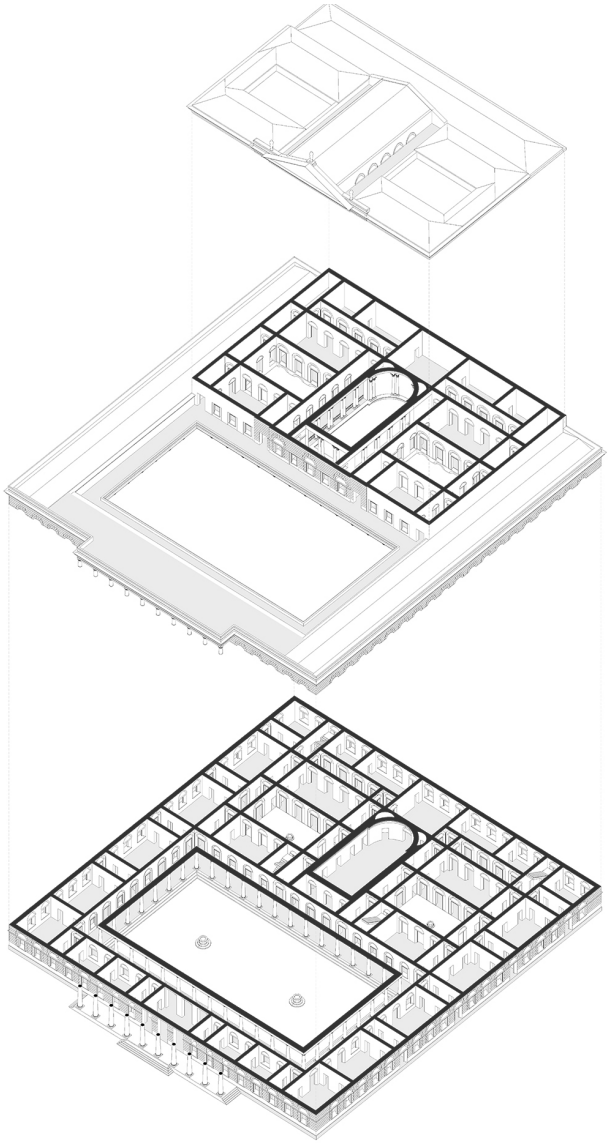
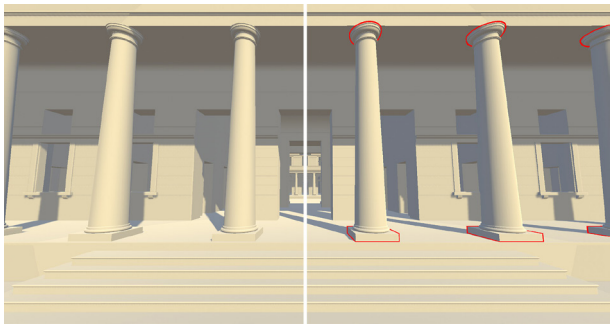


Fig. 9. Axonometric exploded view [graphic elaboration Simone Cera, scientific coordinator Vincenzo Bagnolo].

from the archive. In this way, it will be possible to extrapolate and relate - through the definition of appropriate parameters and the use of appropriate tools - a series of information from different case studies and produce works related to the work but not present among the original ones (Fig. 9) that are able to open up new interpretations of the meanings of the works.

Virtual tour

One of the uses of BIM models for communicative and didactic purposes that is finding more and more space in research is the development of virtual environments, understood as simulated spaces that can be crossed and interacted with by the user. In the cultural heritage sector, where technologies such as virtual reality, augmented reality and other forms of mixed reality have been experimented for some time [O'dwyer et al. 2021], the tool of virtual tours is widely used for the promotion and communication of cultural heritage [Arcese, Di Pietro, Guglielmetti 2011, Bekele et al. 2018]. This has led to increasing integrations between game engines and BIM models in order to exploit the hierarchies and information that the latter match the modelled objects [Bagnolo et al. 2021b; Milkova, Chadimova, Manenova 2019].
For the transposition of the Court of Appeal model into a virtual tour, it was decided to adopt the *Unity* game engine as the development environment; the choice is dictated by the relative simplicity in the initial stages of small prototype development and the wide range of free assets available; other game engines, such as the Unreal Engine, might be superior in aspects such as rendering power and photorealism [Christopoulou, Xinogalos 2017], but these are aspects that are beyond the scope and level of development established for the tour in question.
The transfer of models from *Revit* to *Unity* was done through the FBX format, which is handled natively by both software; moreover, this format allows preserving settings such as materials, element hierarchies, as set in *Revit* [Lee et al. 2019].
By means of a basic movement system and the preconfigured collision system in *Unity*, the model becomes an explorable environment for the user (figs. 10, 11); in addition to movements the user has available actions such as climbing or descending stairs, jumping, or 'falling' from elevated parts, making the model fully explorable.



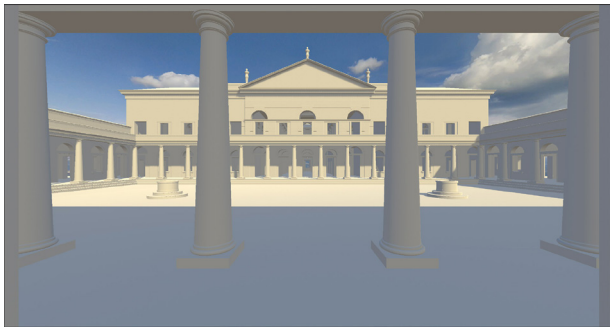


Fig. 10. The entrance to the complex in the virtual tour. On the right, an example of identifying elements with a certain degree of uncertainty in modeling [graphic elaboration Raffaele Argiolas, Simone Cera, scientific coordinator Vincenzo Bagnolo].

Fig. 11. View of the main courtyard in the virtual tour [graphic elaboration Raffaele Argiolas, Simone Cera, scientific coordinator Vincenzo Bagnolo].

Finally, by clicking the mouse, the user can interact with some of the objects on the tour by activating a colored border that identifies the degree of deduction described in the previous chapters.

Conclusions

With the advent of technologies for the communication of cultural heritage, traditional archiving and representation tools are no longer able to meet the needs of a large and 'new' audience. Creating content that establishes personalized and participatory user experiences must be one of the goals of digitization. It is necessary to respond to the growing need for additional functions to those that typically characterize the protection and enhancement of archival assets. This need is particularly evident and felt when we refer to architecture archives. The attention of the scientific community to the Archives of Architecture is now consolidated by initiatives and research that animate the debate on the so-called "paper architectures", as in the emblematic case of the project "Drawing in the Archives of Architecture" of the Unione Italiana Disegno [1].
One of the objectives of our research is undoubtedly to activate a path of knowledge of the heritage held by the DICAAR, documents that must also be included within the framework of the academic training courses of the Regia Università di Cagliari.
A first approach to the study of this heritage, preparatory to the census and the archival descriptions of the documentary units, necessarily passes through a reorganization of knowledge. A preliminary analysis of the information to guarantee an effective narration in a digital environment is also necessary. This introductory phase is essential to define effective tools functional to scientific research. At the same time, the new tools are also aimed at general users by supporting the enhancement of documents in the different forms allowed by technologies for the communication of cultural heritage. The methodology is based on the correlations between the operational aspects connected to the data and the construction of new meanings. The creation of thematic catalogs is further enriched through the implementation of technologies such as augmented reality, virtual tours in immersive environments, animations or training experiences through the creation of serious games.
Enhancing the latent contents of paper drawings and involving users in an active participation system also means defining a new digital space. In the case of architecture archives, this means taking on a new role very close to that of the virtual museum, where remote visitors feel free to access the narrative in a casual way or at least in a non-linear way [Rota 2015] in the now changed role of the visitor who becomes a "visit-actor" [Sangiorgi 2015].
The neoclassical culture of architectural design defines a theoretical operation of conformation of spaces and, at the same time, represents architecture in all its parts with a rigorous control of the individual elements. In the digital reconfigurations of the paper architecture, it was decided to operate in a BIM environment. This choice derives in part from some typical characteristics of neoclassical architecture but, mainly, from some advantages that this methodology offers within the proposed workflow. In addition to providing the tools typical of all standard 3D modeling environments, BIM allows you to impose relationship constraints between elements, offering the advantage of identifying recurring construction elements in different projects. This allowed us to model the individual elements in shared families and catalog them in analytical schedules. In the case of architectures that have never been built, the BIM environment facilitates the validation of the constructive consistency of the project. In addition, by creating instance attributes, the BIM environment offers the possibility of graphically translating the different degrees of uncertainty of the digital model. These levels of uncertainty typically derive from deficiencies in the starting information of the drawings. These may be due, for example, to the adoption of a certain reduction scale or to the lack of representation of some parts of the building, as happens when there is a drawing of only one elevation. In the digital model, these 'gaps' are filled by deducing the missing information from the other graphics.
The workflow is not meant to be the final output of the research. The workflow composes the steps of an integrated knowledge process between archive and design aimed at defining some models and digital tools for the enhancement and communication of paper architectures. In a multidisciplinary approach, in addition to the necessary involvement of archival sciences, a further extension of the tools may derive from the contributions of disciplines such as the history of architecture, architectural and urban composition or museology. In the long term, this multidisciplinary approach aims to define a methodological proposal that is no longer just occasional but generates a scientific criterion that can also be applied to other contexts.

Credits

Luigi Arthemalle Persi's drawings are in possession of the DICAAR - University of Cagliari. This article is the result of the joint work of the authors; in particular Vincenzo Bagnolo is mainly responsible for the paragraphs "Introduction", "The pupils of Gaetano Cima" and "Conclusions"; Raffaele Argiolas is mainly responsible for the paragraphs "Database", "BIM modeling for designed architectures" and "Virtual tour"; Simone Cera is mainly responsible for the paragraph "The BIM model". "Il modello BIM".

Note

[1] <https://www.unioneitalianadisegno.it/wp/archivi/> (accessed 20 April 2022).

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From the Shelf to the Map, from the Map to the Information Model and Back: the Archivio Porcheddu at the Politecnico di Torino

Maurizio Marco Bocconcino, Mariapaola Vozzola

Abstract

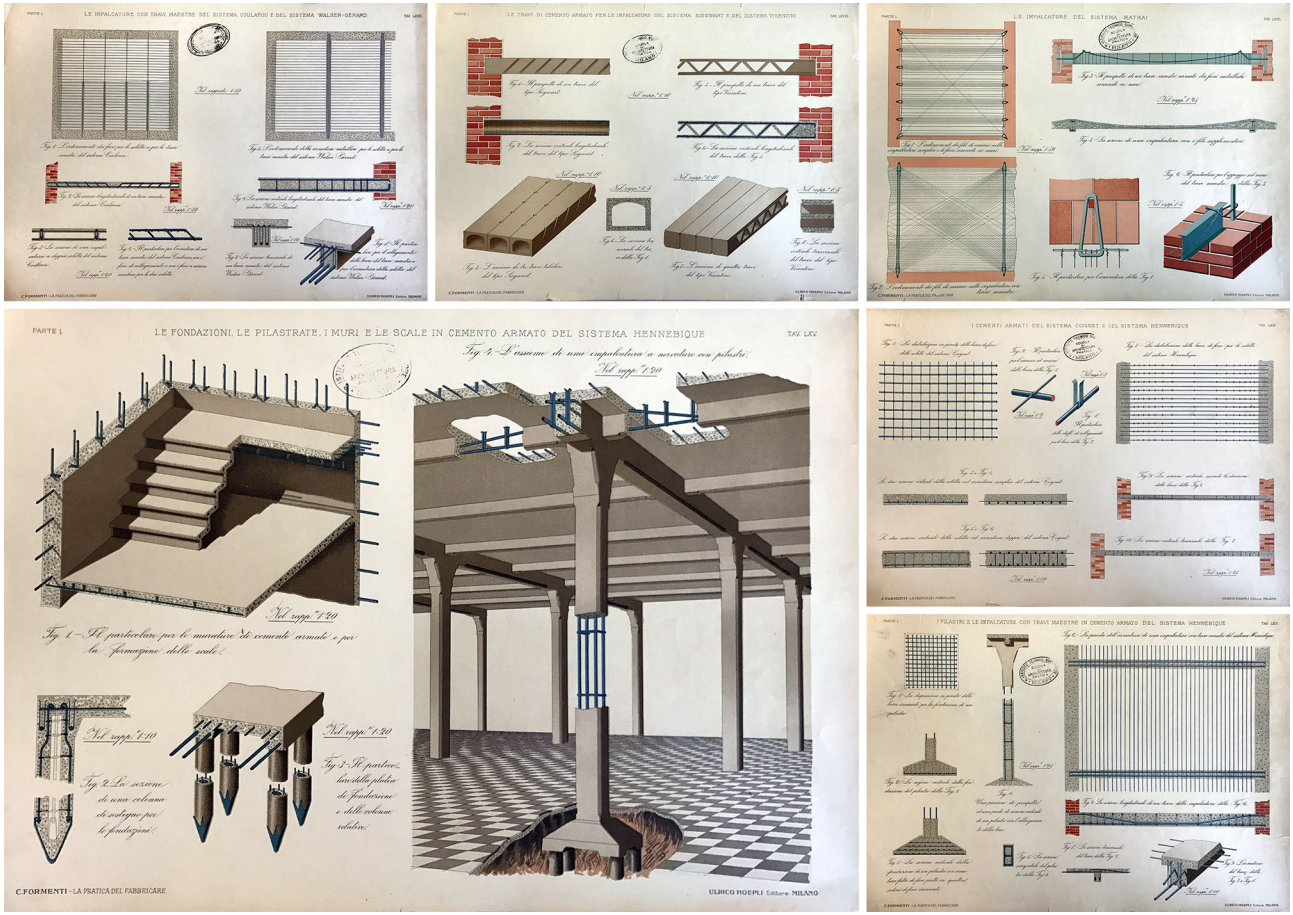
The Politecnico di Torino has undertaken actions to promote and disseminate its historical archival heritage as a unitary system of technical knowledge and information. The critical use of dedicated management methodologies and information technologies is the cornerstone for the enhancement of its repositories. The contribution illustrates the preparation of a web-based distributed information system that links together the apparatus of the Archivio G.A. Porcheddu in the period 1894 to 1994. Porcheddu in the period 1894 to1927 –Agent and General Concessionaire for Upper Italy of the system patented by François Hennebique– kept at the Department of Structural, Geotechnical and Builiding Engineering of the Politecnico di Torino. These heritages are rich in conceptual elements, brought to life by specially designed graphic supports, which effectively exploit the performance of digital technologies and restore value to the most recent studies on the City through more efficient processes of sharing.

Keywords: Archivio G. A. Porcheddu, Hennebique System, reinforced concrete collections and documentation, 3Dweb.

The cultural context and research activities

The development of the practice and graphic codification of reinforced concrete projects has been the subject of studies presented on several occasions for scientific discussion, including the cultural context within which this business archive, which is very interesting for the history of civil engineering, was formed.
As an example, graphic boards complement the volume of polychrome lithographs and accompany the 1909 re-edition of the 1893 *La pratica del fabbricare* manual by Carlo Formenti (professor at the Regio Istituto Tecnico di Milano), presenting some of the construction systems patented at the time: the reinforced cement of the Coignet system and the Hennebique system; the pillars and scaffolding with reinforced concrete main beams of the Hennebique system; the foundations, pillars, walls and stairs in reinforced concrete of the Hennebique system; the scaffolding of the Matrai system; the scaffolding with main beams of the Coularou system and the Walser-Gérard system; the reinforced concrete beams for scaffolding of the Siegwart system and the Visentini system (fig. 1).
The advent of reinforced concrete and its first applications constituted a field of research experience for the discipline of Drawing, which in some occasions of scientific comparison on the subject the Authors [Novello, Bocconcino 2018a] have defined as a "field of graphic experimentalism": maps and drawings that in the first projects anticipated that formal codifica-

Fig. 1. Concretes and reinforced cements in different construction systems [Formenti 1909].



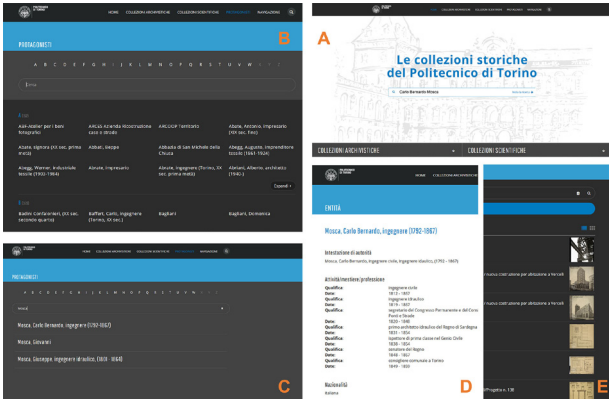
tion that was the matrix of representations that over time, and concerning the development of techniques, have evolved up to the current graphic standards. The Authors [Novello, Bocconcino 2020] have been investigating those expressive forms for a long time, largely based on the study of the vast *corpus* of documentary and iconographic sources of the Archivio G.A. Porcheddu [1], stored in the Department of Structural, Geotechnical and Building Engineering (DISEG) [2]. buildings, and their components.
The contribution shares the experience of an Italian university on the theme of diffusion, seen by the Politecnico di Torino as a structural aim of the management policies of its historical repertoires: *archivi vivendi*, which open up within the panoramas of technical knowledge to validate vocations and exclude dangerously risky interventions [Novello, Bocconcino 2019].
The complexity of the operation that we intend to bring to light at DISEG, resulting from the constant work of the Departmental Commission for Museum and Archival Heritage (coordinated by Pina Novello until November 2020), in line with the guidelines laid down by the Commission for the Enhancement of the Library, Archival and Museum Heritage of the Politecnico di Torino (coordinated by Professor Sergio Pace), lies in the fact that sharing and disseminating the results of the research cannot merely follow the care given to the dissemination of documentary, book and iconographic materials (fig. 2) [Novello, Bocconcino 2018b].

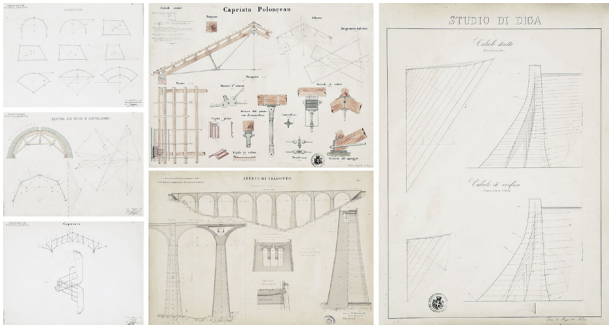
Fields of experimentation: Archivio Porcheddu at the Politecnico di Torino

Among the archives of the Politecnico di Torino endowed with DISEG, the Mosca and Porcheddu archives, scientifically edited by Pina Novello, Maurizio Marco Bocconcino and Paolo Piantanida, constitute a significant part of the entire patrimony preserved. To these fonds is linked an important repertory of works produced by the student engineers of the Regia Scuola di Applicazione per gli Ingegneri in Torino (files of reports, calculations and drawings) (fig. 3) and a large collection of construction models, historical models used between 1865 and the end of the 19th century as teaching aids; the cultural richness of this repertory

Fig. 2. Politecnico di Torino - Archival and Scientific Collections Portal (Le collezioni storiche del Politecnico di Torino: <https://collezionistoriche.polito.it/>, accessed 1 March 2022).

Fig. 3. Summary of the theoretical and practical activities of the art of manufacturing learned by the students (source: Politecnico di Torino, Allievi della Regia Scuola di Applicazione per gli Ingegneri, 1878-1897).





has prompted many studies displayed for the exhibition *L'arte di fabbricare - Giovanni Curioni and the birth of Construction Science* housed on the premises and accessible virtually [3].
The corpus of documentary and iconographic sources in the Porcheddu Archive is a precious heritage that is indispensable for investigating and understanding the birth and spread of reinforced concrete technology in design and construction practice. A distilled synthesis of the extensive iconographic apparatus preserved in the archive, which can be explored by using multiple thematic filters within an interesting and varied wealth, the applications developed lend themselves to being integrated to make those comparisons that are necessary to improve the understanding of a work and can therefore be used to support design choices for qualified reuse.
Finally, numerous studies have analysed the advent of reinforced concrete as a highly innovative construction technology through critical reviews and specialised in-depth studies, presenting different disciplinary approaches, mostly attributable to researchers from areas other than that of Drawing to which the authors belong [Albenga 1946; Gabetti 1955; Iori 2001]. The contribution of Nelva and Signorelli [1990] is very significant and accurate.

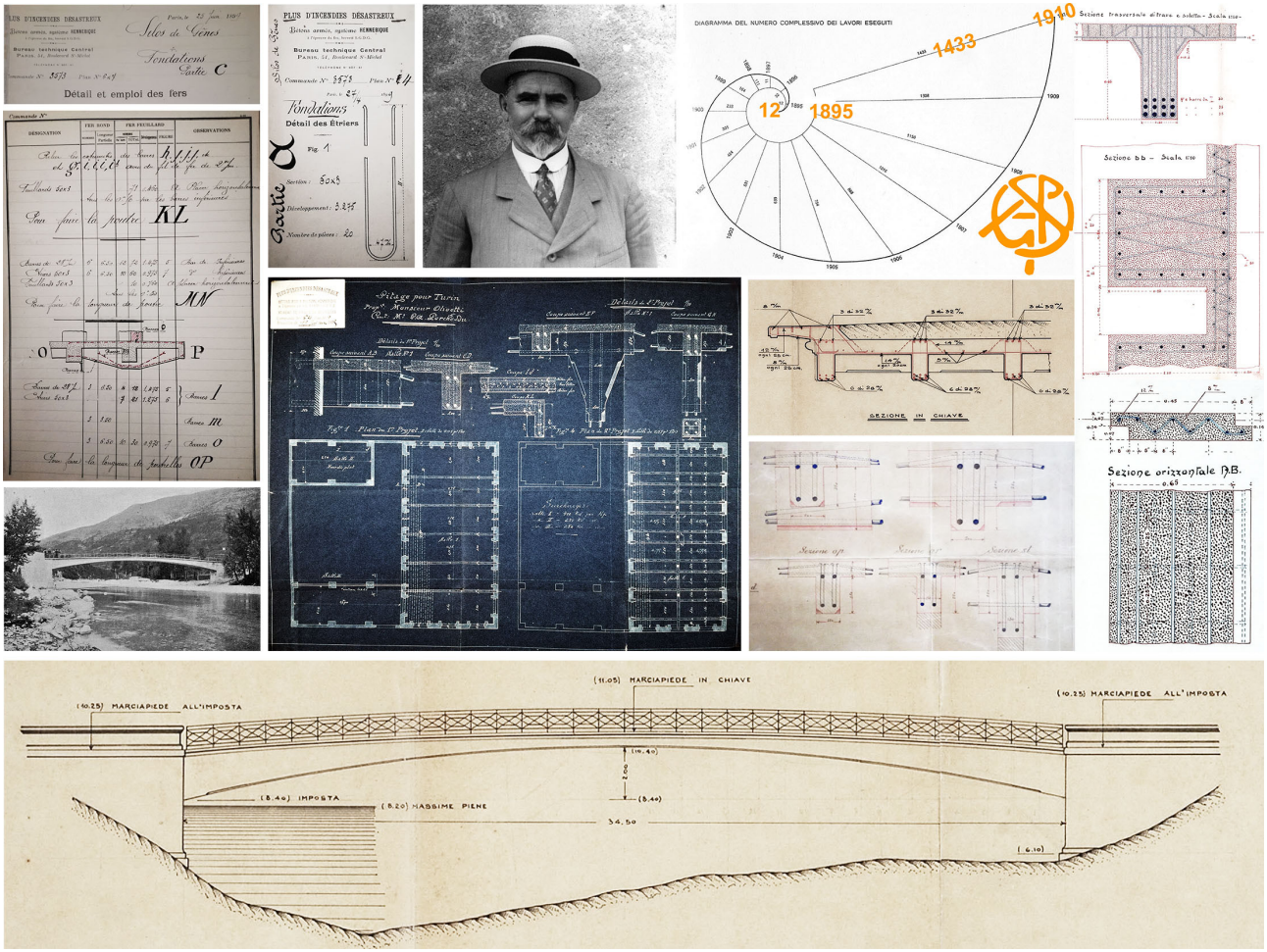
Graphic experimentation in reinforced concrete design

The documentation belonging to the Archive presents drawings aimed at executive and construction design, drawings developed within a workflow of a construction company specialised in an avant-garde field linked to international environments, intending to realise works that were also very demanding from the point of view of the construction site. If we want to dwell on the methods of representation used in the drawings, it is possible to note [Novello, Bocconcino, Donato 2017] a specification of information from the general to the particular, wherein the general plans the dimensions of the formwork and the arrangement and size of the reinforcement rods are defined; the introduction of a graphic convention for the floors, characterised by main beams and orthogonal ribs, which represents the soffit as reflected in a mirror placed below the floor, in French *plan vu en dessous*, and which is a convention that is still current; the cross-sections of the general plans turned over on-site, coordinating the views and modifying the scales of representation, according to the level of detail required; the partial sections on a larger scale, where the irons are extended for a stretch beyond the outline of the beam or column and hatched in the parts not in view.
Other interesting themes are the symbols of the sectioned conglomerate, which are replaced by simple contour lines; the irons, including the tie stirrups, which are represented with a continuous line; the measurements transcribed utilizing quotas placed in series, differentiated in the units of measurement, according to the element dimensioned: metres and centimetres for dimensioning and main and secondary modularity, millimetres for reinforcement. Again, in the first drawings, the colour was used to highlight the reinforcements. Later on, the need for multiple reproductions dictated the abandonment of colour and favoured simplified and conventional schematisation, with the increasingly frequent inclusion of textual, tabular and numerical annotations; as the complexity of the works increased, the structural component was represented in its own right, to better describe it and facilitate work on the site (fig. 4).
It is important to underline that the opportunity of direct consultation of the documents in the Archive allows an analytical evaluation of the permanence, invention or variation of the graphic codes used, highlighting the recurrence or predilection for certain systems of representation more suitable for the corresponding technical-descriptive purposes: overall and detail drawings, quoted at different scales (from 1:100 for plans and overall drawings to 1:25 - 1:10 for detail drawings), dense writing and cross-references, orthogonal projections, a large number of sections, axonometric projections and axonometric cross sections, and finally some perspectives dedicated to spatial articulation or to describe specific lighting performances.

A challenge: to disseminate and communicate through light and widespread systems, from the shelf to the map

One part of the experiments carried out on DISEG's heritage was the study of the methods used to proc-

Fig. 4. Variety and specification of codes and graphic techniques in the design of civil works (source: Archivio Porcheddu, DISEG).



ess data and information, intending to highlight the expressive and communicative potential of the archives' documents and of restoring it, in a simple yet effective way, with the help of digital processing made possible by information technology [Novello, Bocconcino 2006].
The paper material belonging to the archive is of various consistencies and formats. In particular, about consistency, some documents are vulnerable and deteriorating over time concerning media and transcripts that are losing their potential and informative quality.
Specifically, the information and computer system set up, on an alphanumeric and geographic basis, ties together practices and contents through two possible paths of in-depth analysis and information potential, explored to understand the advantages and criticalities to the composition of the documentary apparatus and the relative representation techniques used for the construction project of works carried out in Turin in the period 1894-1927.
The first path, which is extremely analytical and therefore more burdensome in terms of the resources and time involved, catalogues each paper document of the individual file, i.e. both the informative and content aspects, unfiltered by interpretations and extractions, digitally acquired with high graphic resolution to be correctly interpreted in all its parts. The second path, more synthetic and agile, was instead directed towards the detailed acquisition of alphanumeric data of the individual files, according to the same scheme operated on the first level of detail, but limiting itself to the digital acquisition of only those documentary elements considered significant, delegating to a subsequent phase the complete digital archiving. These digital selections were associated with information relating to the consistency of the file about specific categories, such as the number and consistency of documents relating to technical and special reports and types of graphic representation. In this more expeditious way, the user, even though not having access to the entire digital heritage of the "folders" still has the data relating to the size of the documentation and can consider whether to proceed further in the consultation and request direct viewing of the material.
Digital preservation is being carried out in distinct phases (fig. 5):
- the capillary activity of document registration through scanner or photographic acquisition, with a long-term time horizon;
- association to each document of all significant data;
- geographic localisation of all files within a geographic information system;
- expeditious recognition with the selection of some documents extracted from individual files and recording of the relevant data;
- registration of the main data and consistency of each file associated with an intervention;
- elaboration of schematic information model derived from archival documentary sources;
- association in the BIM environment and web environment of the documentary sources;
- field photographic surveys on opensource web gis;
- structure from motion from photographic surveys;
- cloud to bim and cloud to web and association of document sources.

In addition to the *corpus* of paper documents, there is also a large apparatus of photographic prints of construction activities that cannot be directly traced back to the specific files and for which the connection must be made by deducing the individual attributions from the images.

Docks Dora in Turin: from map to model

The proposed case study is part of the collection of the architectural-environmental identities of the city of Turin of a particular historical period, that of the advent of reinforced concrete on which we have previously focused: the Torino Docks, known as Docks Dora (fig. 6).
The methodology developed is based on the desire to create an integrated information system where it is possible to manage the data that will vary over time, and which will describe and bear witness to the changes to which the property is subject, based on the definition and integration of four main strategies:
- the collection and systematization of archival sources;
- the collection and systematization of direct or indirect survey data on the property;
- modelling of the asset: analysis of the possible models that can be created, focusing on their purpose and usefulness, on the users who will be able to use them and on the work environment in which they will be able to interrogate them;

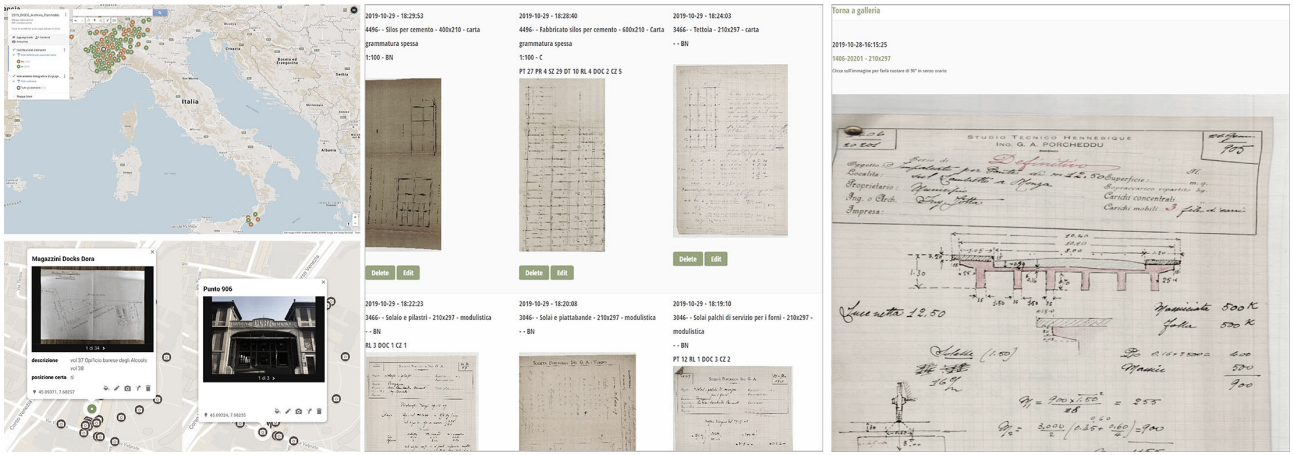


Fig. 5. Map in shared environment. Documentary materials associated with location. Georeferenced works about 900 out of 2,600 (source: extranet mmb-polito.info, user and password needed, accessed 1 March 2022).

- the communication and dissemination of the information system: with a careful analysis of the users who will have access to the operating system, the working environment in which it will be possible to consult and query the system and the type of communication to be used.

The information system has collected iconographic and documentary material in addition to the primary source constituted by the Porcheddu Archive, coming from the archival heritage of the city of Turin (fig. 7): the State Archive - AST; the Historical Archive of the City of Turin - ASCT and the Building Archive of the City of Turin - AECT.

The data collected were digitised and classified according to the cataloguing standards proposed by the Central Institute for Catalogue and Documentation: the adoption and application of the criteria introduced aim to achieve the main objective of sharing and disseminating information among the actors involved in the Cultural Heritage and Tourism sector [Bocconcino 2015]. In the work process briefly described, the adoption of and compliance with the standards are a guarantee for the creation of a quality database and therefore a "heritage catalogue" at the service of the administration and the community [Mancinelli 2018].

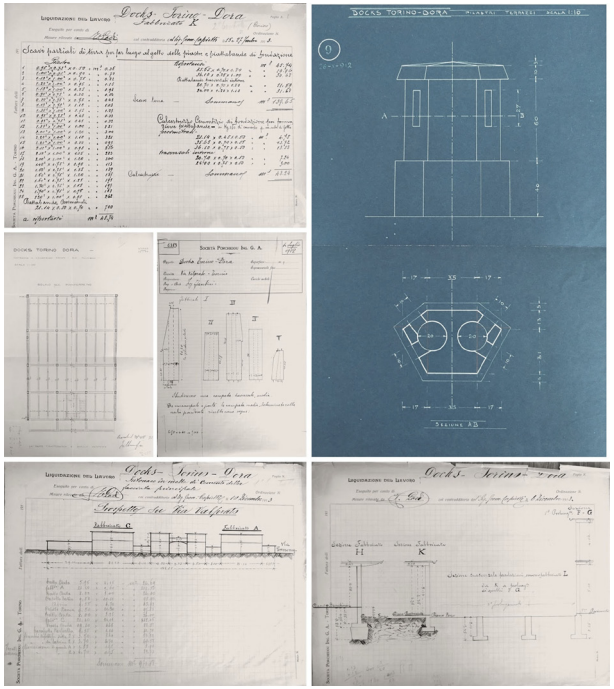
Following the documentary analysis, a survey campaign –direct and indirect– was launched on the buildings to obtain a digital representation of the architectural assets that make up the complex. The tool used for the collection of the different types of files and the photographic images and annotations was the same. Up to this point, the project has dealt with the conservation and dissemination of the Archive essentially in its three dimensions, geographical coordinates and time.

Having solved the issues related to the georeferenced sharing of the Porcheddu Archive, the supplementary sources and the field surveys within a single processing environment (see the previous paragraph and fig. 5), the addition of a further new dimension to the cognitive project introduced new challenges; once the sampling was obtained, further questions arose related to the very nature of the digital information models (fig. 8):

- how to encode the data obtained from the survey phases to be able to use them easily in the different 4D applications and for different dissemination and study purposes;
- how to make accessible the data and information deduced during the survey phases;
- how to relate the survey data to the data obtained from the archive documentation, and how to relate them by representing the collected data and metadata;
- how to archive data and metadata to make them available to the largest possible number of users;

Fig. 6. Photographic survey of the Docks Dora, March 2021 (source: photographs by the Authors).

Fig. 7. Some documents relating to the Torino Dora docks project (source: Archivio Porcheddu, dossier Torino 1910, volumes 37 and 38).



- how to represent and visualise the information and data collected in a single, user-friendly environment.

The approaches to the two models can only be qualitatively assimilated for three-dimensional visualisation of the asset, within a shared platform where related documents can be viewed. In these early stages, it was decided to develop those two models independently to understand the costs and benefits of the two approaches.
The digital model of the asset thus assumes the dual function of a means of communication and dissemination of data and metadata, and at the same time, it is also a virtual prototype that can be used to conduct further simulations and analyses [Donato, Bocconcino, Giannetti 2017], without sampling or testing the asset. In the first case, the use of the model obtained from the photogrammetric survey is more effective, in the second case the model elaborated in the BIM environment is more efficient.

Information model processing and information sharing

Over the years, numerous solutions for complex model viewers have been developed and presented, capable of processing interactive visualisations on web platforms. The following are some environments for the visualisation and sharing of 3D models resulting from the digitisation of Architectural and Cultural Heritage and related historical sources and documents.
These environments were considered in terms of functions, formats and operating platforms and led to the choice of the *Sketchfab* viewer for the application to the DISEG archive (fig. 9). As anticipated, the detailed study of the buildings that make up the Docks Dora complex was conducted by first elaborating a model in a BIM environment, obtained through the integration of archive sources (fig. 10).
This choice is supported, from a theoretical point of view, by the fact that the model can be considered as the place where the different temporal photographs (documents and surveys) of the analysed architectural asset are represented.The aim of the proposed research will therefore be to define and standardise a possible methodology for the survey and representation of digital models of architectural heritage, using BIM as a modelling process, implemented in its geometric forms through information

and data deduced from point clouds, to be able to add data and information to the models thus created that can be, in the first instance, shared through web viewers, and implemented and modified, using parametric and semantic objects [Lo Turco, Giovannini, Tomalini 2021; Brusaporci, Tata, Maiezza 2021].
From what has been considered emerges the need to understand the limits and potential of the models created:
Phase 01 HBIM model – the creation of the model of the architectural asset through the consultation of archive sources: the creation of the model with shared parameters and thematizations. The model sharing paths can be (fig. 11):
- sharing of data and metadata with other users by sharing the model in its native environment: opening of the model directly within the creation software;
- sharing the model by sharing and viewing in:
  - cloud viewers: simple visualisation of the asset's geometries and visualisation of the theming created in a BIM environment;
  - export of the model in CAD formats and import into 3D web viewers, where it is possible to manually associate notes and sources to the different geometries or parts of the model.

Phase 02 Point cloud model: generation of the point cloud of the asset with digital survey technologies, the possibility of querying, modifying and displaying the point cloud in different environments, with heterogeneous objectives and users. The model sharing paths can be:
- sharing of the cloud with other users by sharing the model obtained from the images in its native environment: opening of the model directly within the creation software, the possibility of interrogating the model, reading its geometries and elementary characteristics;
- model sharing and visualisation in:
  - BIM environment: import of the point cloud into the BIM working environment and implementation of the initial model with information and data deduced directly from the point cloud;
  - point cloud viewer: visualisation of the geometries of the asset, with the possibility of querying geometric data;
  - BIM model cloud viewer: visualization of the geometries of the asset and visualization of the thematizations created in the BIM environment;

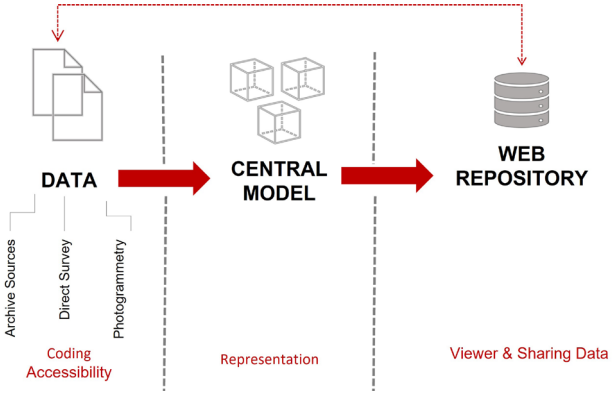


Fig. 8. Data workflow - representation - sharing.

  - 3D web viewer: possibility of associating notes and sources to the geometries of the model;
- exporting the model in CAD formats and importing it into 3D web viewers, where it is possible to manually associate notes and sources to the different geometries of the model. The model can be made public by sharing it on a web platform, where users can interrogate the model and view the associated sources and data.

Conclusions and application developments for a return

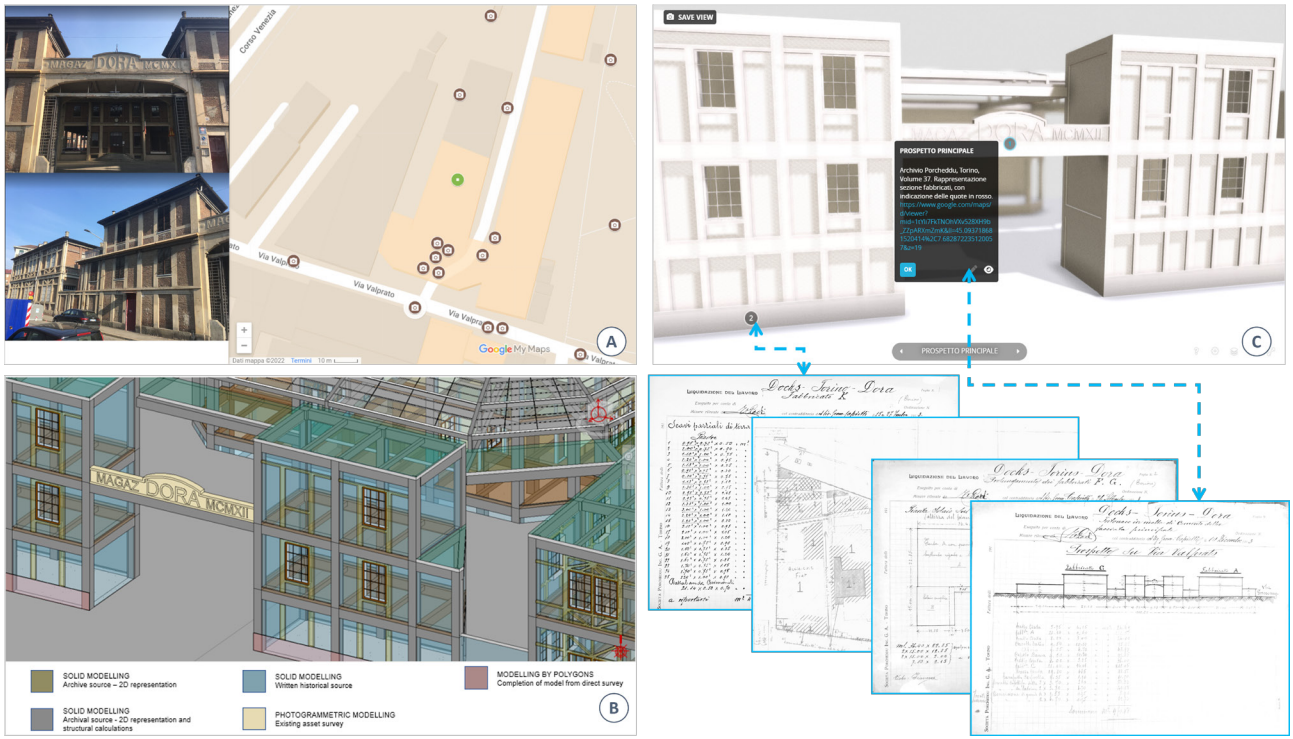
It is evident how the contribution of the disciplines of representation within the project of ordering the knowledge for an urban centre involves aspects that range from the knowledge of surveying to the setting up of multi-relational banks for the treatment of data, to the interaction with GIS, DBMS, BIM and WEB systems. On the one hand, it is necessary to faithfully render, without loss of informative quality, maps capable of representing, in synthesis, demanding conceptual elaborations of a logical deductive type; at the same time, it is necessary to make uninterpreted data instantly available, as well as tools for analysing the same, capable of allowing the various players in the field to carry out analyses that could not have been foreseen in the research project as conceived in its initial stage. Finally, it is necessary to provide multiple queries for extensive thematic filters.

Fig. 9. A brief overview of the functionalities of the main off-line and on-line 3D viewers and navigators.

Fig. 10. Source sharing environments: A. Google My Maps view; B. BIM model with theming of sources; C. Sketchfab model with annotations and links to archive documentation.

3d Viewer	Works on			Source		Data Import																	To do						Share	
	web	windows	ios	open	closed	.PLY	.obj	.blend	.fbx	.glb	.3dc	.asc	.3ds	.abc	.dea	.zae	.igs	.ges	.las	.stl	.dwf	.dxf	HiRes	.x3d	3d visualizer	Interactive Tours	note	Settings materials	Lights	Environment	Slice	Measure	yes	no
Nexus		■				■	■																		■	■							■	
3dHop*	■		■	■		■	■																		■	■	■	■	■			■	■	
Sketchfab	■			■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■					■	■	
OpenSource3d		■		■			■	■	■				■		■					■		■		■	■		■					■	■	
Smithsonian Museum X3D	■				■																					■	■	■	■	■	■	■	■	

* Meshlab import: .ptx | .pts | .xyz | .txt (generic ASCII list of points)



The above considerations, some of which are methodological, others operational and descriptive ones, highlight an issue that is considered fundamental and which returns to the fore when it is necessary to transfer knowledge of technical assets through the various forms of widespread communication accessible to heterogeneous audiences. The selection of effective, punctual and rigorous elements, without the risk of leaving out elements of interest or foundations, can inevitably lead away from the original languages of elaboration. For this reason, the digital reproduction of the materials, capillary and curated, could represent an independent way of sharing, but in constant dialogue with the critical synthesis that in parallel is implemented and recorded within the information system.
Texts, formulas, diagrams, tables and drawings are in a complementary relationship with each other; in different forms, they often represent the same content and are mutually enriched through the direct and material reading of the documents with clues that cannot be fully restored through digital acquisition, such as the consistency of the paper and the inks, which can also be revealing of the methods and times of execution of the works.
From what has been developed, it can be deduced that to obtain a model that represents the architectural asset in all its parts, as exhaustively as possible, and for it to be shared by as many users as possible, it is necessary to create a clear workflow that defines all the steps of acquisition, modelling and sharing of the data and information that define and characterise the asset (fig.12).
To set up a parametric model of an existing asset, it will therefore be necessary to determine and characterise the flow of data and information that flows from the various sources –archival and survey– into the model, becoming an integral part of it, implementing the geometric characteristics that define the asset with data and metadata, which are also of fundamental importance for understanding the asset. The same parametric definition of the asset, and all its components, will have to maintain a correct semantics: each digital component of the asset will have to have the same characteristics as its real correspondent and a correct taxonomy, to avoid ambiguities. In this regard and with a view to collaboration for future development, we mention the interesting

Fig. 11. Model distribution scheme and its visualisation.

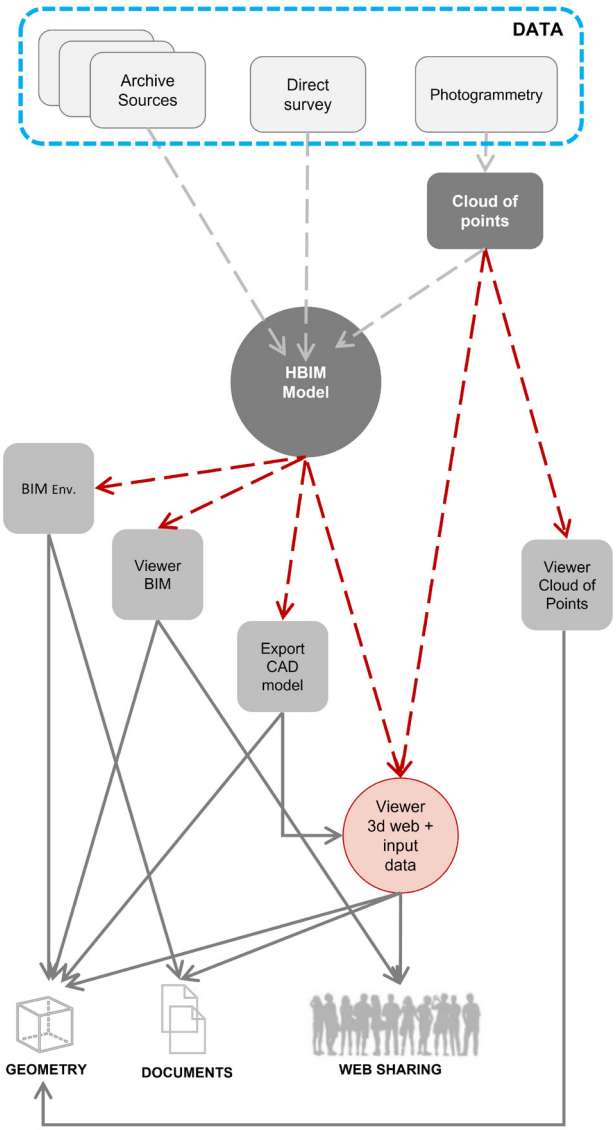
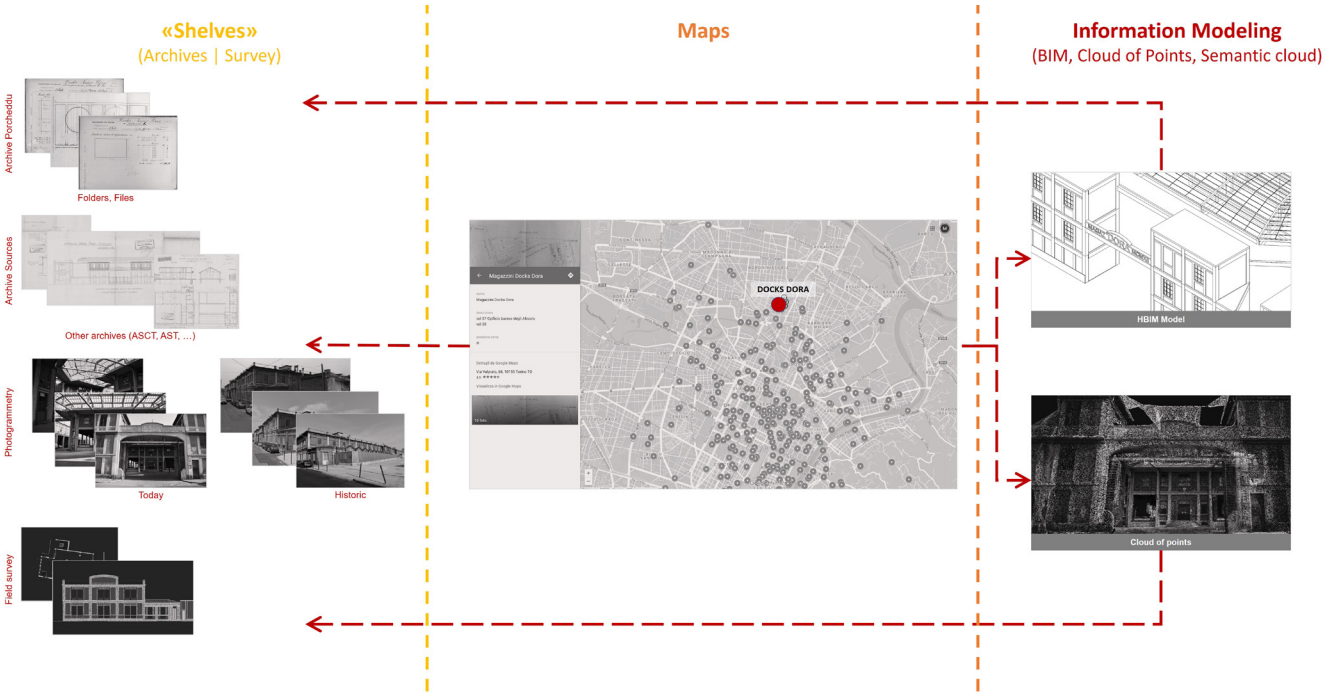


Fig. 12. From the map to the information model, from the information model to the shelves.



project that is being carried out within the Politecnico di Torino "Architectural Cultural Heritage point clouds for classification and semantic segmentation" [Matrone et al. 2020] [4].
As illustrated, the project for the enhancement of the heritage preserved in the Archives takes into account these aspects of care and sensitivity, going beyond certain experiences and integrating with policies that at the University level incorporate the dynamics of the individual Departments. The dissemination project, which is constantly being refined, must respect the principle of conservation and must increase the methods of direct access to the documents. The experimentation, which started years ago on the occasion of the study day held at the Politecnico di Torino in November 2004 [Novello, Bocconcino 2006], today is no longer just an ideal path.

Credits

We would like to thank Professor Pina Novello who, at the end of the 1990s, initiated and coordinated the work of studying and sharing the DISEG heritage. The sections *The cultural context and research activities*, *Fields of experimentation: Archivio Porcheddu at the Politecnico di Torino*, *Graphic experimentation in reinforced concrete design*, *A challenge: to disseminate and communicate through light and widespread systems, from the shelf to the map*, and *Conclusions and application developments for a return* were mainly edited by Maurizio Marco Bocconcino; the sections *Docks Dora in Turin: from map to model*, and *Information model processing and information sharing* were mainly edited by Mariapaola Vozzola.

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We would like to thank: Mrs. Maria Patania and Mr. Pierluigi Guarrera of DISEG for the cataloguing and digital registration of the documentation; junior engineers Erika Bosco, Alessio Bucciarelli and Emanuele La Vecchia for their contribution to the work of loading data and images into the information and computer system; master's degree student in Building Engineering Alessio Bucciarelli for the elaboration of the BIM model of the Docks Dora that constituted the start of the critical reasoning presented in the web applications of the illustrated information models.

Notes

[1] The construction company Porcheddu Eng. G. A. (Giovanni Antonio Porcheddu, engineer and founder of the company, Agent and General Concessionaire for Upper Italy of the patent of the French builder François Hennebique) was set up as a company in 1896 and operated in Italy and some Italian colonies until 1933. The business had already been started in 1894 by the young engineer, who had graduated from the Royal School of Application for Engineers in Turin in 1890. The founder's lively entrepreneurial skills and the quality of his training were decisive factors in the success of the initiative: As a pupil of Camillo Guidi, professor of Graphical Statics at the School from 1881-82 and of Construction Science from 1887 to 1928, it is likely that the young Porcheddu absorbed the strong theoretical and applicative tension and the innovative spirit that led him to take an early interest in the construction of béton armé, as well as the experimental results from the tests on the new system that Guidi conducted in the laboratory attached to the Cabinet of Constructions [Novello, Bocconcino, Donato 2017].

[2] The documentary and iconographic sources in the Archivio Porcheddu are a precious heritage that is indispensable for investigating and understanding the birth and spread of reinforced concrete technology in design and construction practice. The archive was handed over to the Laboratory of Wood, Iron and Reinforced Concrete Constructions directed by Professor Giuseppe Albenga, who was assisted at the time by a young Augusto Cavallari Murat, after the company was liquidated. It was Professor Cavallari Murat himself who, starting from this archive, had studied several low arch cellular bridges such as the Risorgimento bridge in Rome built by the Porcheddu company in 1911. The order in which Professor Riccardo Nelva and architect Bruno Signorelli carefully arranged the files reflects the original cataloguing of the files made by the company: 385 files with approximately 2600 works [Nelva 1990].

[3] <https://www.biblio.polito.it/eventi_culturali/2020/bibliopolidate_politodate/l_arte_di_fabbricare> (accessed 1 March 2022).

[4] <http://archdataset.polito.it/> (accessed 1 March 2022)

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Digital Reconfigurations

The Construction in Progress of a Private Archive

Francesco Maggio, Eleonora Gelardi

Introduction

A few years ago, from an idea born in 2015 on the occasion of a specific study on the professional activity of women architects in Palermo [1], Dacia and Sabina Di Cristina, daughters of the architect and university professor Luciana Natoli (fig. 1), born in 1936 and passed away too early, in 1978, at the age of 42, started to 'build' their mother's archive.
Natoli's young age might suggest a modest size of the archive; in fact, the opposite is absolutely the case.
It was in fact the sheer quantity of rolls, files, heliographic copies, drawings on tracing paper and sketch paper, photographs, correspondence, books and magazines that for so many years prevented her daughters from ordering this great mass of content. Luciana Natoli was an integral architect whose interests ranged from architectural design to the design of city and the territory, from the design of objects to interior renovation.
The archive is not only composed of the graphic outcomes of these interests.
Books, journals, papers written in her own hand, university exercises, degree theses and student work are part of the archive. Luciana Natoli was in fact a brilliant lecturer at the Faculty of Architecture in Palermo from 1965, the year in which she won the competition for assistant professor of Architectural Composition [2].
The opportunity of a funding obtained for a project entitled *Archivi delle donne Architetto nel Novecento* (Archives of Women Architects in the 20th Century) [3], coordi-

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

Fig. 1. Luciana Natoli with Alberto Samonà in an exam commission (Luciana Natoli Archive).

nated by the archivist Antonia D'Antoni under the scientific responsibility of Paola Barbera, presented in 2017 by the Fondazione *Salvare Palermo* to the General Directorate for Archives (DGA) of the Ministry of Culture, allowed the cataloguing of the archive material to begin. The work has made it possible to catalogue, at present, 382 archival units consisting of 457 rolls, 33 volumes, 116 envelopes, 224 files, 2 folders, 5 binders, 1 box, 1 notebook, 3 address books and 1 diary [4]. This quantity allows us to understand the activity carried out by Luciana Natoli during her career.

The biographical notes show that an interest in study and research characterised her intellectual approach as early as his formative years at the Faculty of Architecture. Already in 1959, a year before graduating, on behalf of the Director of the Faculty's Institute of Urban Planning, she collaborated with the Superintendency of Antiquities for Western Sicily on the interpretation of Solunto's urban layout [5]. The excavation campaign in Solunto, which began in 1825, is still going on. Her fascination for archaeology, probably stemming from the classical studies she pursued at the Garibaldi High School with Giusto Monaco [6], led her to the elaboration of her thesis on a project on the slopes of the Doric temple of Segesta.
Luciana Natoli's propensity to tackle the project at various scales, from the spatial scale to the construction details and the design of the furnishing elements intended as an integral part of the designed spatial *unicum* [7], is already evident in her thesis.

An academic project

A university paper from 1959 prepared for the Composition Course held by Professor Vittorio Ziino [8] concerning the design of a hospital for polyomelitics was found in the archive. A number of heliographic copies concerning the general plan, elevations and a 1:50 scale detail of the floor plan of the ward block were found in an A4 file (fig. 2).
From the few documentary indications, it was possible to digitally reconstruct the project in order to understand both Luciana Natoli's approach to the subject of hospital architecture and the language adopted.
The exercise was not assigned a specific location, so it is a project that combines the compositional exercise on space and the functional component.
This 'imagined' place was predominantly flat, with a steeper slope towards the north side, as can be seen from the orientation indication in the general plan and the ground line in the elevation drawing.
The complex consisted of six buildings of different heights; four of these were connected to each other while the other two, the administration, pharmacy and training block and the one for the headmaster's residence, remained isolated (fig. 3).
The ward block, the services block, the medical care block and the contagious ward were shaped like two

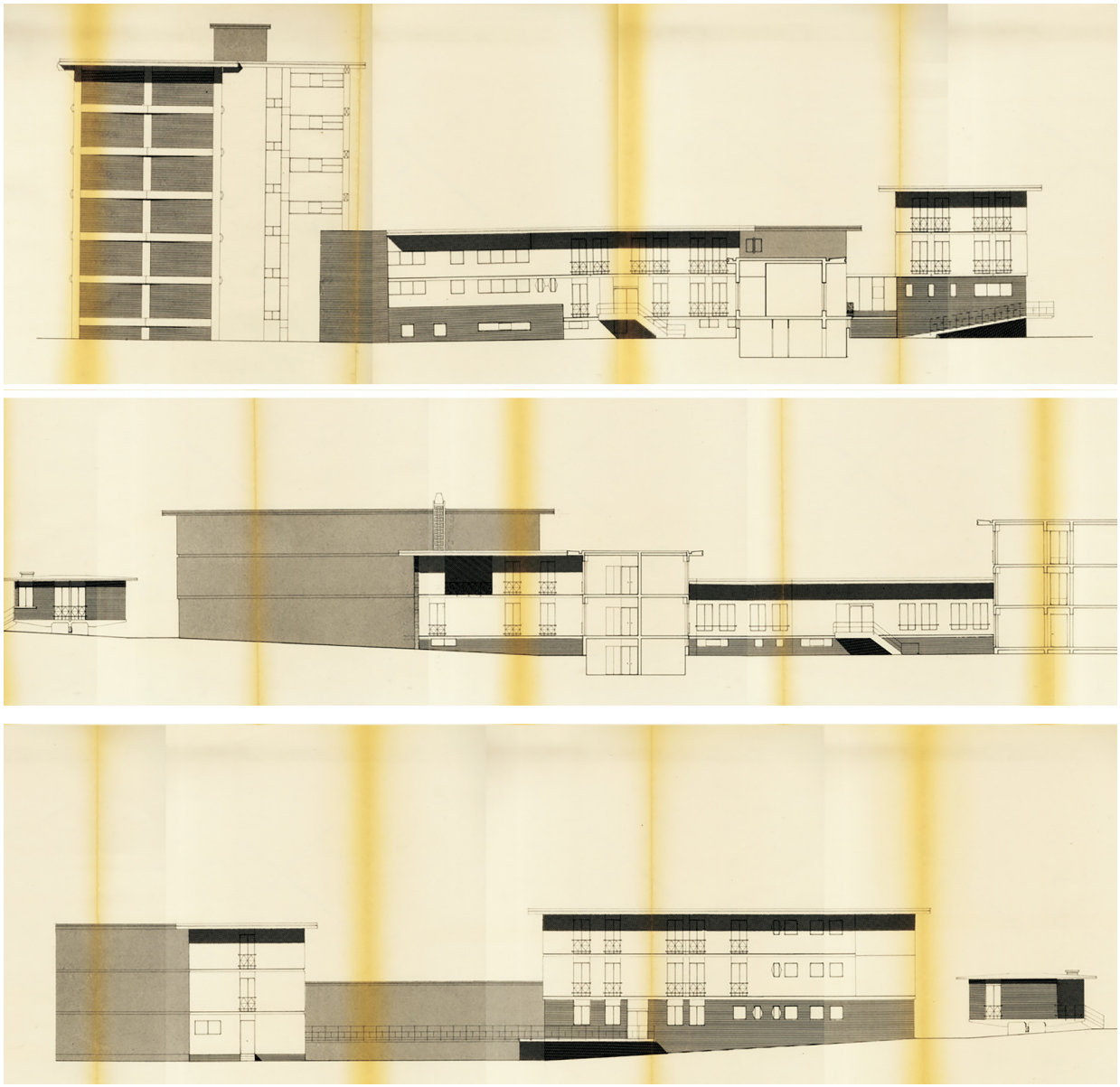


Fig. 2. Elevations of the Hospital for poliomyelitics, 1959 (Luciana Natoli Archive).

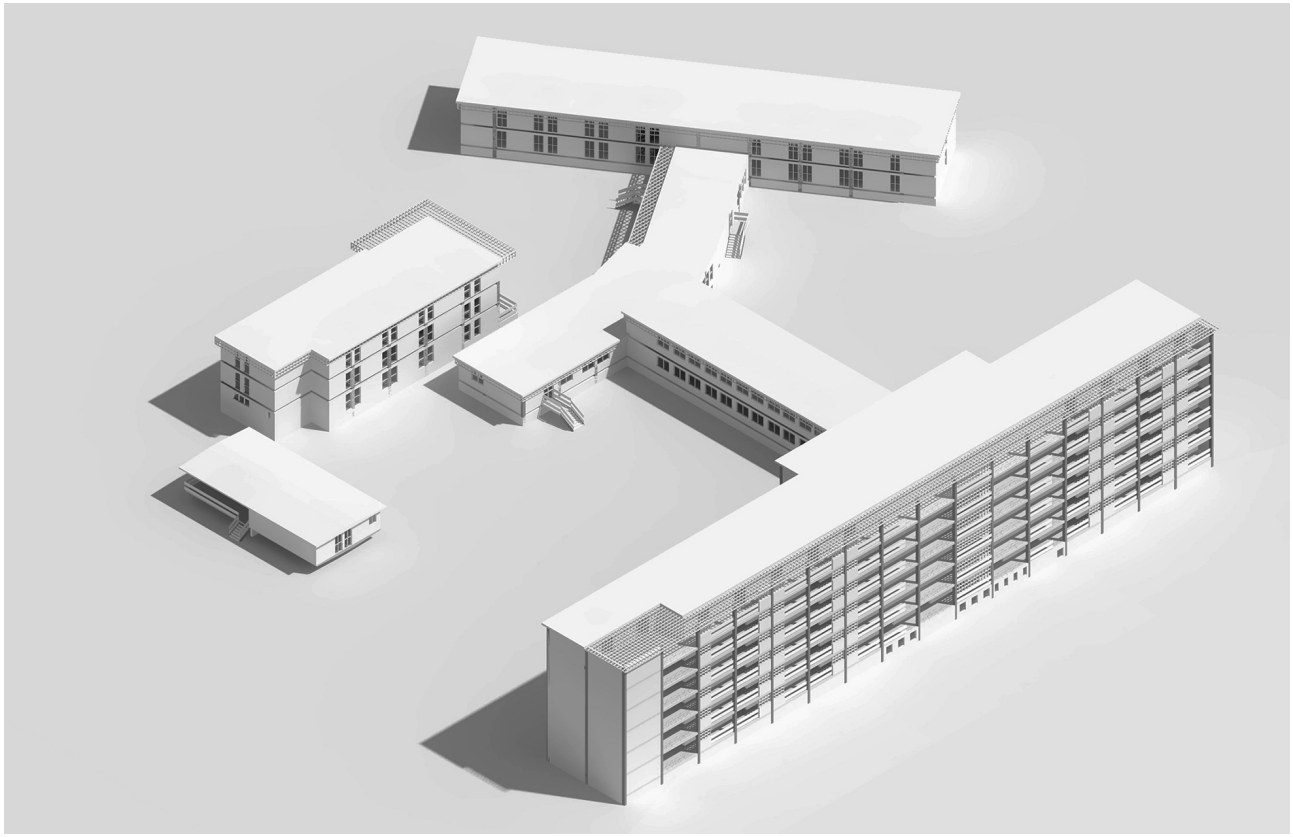


Fig. 3. Axonometric view of the Hospital for poliomyelitics (graphic elaboration by Eleonora Gelardi).

inverted "T", rotated towards each other. This system finds a compositional logic in a general scheme consisting of two squares slightly offset from each other which define the rigidity of the layout, which is contrasted by the smooth design of the garden.
From the drawings found in the archive [9], it was possible to redraw the design idea of the project through the 'construction' of three-dimensional images that allow the logic of the project to be read more immediately.
The entrance to the hospital complex was probably from the south-east in a space, a hinge between the service-degency block and the medical-contact block, where functions for both staff and patients and visitors were sorted.
The six-storey high in-patient block, in addition to the ground floor, contained fourteen rooms per floor for a total of 336 patients in the entire block. This calculation was possible from the double interpretation of the plan detail at a scale of 1:50 and from the elevations and is assumed to be a number close to that requested by the course lecturer.
The façade on the north side is marked by deep loggias punctuated by *brise-soleil* (fig. 4), while the south-facing

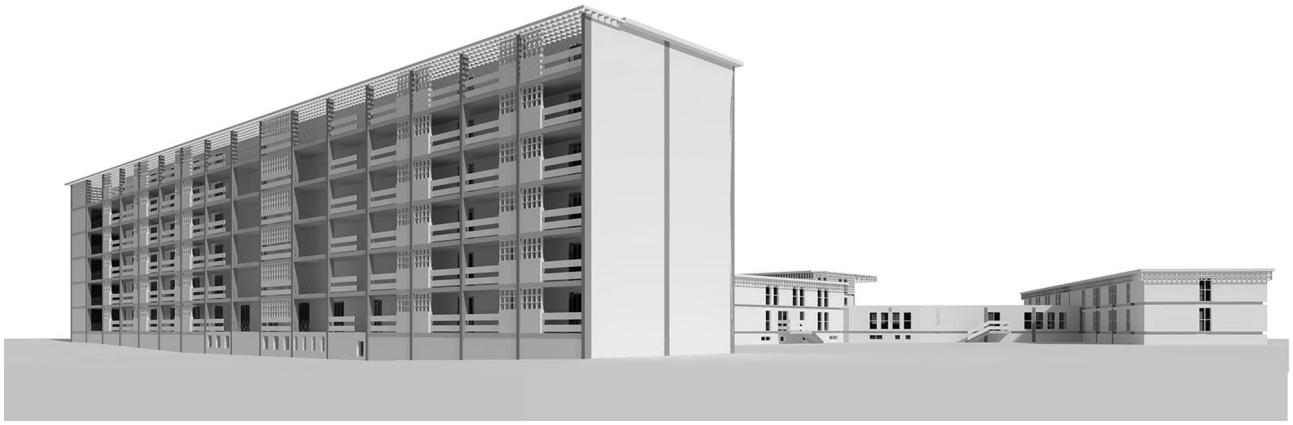


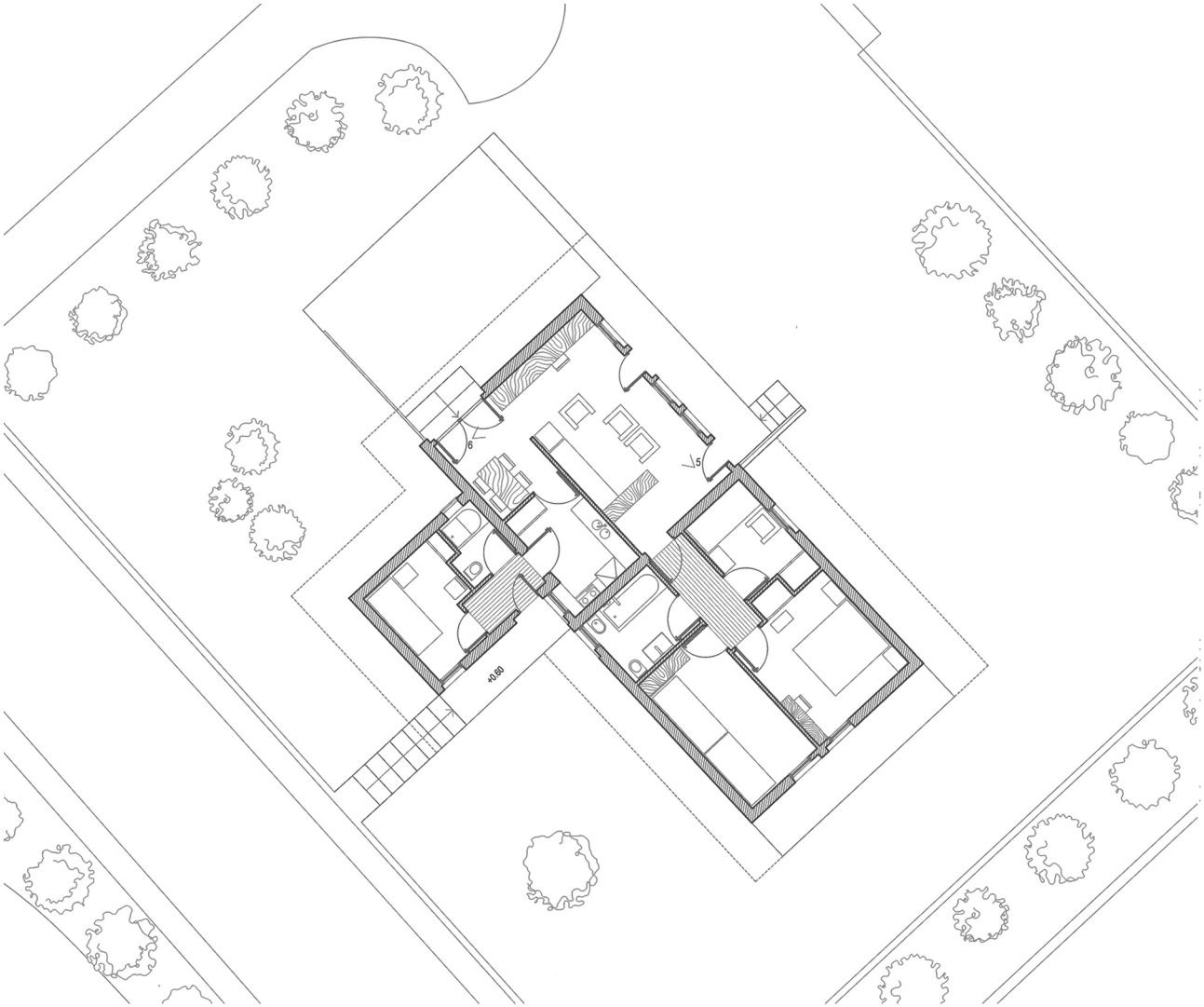
Fig. 4. Perspective view of the service-degency block graphic elaboration by Eleonora Gelardi).

side is punctuated by large square windows and ribbon windows where the wards block intersects with the services block.
Trusses marked the crowning of the buildings or highlighted the access parts. The plinth, the *brise-soleil* of the wards, the lattice-work iron railings in the loggias or with a rhombus design and the crowning, hint at timid signs of adherence to the neo-liberty language that would instead be more disruptive, six years later, in the project for the "GH" building designed together with Umberto Di Cristina, that would win the regional INARCH award in 1966.

The first realization

As it is almost always the case for a young architecture graduate, the first client is very often a relative or friend. This was the case for Luciana Natoli.
In 1961 she designed the holiday home for his uncle's family. It is a small house of 84 square metres on one level that can be considered a small jewel of a synthesis of her skill. In fact, the architect pays attention to every detail, from the landscaping to the architecture and the interior design.
The house, located close to the sea, is in a coastal location in the province of Messina not far from Marina di Patti. The house is situated between the road and the beach between which there is a difference in height of about 3 m.
Luciana Natoli's project, unilike the neighboring houses, is organized on one single floor, so that only the roof can be perceived from the street and the architectural volume becomes part of the landscape.
The house is accessed via a small driveway, located orthogonally to the SS113 road, which leads to a subterranean widening used for car parking.
The layout, very simple and in load-bearing masonry, is formed by a rectangle divided into two parts of different sizes; one, square in shape, contains the living area with the living room and kitchen, the other, destined for the sleeping area, houses three bedrooms and the bathroom. A lower volume, towards the street, contains the secondary entrance and the room for a possible guest.
The roof of the two volumes is flat and characterized by an overhang of approximately 50 cm, made of fair-faced reinforced concrete, around the entire perimeter (fig. 5).
The real particularity of this small house is the treatment of the masonry. Luciana Natoli designed an exposed brickwork with a stylized joint for three quarters of the elevations, leaving the part immediately below the roof plastered in white. A heliographic copy of the details, measuring 99.2 x 148.6 cm, informs us of the attention to detail paid by the architect, who designed a very particular corner solution by alternating the bricks

Fig. 5. House in Marina di Patti, plan (graphic elaboration by Eleonora Gelardi).



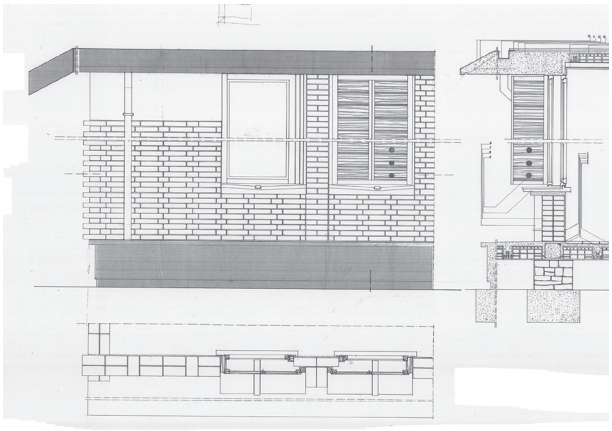


Fig. 6. House in Marina di Patti, construction details (Luciana Natoli Archive).

Fig. 7. Historical photo (Luciana Natoli Archive).

with an overhang that gives plasticity and three-dimensionality to the corner itself (figs. 6, 7).
High sunshade walls, made of perforated bricks, mark the entrances to the dwelling, which opens towards the sea through large rectangular openings, while at the back, towards the street, it remains tightly closed except for the presence of two small windows.

An unrealized house

In 1977, Luciana Natoli designed a single-family house for the Modica family to be built in Mondello on land belonging to the Consorzio Strade Fondo Anfossi destined for large-scale subdivision. A place close to the sea and not far from the city that began to develop in the Sixties when citrus have grown and the countryside gave way to fine single-family houses inhabited by the Palermo bourgeoisie.
In the archive there is a file containing three folded heliographic copies, all 55 x 29.7 cm in size, relating to the plans on a scale of 1:100 and several freehand study drawings on light sketch paper relating to the elevations and sections (fig. 8).
From these drawings, it was possible to digitally reconstruct the house and return three-dimensional images that inform the possible formal configuration of the house.
The element on which the project is articulated is the central square patio located at - 2.50 m, onto which the basement and ground floor rooms and the first floor terraces overlook. The latter has a lower cubature than the levels below, and the rest of the area, corresponding to the roofs of the first floor, is designed by Luciana Natoli as a series of garden-roofs at different heights which follow the heights of the rooms below.
The ground floor, in fact, is developed on three different heights: the one of the entrance (0.00 m), the one for of the raised basement (+ 0.84 m), on which the sleeping and living areas are arranged, and a third height (+ 1.30 m), corresponding to the kitchen.
Two different stair systems allow access to the ground floor from the basement. Another C-shaped staircase,

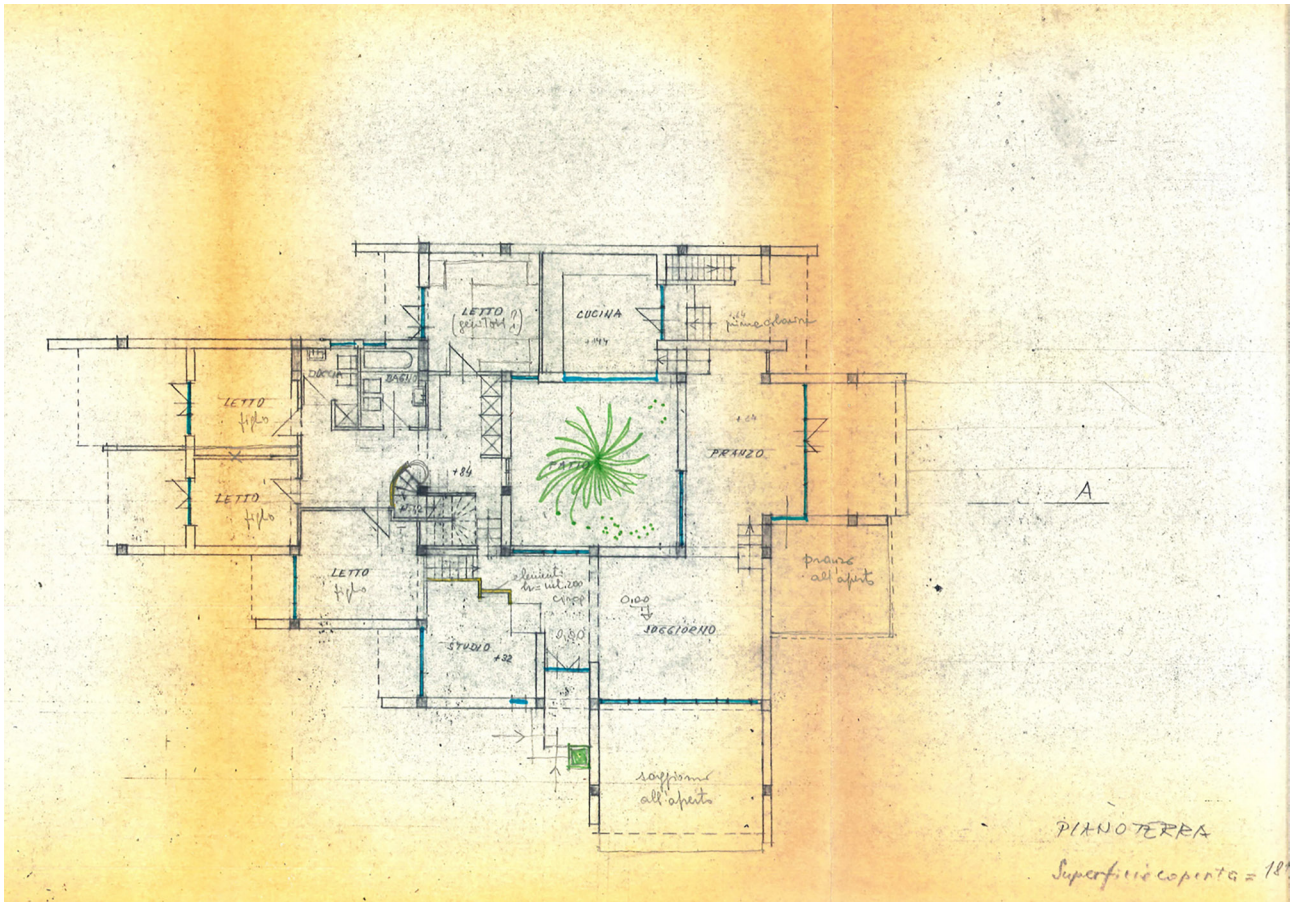


Fig. 8. House Modica, 1977 (Luciana Natoli Archive).

characterized by the first curvilinear ramp, leads to the first floor where two more bedrooms were planned. The form of this staircase anticipates, in a certain sense, Luciana Natoli's second design phase characterized by the use of the curvilinear form which, especially in interior design, takes the place of the more elementary forms used in the first phase of her professional activity. Architectures composed of rigid volumes are replaced by more complex architectural texts generated by the juxtaposition of several elements that never lose their final formal unity. In this project, the juxtaposition of volumes of different sizes generates an articulated volume strongly characterized by the shadows determined by the presence of deep loggias that draw the elevations (fig. 9). The representations found in the archive only indicate a rough idea of the possible future construction. In this sense, it is not possible to describe the material aspect of the project, although, by analogy with others, it can be assumed that the walls were intended to be partly plastered and partly in fair-faced concrete.

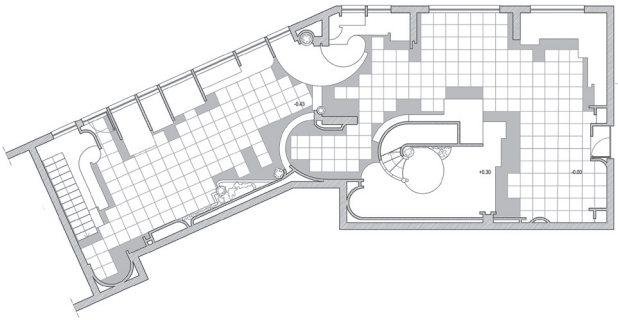
Fig. 9. House Modica, perspective view (graphic elaboration by Eleonora Gelardi).

This project lacks the elements of detail that characterizes Luciana Natoli's work, but the multi-scalar attitude can still be glimpsed in the design of the C-shaped staircase, which heralds themes that will later become clear in the interior architecture project as, for example, in the Fardello shop in Palermo.

Interior architecture. The Fardello shop

Interior design was one of Luciana Natoli's assiduous activities. The focus on small-scale design was already evident in her graduation thesis on an *Antiquarium* in Segesta for which she designed mobile exhibition panels, technical tables, bookcases and seats.
An analysis of the archival fonds shows that, with regard to furniture designs, there are 44 archival units consisting of 44 rolls, 2 envelopes, 15 files and 1 folder that refer to the architect's production from 1962 to 1976.
These include the interior design of the Fardello shop in Palermo, which can be considered a synthesis of the Natoli's design experience. The shop for furniture and household articles was completed in 1976 and it no longer exists today. However, the architect's drawings and photographs (fig. 10) remain, which have made it possible to reconstruct the form and understand the spatial layout.

The commercial activity consisted of three levels: the ground floor (fig. 11), which was used for display and sales, the first floor, where the offices were located, and finally the basement, which housed the storage of goods. The building in which the shop was located has a rectilinear development with two different layouts forming an angle of approximately 150°.
The ground floor of approximately 250 m^2 straddled the two locations and had an elevation difference of 43 cm between one part and the other. Access to the shop was from both Viale Regione (elevation - 0.43 m) and Via Scobar (0.00 m), streets onto which the shop windows faced. The space was designed by Luciana Natoli as a single display area, with no intermediate partitions, and was characterized by alternating concave and convex lines. In fact, curved walls housed both the displays and the flower boxes, and the staircase, bordered by a curved concrete wall, became a true sculptural element. Attention to detail was also evident in the design of the flooring, which was extremely innovative. The two-tone black and pink of the two types of material used (50 x 50 cm pink granite slabs and absolute black marble) predominated. Steel elements for the treads between the two differences in height of the room and concrete elements for the tread anticipated the spiral staircase leading to the office floor. The latter, with a smaller surface area than the exhibition space below, housed two offices for the Fardello: the secretary's



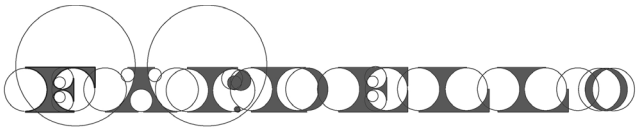


Fig. 10. Fardello shop, historical photo (Luciana Natoli Archive).

Fig. 11. Fardello shop, ground floor plan (graphic elaboration by Eleonora Gelardi).

Fig. 12. Fardello shop, graphic construction of the shop sign (graphic elaboration by Eleonora Gelardi).

room and a meeting room, as well as services. Access was either via the condominium staircase or via the staircase described above, which led to a rectangular open space. The rooms were separated from each other by sliding panels made of natural leather, testifying to the modernity of the architect's design attitude.
In this project, the use and alternation of concave and convex forms generated the dynamism that is a distinctive element of Luciana Natoli's second design phase in which architecture becomes more complex and it's emphasized through a predilection for curves.
Luciana Natoli's multi-scalar attitude is finally evident in the design for the shop sign designed with geometric constructions in which the circle is the generating element (fig. 12). It is precisely through this last element that one can fully understand the complexity of the work, so rich in details, that contain clear compositional logics from the careful study of the design condition.

Conclusions and possible developments

An archive of architecture can be built with a double register; the analytical register of filing, an operation that archivists carry out with great meticulousness, and another one, hermeneutic, relating to the comprehension of the sign, which is an activity that must be entrusted to those who practice design at any scale.
The interaction between these two figures makes it possible to create the chronological iter of the graphic documents held in the fonds when there is no temporal reference in them, or to construct the design history from sheets that find different locations in the archive. It is indeed possible to recognize, for example, in the series of an archive fonds, some graphics belonging to another series especially if there is no written notation in these drawings. The dual work of an archivist and an architect could overcome these possible problems.
The Luciana Natoli archive naturally does not only contain architectural projects. A large part of the fund is

made up of urban plans, outcomes of professional assignments or competitions [10].
Luciana Natoli's interest in planning certainly stems from her collaboration with Edoardo Caracciolo. In 1961, a year after graduating, she founded the *Gruppo per l'Architettura e l'Urbanistica Siciliana* [11] that operated in Palermo in the early Sixties. The members, all trained at the Faculties of Architecture and Engineering in Palermo, some of them also professors at the same, were united by the same stimulus to commit themselves, and in turn to commit public administrations, the professional classes and public opinion, to the city's Regulatory Plan as the only valid instrument for urban planning discipline. It was precisely for this reason that they emphasized certain shortcomings in its formulation, suggesting some revisions that were also a consequence of the advances in urban planning culture recorded in the years following its drafting.
If the redrawing of Luciana Natoli's projects has made it possible to reconstruct architectural spatiality, a new direction in archive research is desirable, one that investigates the Palermo architect's thinking on urban issues.
Such a study would also make use of all of Luciana Natoli's texts, both published and unpublished, on town planning, which constitute a fundamental part of the archive because they witness the thought of an architect [12] who can be considered one of the first protagonists of the Modern Movement in Sicily, at that time a difficult context especially for a woman.
But not only would it be interesting to take an in-depth look at Luciana Natoli's urban and territorial visions, which, when observed carefully, seem to anticipate themes subsequently dealt with by more well-known figures on the national architectural scene [13], but it might also be interesting to analyze and repropose, through redesign, the entire production relating to furniture and furnishing projects [14], which testifies to the breadth of her multi-scalar gaze that can be understood as a true teaching of a way of proceeding.

Credits

While sharing the positions expressed in the article, the result of common elaborations, the paragraphs *Introduction*, *An academic project*, *The first realization* and *Conclusions and possible developments* are to be attributed to Francesco Maggio, while the paragraphs *An unrealized house* and *Interior architecture. The Fardello shop* are to be attributed to Eleonora Gelardi.

Notes

[1] The idea of studying the figure and work of Luciana Natoli essentially arose from the friendship that has linked Francesco Maggio, one of the authors, to Sabina Di Cristina for almost forty years. With Sabina and Eleonora Gelardi, a young student at the time, we began this work between 2015 and 2016, which materialized in Architect Gelardi's degree thesis entitled *Luciana Natoli. La Teoria e il Progetto* (Luciana Natoli. The Theory and the Project) that constitutes the germ of a work *in fieri*.

[2] Between 1961 and 1964 Luciana Natoli was Volunteer Assistant to Prof. Edoardo Caracciolo, then Professor of Urban Planning. In 1965 she won the competition for Ordinary Assistant to the Chair of Architectural Composition. In 1967, he qualified as a free lecturer in Elements of Composition and in those years, at the Faculty of Architecture in Palermo, he took over the courses Interior Architecture and Furniture and Decoration. In 1971 he qualified as a lecturer in History of Urban Planning.

[3] In February 2017, the Fondazione *Salvare Palermo* –in full agreement of intent and purpose with the owners of the archives– submitted a request to the DGA for funding for a specific project relating to the *Archivi delle donne Architetto nel Novecento* (Archives of Women Architects in the 20th Century), identifying three archival fonds of three female professionals who worked in Palermo from the 1960s onwards. The archives in question were the *Anna Maria Fundarò* archive, the *Tilde Marra* archive, and the *Luciana Natoli* archive. The DGA, in a note dated 28 June 2017, included the project among the winners of the selection and signed an agreement with the Fondazione *Salvare Palermo*. Paola Barbera (scientific head), Antonia D'Antoni (coordinator) and the archivists Caterina Bellomo and Rosalia Vinci collaborated on the project. For the Fondazione *Salvare Palermo* the project manager was Renata Prescia, President of the Foundation.

[4] These collected data, provided by Sabina and Dacia Di Cristina, indicate the current state of the archiving process of the material in their possession.

[5] Solunto is an ancient Hellenistic city on the northern coast of Sicily, on Mount Catalfano, about two kilometers from Santa Flavia near Palermo. According to Thucydides, Solunto was, together with Panormus and Motya, one of three Phoenician cities in Sicily. In reality, excavations show that the hypothesis that Solunto was a town of Phoenician origin still lacks adequate archaeological support and points to Sicans as its authentic founders. Excavations began in

1825 at the interest of the Commission of Antiquities and Fine Arts and on that occasion a statue was found depicting Zeus enthroned that is now preserved in the Antonio Salinas Regional Archaeological Museum.

[6] Giusto Monaco, a Latinist, was born in Syracuse in 1915. His father is an official at the Ministry of Finance and is periodically transferred, as was customary for officials assigned to delicate tasks such as tax collection. He attended high school in Trapani and the Garibaldi Lycée in Palermo, where he returned to teach in 1947. In Palermo, Monaco followed developments in local university life and in 1955 he obtained a professorship in Greek and Latin grammar, which he began teaching at the newly founded Faculty of Magisterium.

[7] In her graduation thesis, a project for an *Antiquarium* in the archaeological site of Segesta, Luciana Natoli showed her aptitude for design that would later distinguish all her work. The thesis supervisors were Luigi Epifanio, Edoardo Caracciolo, Gino Levi Montalcini and Domenico Lo Cascio. Luciana Natoli's multi-scalar gaze is already evident in this project, which inaugurates a compositional method to which future elaborations belonging to the first phase of her professional activity will refer, in which the architectural organism fits into its surroundings in a harmonious dialogue that refuses any attempt at mimicry.

[8] Vittorio Ziino (1910-1980), a pupil of Salvatore Caronia Roberti, is to be considered one of the leading exponents of the Modern Movement in the Sicilian cultural panorama. His convinced adherence to the Italian rationalist current is already evident in his early projects.

[9] These are three heliographic copies folded in A4 format whose dimensions are: general plan 70.5 x 58.4 cm, elevations 422.6 x 29.7 cm, detail of the ward block 55.8 x 29.7 cm.

[10] The archive contains 55 archival units consisting of 98 rolls, 1 volume, 50 envelopes, 48 files and 1 box.

[11] The *Gruppo per l'Architettura e l'Urbanistica Siciliana* (GAUS) was made up of Antonio Bonafede, Benedetto Colajanni, Umberto Di Cristina, Luciana Natoli, Gianni Pirrone, Salvatore Prescia and Nino Vicari who were joined by Archimede Mignosi and Alba Gulì in 1962 and Carlo Doglio in 1963.

[12] On the use of the female 'architect' see Zarra, G., Marazzini, C. (2017). *«Quasi una rivoluzione». I femminili di professioni e cariche in Italia e all'estero*. Firenze: Accademia della Crusca.

[13] Reference is made to the themes treated by Vittorio Gregotti and Aldo Rossi [Gregotti 1966; Rossi 1966].

[14] As far as the furniture projects are concerned, the archive currently contains 44 archival units composed of 44 rolls, 2 envelopes, 15 files, 1 folder, while for the furniture projects 4 archival units composed of 4 rolls.

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Ubaldo Castagnoli: on the Graphic and Historical Traces of an Exponent of Gruppo 7

Manuela Incerti, Gianmarco Mei, Anna Castagnoli

Abstract

In 1926, a group of seven friends who studied at the Regio Istituto tecnico superiore of Milan –made up of Ubaldo Castagnoli, Luigi Figini, Gino Pollini, Guido Frette, Sebastiano Larco, Carlo Enrico Rava and Giuseppe Terragni– decided to found Gruppo 7. Between 1926 and 1927, the seven young architects published some articles in the journal Rassegna Italiana *that are still considered today as one of the founding moments of the new Italian architecture. Ubaldo Castagnoli left the group almost immediately, being replaced by Adalberto Libera and, for this reason, his name disappears from the history of architecture books. The career of this professional developed within one of the most important companies in the country, STIPEL, the Piedmontese and Lombard interregional telephone company (which in 1964 was incorporated into the SIP), with the role of Central Director at the disposal of the General Management of real estate affairs. He also had a long professional relationship with Luigi Einaudi, before and while he was President of the Republic. The work presented below aims to continue the research recently inaugurated on this figure, that is still not adequately investigated, in order to deepen the role of the cultural debate of those years on his vast professional activity, working with the methods and techniques of the disciplines of representation.*

Keywords: Gruppo 7, BIM, STIPEL, archives, graphic analysis.

Introduction

The paper aims to investigate, through the tools and techniques of representation, the culture of the project of Ubaldo Castagnoli, architect of Gruppo 7, continuing the work recently inaugurated by the research group. From a first list of his works, still incomplete, two buildings were selected and some critical readings were conducted initially on his graphic language [Velo, Castagnoli, Incerti 2020], in relation to the course of higher studies and the debate then in place [Buratti Mazzotta 2013; Moretti n.d.; Selvafolta 2008, 2012]. Reflections were also proposed on the use of form [Velo, Castagnoli, Incerti 2020] and on original perceptual aspects of some spaces that today have been strongly transformed. At a later stage, the three-dimensional digital reconstruction was used, according to a method that is now widely consolidated in the scientific disciplinary sector, in its value both as a study tool and as an opportunity to enhance and disseminate the theme of the architectural project not built or lost due to subsequent events [Incerti, Mei, Castagnoli 2021]. The present contribution aims to analyze two buildings, Centrale Telefonica di Città Studi in Milan and the Palazzo dei Telefoni in Turin, systematizing archive drawings, documents, surveys of the facades and techniques of two- and three-dimensional graphic analysis (both in BIM environment and with manual modeling of NURBS surfaces).

Ubaldo Castagnoli and Gruppo 7

The architect-engineer Ubaldo Castagnoli (Rome 1902 - Turin 1982) graduated in 1925 from the Regio Istituto Tecnico Superiore of Milan. In this environment he met the young colleagues, who were tutored and influenced by Piero Portaluppi (then he was assistant to the chair of Architecture) and in 1926 they decided to found Gruppo 7, the first group of modern Italian architects, composed precisely by Ubaldo Castagnoli, Luigi Figini, Gino Pollini, Guido Frette, Sebastiano Larco, Carlo Enrico Rava, Giuseppe Terragni [Belli 1935; Betta1927; Cartasegna, Santi 2017; Pacifiers, Bricklayer 2010]. The seven colleagues sign with the name Gruppo 7 the four famous articles that appeared a few months later in the *Rassegna Italiana* magazine between December 1926 and May 1927: these articles and the lively debate that followed are still considered today one of the founding moments for the new Italian architecture. As known, Castagnoli's membership to the group was short: he was immediately replaced by Adalberto Libera and, for this reason, his figure almost immediately disappears from the pages of history of architecture books.
In addition to his participation in the 4th Triennale di Monza (1930), the 2nd Exhibition of Rational Architecture (1931) and the Permanente in Milan (1931), the first works produced by our research-group have pointed out some collaborations with well-known figures of the epoch, including Guido Frette (1929-1935), Piero Bottoni (1930) and Antonio Cassi Ramelli (1933) [Buffa, Cassi Ramelli 1934; Caneva, Griffini 1930; Castagnoli, Frette 1934; Incerti 2016; Istituto per le case popolari Milano 1933; Rassegna di Architettura 1931].
In 1935 Castagnoli was hired by the STIPEL Telephone Company for which he worked as an engineer of telephone exchanges for the Piedmont and Lombardy area until 1962 when, due to some health problems, he resigned while continuing to work for the company as a freelancer. The intense development activity of the telecommunications sector (especially after the war) in which Castagnoli worked, as well as the confidentiality required by his important role, certainly did not facilitate his notoriety which, however, had to be remarkable, given that, in 1947, he started to work for Luigi Einaudi, with whom he had a long and fruitful relationship that lasted even while Einaudi was President of the Italian Republic.

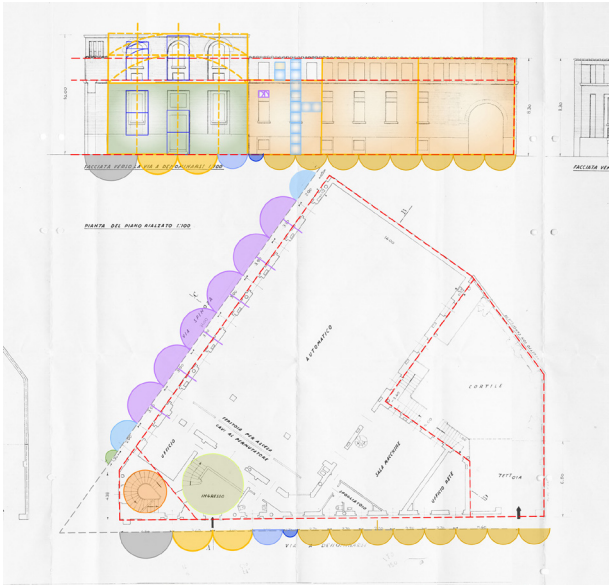
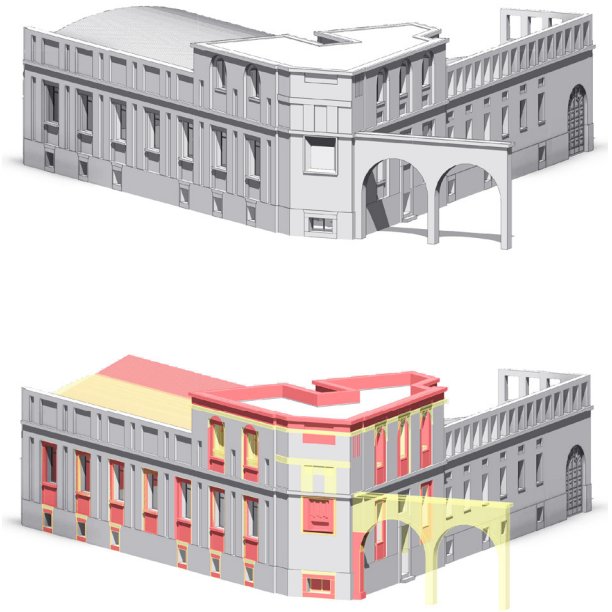
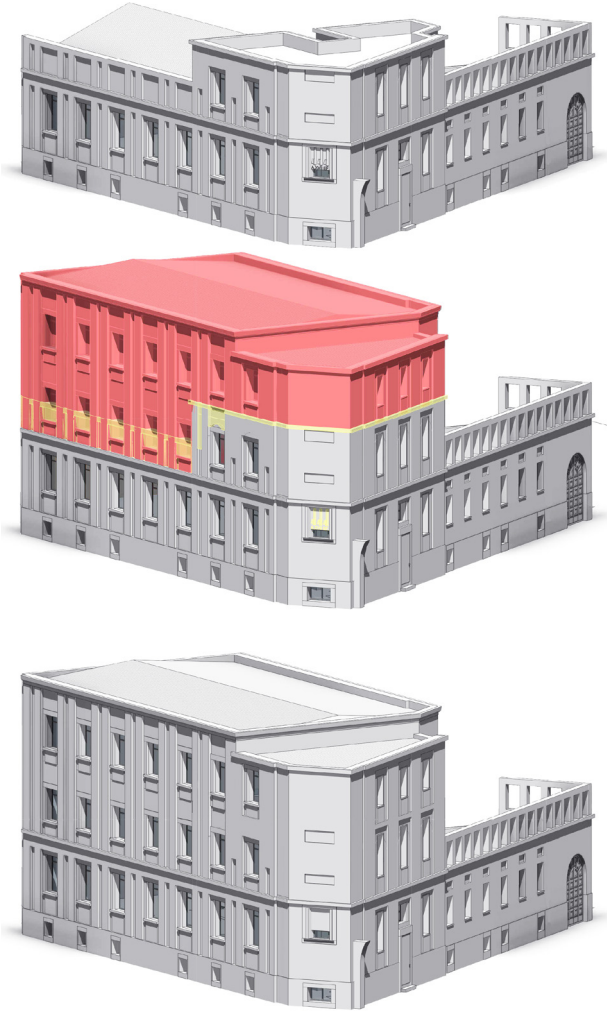


Fig. 1. Centrale telefonica di Città Studi, analisi grafica del piano rialzato e del prospetto su via Villani (1939), (elaborazione grafica degli autori).

The first project for the Centrale Telefonica di Città Studi

The project for the Centrale Telefonica di Città Studi started in 1938, in a historical period of impressive development of the telecommunications network and in an area of urban expansion which had long been destined to become a new university area. Twenty-five years earlier, in 1913, Augusto Brusconi and Gaetano Moretti, professors of the R. Politecnico di Milano of Milan, had carried out a general project of the university complex consisting of nine buildings connected to each other [Ricci 2008]. The construction, interrupted by the great war, ended in 1927, the year in which the inauguration took place. The first telephone exchange of the company, located in the main building of the University, quickly became insufficient for the growing needs. The impossibility of building extensions led the Company to identify a new plot in the area north of Piazza Leonardo where, in 1919, the Gran Sasso Garden Village was built to respond to public housing shortage.
The irregular shape of the plot is the result of a series of changes to the Town Plan and consequent negotia-





tions, documented by some planimetric hypotheses and sketches preserved in the folder relating to the project (Archivio Storico TIM, Subfondo "DCT – Direzione Centrale Tecnica", Serie "SE - Servizio Edile, faldone 7/2). The building overlooks the pre-existing Via Spinoza (to the south-west) for about 31 meters, Piazza Leonardo (to the south) for just over 4 meters, and a new road that will be called Via Villani (to the East) for about 34 meters. On the opposite side of the latter street, the construction of a parish complex was planned. Its project was initially conferred to Giovanni Muzio (1893-1982) but was then carried out in 1955, with more sober forms, by Giuseppe Chinigher (1921-2012).

In 1939 the expropriations and demolitions of the residential buildings of the Garden Village were carried out; the construction works began in 1940 and ended in 1943 (therefore in the middle of the war) as evidenced by the contracts with the construction company. The morphology of the building, which can be divided into three blocks, arises from the need to fit into an irregular polygonal plot: the two-level volume on via Spinoza (1) occupied by the

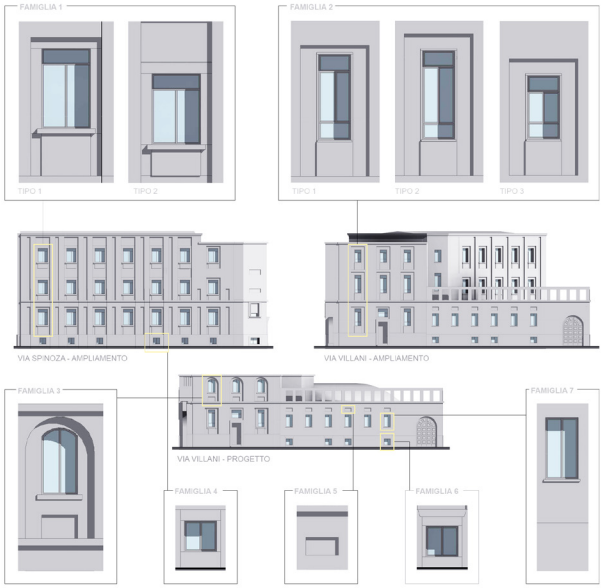
Fig. 2. Centrale telefonica di Città Studi, viste assonometriche del primo progetto del 1939 e dello stato comparativo tra il primo progetto del 1939 e la realizzazione completata nel 1943 (elaborazione grafica degli autori).

Fig. 3. Centrale telefonica di Città Studi, viste assonometriche della realizzazione del 1943 e dello stato comparativo tra la realizzazione del 1943 e la sopraelevazione del 1962 (elaborazione grafica degli autori).

Fig. 4. Centrale telefonica di Città Studi, vista assonometrica con la sopraelevazione del 1962 (elaborazione grafica degli autori).

actual telephone exchange; the one on via Villani (2), again on two levels, dedicated to the rooms for heating, offices and the engine rooms; and finally the one on the corner of Piazza Leonardo (3), on three levels, occupied by staircases, offices and the caretaker's apartment. This planimetric partitioning can be also recognized from the outside, thanks to the composition of the volumes: volumes 1 and 2 are made up by basement and ground floor, while volume 3 consists of basement, ground floor and first floor.
From the project drawings of the young engineer-architect Castagnoli it is possible to deduce his attention for technological innovations and for the debate on the theme of the architectural project which, in the development of the architectural process, necessarily find continuous interactions between them.
The structure of the building was planned in brick masonry, unreinforced concrete, reinforced bricks and, only partially, in reinforced concrete ((Archivio Storico TIM, Subfondo "DCT – Direzione Centrale Tecnica", Serie "SE – Servizio Edile, faldone 7/2) see the application to the

Fig. 5. Centrale telefonica di Città Studi, abaco delle famiglie parametriche delle finestre del modello BIM (elaborazione grafica degli autori).



Ministry cited in correspondence dated November 16th, 1939). The roof of the large room called 'automatico', 14 m wide and about 25 m long, is indicated in section with a lowered arch typical of the Volta SAP. Presented for the first time at the Milan trade fair in 1938 with the famous large arched structure, the system had been patented in 1936 and was produced by the Fornaci Fratelli Rizzi Donelli Breviglieri & C. of Piacenza. This is the same technology that Giuseppe Pagano decided to use in 1939 in the extension project of the building Nuova Pettinature Riunite in Biella (in collaboration with engineer Predaval), and that few years later, in 1943, was also used by Piero Bottoni for the roof of the Olivetti Shyntesis factory in Apuania. Two examples referable to industrial architecture, an area in which this technology was actually widely used [Paolini, Pugnaletto 2017].
The graphic analysis conducted on the original drawings can help us reveal the architect's thinking and his cultural and design references, explicit or implicit. Observing the elevations gives us the perception of a regularity punctuated by the openings and setbacks of planes that materialize, especially on Via Spinoza, a system of beams-pillars, which is useful for internally incorporating ducts for the technical systems. The windows are highlighted by large stone frames and high windowsills. Above, the theme of the loggia with an architrave is treated differently on the south-west side (closed) than on the east side (open). It is still possible to note how some circular shapes characterize the plan of the entrance and the staircase, the openings on the first floor, the two access arches to the current Via Villani (never completed even if set up, as can be seen from the fragment still existing today) and the entrance to the court. Overall, as noted in a previous contribution [Velo, Castagnoli, Incerti 2020], these are forms that are closer to the Milanese twentieth century language than to the international rationalism.
The reading of the compositional module, in plan and elevation (fig. 1), highlights a certain complexity, which finds its own development logic, when we refer to the three volumes previously identified. The module of 3.90 m. of the opening's axis on via Spinoza, is in fact different from that used on via Villani or on the corner volume. It is clear that all the modules are based on the distance between the voids and not on the solids/voids ratio which. In the execution phase, this distance will be sized and proportioned to the dimension of the brick, the true module of this architecture (24-24.5 cm; 11.5-12 cm; 6.5 cm with

mortar thicknesses of about 1 cm). Finally, figure 1 shows the use of some notable proportions (golden ratio, √2, √3, 1: 2) which denote the research, not necessarily rational or conscious, of proportional relationships between the parts.
As will be further explained below, the project examined so far differs from what was actually built. In fact, all the arches disappeared except those of the access to the courtyard: a change of language that had certainly have repercussions in terms of simplification in the construction and, therefore, in terms of costs.
The project drawings of the *Templum Reginae Pacis Augustae* in Milan - Città Studi, elaborated in 1939 and preserved in the Archivio Muzio [Irace 1994, pp. 211, 212] help us to reconstruct the meaning of some of Castagnoli's design choices. In those years Muzio was already a very successful professional, author of numerous civil and sacred architectures including Università Cattolica del Sacro Cuore and its chapel (1929-1949), S. Maria Annunciata in Chiesa Rossa church (1932), Sant'Ambrogio and Sant'Antonio church and convent in Cremona (1936-1939), Sant'Angelo church and Angelicum cultural center in Milan (1939-1947), whose language marks a turning point in the architect's poetic and professional career [Irace 1994, pp. 203-230].
The analysis of Muzio's drawings for the church of Città Studi shows a series of formal and material similarities with the project for the Castagnoli telephone exchange. The new *Templum*, of imposing dimensions, presents an organization of the surfaces similar to the other contemporary Milanese works of its author: horizontal and vertical bands whose measurements are given by the module of the brick, as well as backward or protruding squares or rectangles and round arches. The roofs of the large hall and the accessory building on the north side are curved, therefore large SAP vaults were likely planned. In the drawings and in the model of the project there are also the two arches that frame the beginning of the new via Villani, the same ones that appear in the project of Castagnoli telephone exchange and that are sketched in pencil, in plan, in elevation and on the plan in scale 1: 500 about the land subdivision in plots. In this last drawing, preserved in the project folder, also the articulated perimeter of the church of Muzio (80x69.38 m) appears. The direct confrontation between the two architects is, among other things, testified also by a memo for the STIEPEL General Manager, dated April 1939.

Fig. 6. Centrale telefonica di Città Studi, sopra: vista dell'ingresso dalla porta di accesso, sotto: vista della scala principale (elaborazione grafica degli autori).

Fig. 7. Centrale telefonica di Città Studi, vista degli esterni da Piazza Leonardo da Vinci, al momento della prima realizzazione completata nel 1943 (elaborazione grafica degli autori).

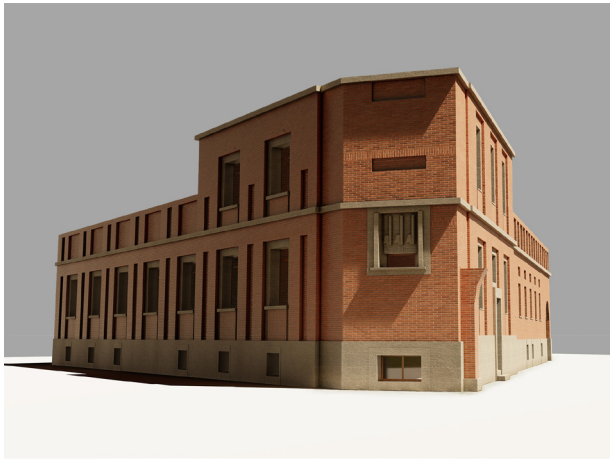


Fig. 8. Centrale telefonica di Città Studi, prospetto su via Spinoza. Sopra: primo progetto del 1939; sotto: ortofoto elaborata con fotogrammetria digitale (elaborazione grafica degli autori).

Fig. 9. Centrale telefonica di Città Studi, prospetto su via Spinoza. Sopra: progetto della sopraelevazione del 1962; sotto: sovrapposizione tra ortofoto e progetto del 1962 (elaborazione grafica degli autori).

According to these documentary evidence, it is clear that the Città Studi project was born with the intention of harmonizing it with the neighboring building, adapting dimensions, materials and proportions, with a measured and respectful attitude that we will see also in the Turin theme illustrated at the end.

The later projects for the Building in Città Studi: from archive drawings to 4D BIM visualization

Castagnoli worked again on the telephone exchange to design a raising project –which gave the building its current shape– in 1962, the same year in which he resigned from STIPEL, due to health reasons. This second project is therefore part of that series of works that the architect carried out for the telephone company as a freelancer after his resignation, as evidenced by the fact that the related documents are kept in the family's private archive.

This temporal information relating to the phases of the building (first project in 1939, construction in 1943, raising project in 1962) were integrated with the three-dimensional geometric ones within the digital model, in a BIM environment with the software Revit, in compliance with the standard UNI11337-1: 2017 which describes the fourth dimension of information models as the 'simulation of the building or its elements as a function of time'. Within the BIM environment, in fact, the models can be made up of 'phases', each representing a distinct period of the life of the project and in particular in H-BIM projects these phases are generally used to describe the evolution of the building and its changes over time [Brumana et al. 2013, Calcerano et al. 2017].
The BIM modeling was carried out on the basis of archival drawings, thus following a procedure of which the examples in the literature are relatively numerous [Bertola 2020], while there are many case studies of BIM models based on indirect surveys integrated with archival documentation (see in this regard the experiences on buildings da-

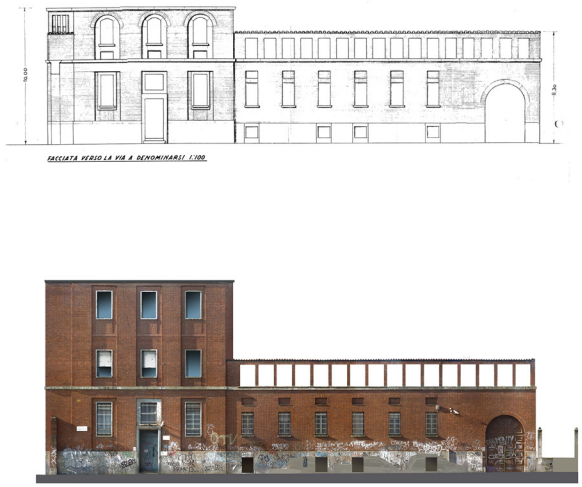


Fig. 10. Centrale telefonica di Città Studi, prospetto su via Villani. Sopra: primo progetto del 1939; sotto: ortofoto elaborata con fotogrammetria digitale (elaborazione grafica degli autori).

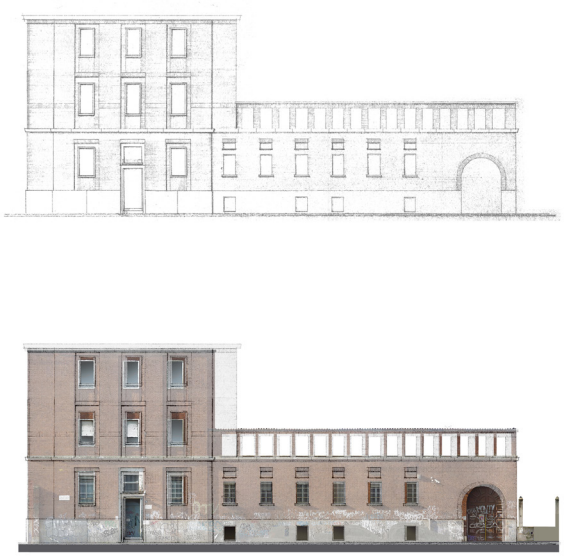


Fig. 11. Centrale telefonica di Città Studi, prospetto su via Villani. Sopra: progetto della sopraelevazione del 1962; sotto: sovrapposizione tra ortofoto e progetto del 1962 (elaborazione grafica degli autori).

maged by recent earthquakes). In particular, for the graphic reconstruction of the phases, the differences between the archive documents were analysed: the parts of the architecture, modified over the course of about 25 years, were progressively documented in the model, without altering the main dimensions of the composition system. Thanks to this temporal structuring of the model, it was possible to create, in addition to the three-dimensional views corresponding to the three phases, also those that highlight the differences between them, showing the removed elements in yellow and those added in red (figs. 2-4). It is therefore noted how, already in the passage from the first project of 1939 to its initial construction completed in 1943, some changes were made, in addition to the already mentioned disappearance of the arches: the SAP vault was replaced by a double pitched roof, the body corner was raised and some compositional and decorative elements of the openings were simplified.

With the raising project of 1962, two floors were added to the first volume on via Spinoza, while on the corner volume, which already had an extra floor, only one was added, with a more limited height, so that this corner volume is lower than the rear one. While still maintaining the same composition scheme of the facades, this intervention completely transforms the general proportions of the building. In fact, previously the facility had a mainly horizontal extension with a plan development much more consistent than the one in elevation, having only one floor above ground, except for the limited two-storey corner portion. Following the raising project, the plan extension remains unchanged but the building becomes three floors above ground (with a height increase of 50%, from 10 to 15 m). For these reasons the altimetric development becomes predominant, in perceptive terms, over the planimetric one. The drawings show how Castagnoli, while creating a building with profoundly different proportions, is able to maintain all the formal elements of the existing building, even reusing them in the design of the elevation, creating a completely coherent and balanced composition and an unitary organism, without any discontinuity between the existing building and the added floors.

Creation of the semantic aware BIM model and its parametric families

The BIM virtualization of the Centrale di Città Studi is a semantically aware digital model, consisting of a collection of structured objects identified through an architectural vocabulary. Its implementation therefore composed by two parallel processes, a cognitive one of interpretation and recognition of the semantic elements that make up the architecture and an operative one for the generation of geometries [Inzerillo et al. 2016, p. 16.4]. Therefore, its realization, in addition to providing useful tools of representation and dissemination, has first and foremost worked as a tool to study the archive drawings. This methodology has proved particularly useful for windows, in fact the modeling of the related parametric families required first of all a careful analysis of the various types present, to identify similarities and differences. An arrangement of the main typologies into seven parametric families was carried out and in two cases these have been divided into several types, which differ in size or detail elements (fig. 5).
This work has shown how Castagnoli repeats in his composition some architectural elements similar to each other, declining them with some dimensional variations. Furthermore, these activities of architectural elements parametrization have the potential to create reusable 3D semantic libraries of historical architectural elements in the context of Heritage Building Information Modeling (H-BIM) [Santagati et al. 2018, p. 111]. Being a mid-20th century building, the use of libraries of standardized elements does not present particular complexities due to the uniqueness of the historical form [Attenti, Rossi 2019, p.189] as the construction techniques of the period were already based on the repetition of elements made by serial production.

Fig. 12. Palazzo dei telefoni di Torino, analisi grafica del prospetto su via Mercantini (1943), (elaborazione grafica degli autori).

BIM model for three-dimensional digital representation: indoor and outdoor

The three-dimensional model was used as a basis for the creation of perspective images with Lumion, a real-time rendering software. This feature, together with the simple and intuitive interface and the rich pre-loaded libraries, makes the workflow very smooth, which is further facilitated by the Lumion LiveSync plug-in for Revit. It synchronizes the file with the BIM model in real time, so that each change is updated in real time, ensuring extreme interoperability between software.
This methodology was applied to create two images of the interiors (fig. 6), produced to analyse the spatiality of the distribution systems generated by a circular matrix. In fact, as already mentioned, the entrance and the staircase stand out from the archive drawings because their perimeters in plan are essentially defined by two circumferences. From the documents available, their geometric connotation on the horizontal plane is very clear but no other drawings or photographs, that describe the spatiality of these environments in three dimensions, are available nor at the moment it was possible to visit these indoor areas. Therefore, they have been modeled on the basis of the information available in the original drawings: through these images a first hypothesis on their three-dimensional development is therefore proposed, in order to enhance the strong geometric-compositional characterization of this spaces.
With the same methodology, a perspective view of the exterior of the building was also created, as it was built in 1943, before the raising project of 1962 (fig. 7). This image provides a clear view of the formal and material elements of the building at the time of its construction and allows to make a comparison, almost on the same level, with the current appearance of the building. It is evident that before the elevation, the angular volume was the highest central element and it dominated the composition, while the two lower volumes were joined on the two sides of it, like two similar wings. With the raising project of 1962, the angular volume becomes lower and smaller than the body on Via Spinoza, from which it is partially incorporated, losing its central role within the composition scheme. In this way the volume on via Spinoza becomes predominant while the wing on via Villani seems to be a small annex.

From archival drawings to survey: a comparison

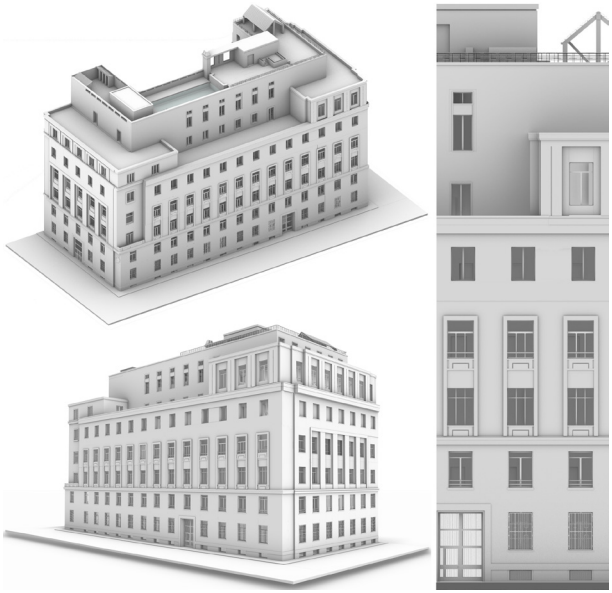
In the context of this research, a further contribution can come from the architectural survey in its value as a document of the completed work. Figures 8-12 allow to compare the project drawings of the elevations of 1939 (first project) and 1962 (raising project) with the orthophoto processed by digital photogrammetry (Agisoft, Metashape, single model made with 190 shots). The overlaps between the survey data and the project data immediately shows the considerable metric differences: moving from the 1:100 scale drawing to an executive, a new design phase is evidently developed. During this the brick module, scrupulously used, re-proportions interaxle spacing and dimensions of the openings. On the east elevation, moreover, it is evident how, the simple 90° rotation of the brick, gives a perceptually much leaner and lighter loggia than the one planned.
This step of comparison between archival drawing and survey of the existing object, allows (as it naturally should be) to further increase knowledge on the culture of the project put in place by the architect in all phases of his work.

Comparison with the Palazzo dei Telefoni in Turin

From a comparison of the Centrale di Città Studi with the Palazzo dei Telefoni in Turin, it is immediately clear that the two buildings, both designed by Castagnoli for the same telephone company, have very different scales. Indeed, in their final configurations, they are respectively a three-storey building and an eight-storey one. The differences also concern the intended use, since the one in Città Studi is a telephone exchange, therefore a building intended to house only telephone systems and the necessary ancillary rooms, while the Palazzo dei Telefoni in Turin is the headquarters of the company and hosts its offices. Despite these differences in size and intended use and the consequent different level of representation that these buildings had for the company, it is possible to recognize a common architectural language, which characterizes Castagnoli's production and is adapted to the different contexts in which it is used. In both interventions, in fact, the architect's desire to blend harmoniously into the surrounding context is clear, even if it has not yet been built but only designed, relating dimensions, proportions

and materials with the neighbouring buildings. This intent is also demonstrated by the design drawings that depict his interventions alongside the neighbouring buildings, such as the Church of Muzio in the case of Città Studi, which was discussed above, and the pre-existing STIPEL headquarters, in the case of Turin [Incerti, Mei, Castagnoli 2021].
The graphic analysis of the façade of Palazzo dei Telefoni in Turin on via Mercantini (detailed drawings in 1:50 scale of the cladding, 1943, EdificaTo Archive) allows us to recognize the presence of the same compositional logic used in Città Studi. The rhythm of the facade (fig. 12) is given by the axis of the openings, according to a 4-meter module that actually derives from the grid of the reinforced concrete pillars. The solids/voids ratio is 3:2 and is sized and proportioned to the dimension of the brick that characterizes the third, fourth and fifth floors. As with the first building, the corner portions are treated with different modules. The openings, while always maintaining the same width, are progressively changed in height, probably due to the different light requirements from the first floor (2.56 m) to the sixth floor (2.20 m).
Finally, it appears evident that the author worked here according to a logic of "volumetric subtraction" from a main solid, which is progressively excavated as already done in the project for a Villa, presented at the 4th Triennale [Incerti 2016, p. 185].
The three-dimensional digital models of the two case studies were created with different methodologies: for Palazzo dei Telefoni in Turin, a NURBS surface modeling software was used (fig. 13). A comparison between this and the BIM modeling already described, allows to propose some reflections (certainly not exhaustive) on the theme of three-dimensional representation starting from archive drawings. Given that the purpose of the contribution is not to propose an in-depth comparison between modeling systems, the two experiences have allowed us to appreciate the advantages and disadvantages in the development of research on the design culture of the architect Castagnoli. Although both methodologies have proved effective in representation and dissemination, especially through three-dimensional views, BIM modeling has presented some particularly interesting aspects. First of all, BIM models are based on the semantic structuring of the constituent elements of the architecture and therefore lead, in this field of application, to a more in-depth knowledge of the real building, since they replicate "a digital model similar to the real one, not only in terms of the mimetic rendering of its configuration, but also in the intrinsic organization of its parts" [di Luggo 2018, p. 50, 51]. In BIM systems the representative moment does not only constitute the moment of graphic reconstruction of reality in the space of representation, but also the critical moment of identification of the formal structure of architecture and the constitutive relationships that substantiate it [di Luggo 2018].
On a purely practical-operational level, the possibility of a temporal structuring of the model, provided by the BIM environment, proved to be particularly useful in the analysis of the definitely difficult to interpret architecture, due to the countless project drawings that have followed one another over the course of more than two decades. Furthermore, the system of parametric families has favoured a careful comparison between the architectural elements of the building (in this epoch already based on serial repetition), automatically creating a useful catalogue for their analysis.

Fig. 13. Viste di insieme e di dettaglio del modello digitale del Palazzo dei Telefoni di Torino (elaborazione grafica degli autori).



Conclusion

With this paper, the project of the Centrale Telefonica di Città Studi in Milan was analysed, systematising archival drawings, documents, surveys and techniques of two- and three-dimensional graphic analysis (with BIM methodology) in order to investigate the author's technical and cultural approach as well as his responses to external solicitations (see the case of Giovanni Muzio's *Templum Reginae Pacis Augustae*). This project was also briefly compared with the case study of the Palazzo dei Telefoni in Turin, for which different representation tools and methodologies were used. The work constitutes a further step in the context of a broader research on the projects of the architect Castagnoli and, given the first results achieved, it has been considered useful also to implement it with BIM methodology. Future developments could concern the construction of a shared abacus of parametric architectural elements that can be used for multiple models, as carried out in the work on the La Sapienza University complex [Valenti, Griffo 2020]: in this case the author would be the unifying element instead of the location of the buildings. A further outcome could concern the creation of a digital environment in which to catalogue the numerous archival documents by connecting them to the three-dimensional model [Bruno, Roncella 2019], with the aim of creating a tool capable of holding materials together, improving the accessibility of cultural heritage through digital tools. The BIM methodology can in fact constitute a bridge between archival documentation and the digital model [Parisi, Lo Turco, Giovannini 2019] and therefore a useful tool also in this lively field of research, as shown by the growing interest of scholars in 20th century architecture archives; the drawing is a document and, as such, a primary source for the in-depth study of the works, the trajectories of artistic movements and designers [Spallone, Bertola 2020].

Credits

The work is to be considered as a unitary product of the research group but each paragraph is to be attributed to one or more authors, as indicated by the initials shown in brackets after the title of each paragraph: Introduction (M.I., G.M, A.C.), Ubaldo Castagnoli and Gruppo 7 (A.C., M.I.), The first project for the Centrale Telefonica di Città Studi (M.I.), The later projects for the Building in Città Studi: from archive drawings to 4D BIM visualization (G.M.), Creation of the semantic aware BIM model and its parametric families (G.M.), BIM model for three-dimensional digital representation: indoor and outdoor (G.M.), From archival drawings to survey: a comparison (M.I.), Comparison with the Palazzo dei Telefoni in Turin (M.I., G.M.), Conclusion (M.I., G.M, A.C.).
The photographs of some of Castagnoli's drawings are kept in Archivio Bottoni of the Politecnico di Milano (Regesto delle fotografie di Piero Bottoni: altre immagini). Other archives that preserve author's material are: Archivio Figini-Pollini at MART, Archivio TIM, EdificaTo, Castagnoli family archive.

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Memory of the Ephemeral. Towards an Italian Baroque Theatre and Scene Digital Archive

Massimiliano Ciammaichella

Abstract

At the end of 16th century, Venice opened its first public pay theatres, but this seemed to presage a history of failure, judging by the Michiel and Tron families' profits, because the success of a sequel interrupted for some 57 years began to barely see in 1637, with the reopening of the San Cassan Theatre, which moved away from the recited comedy genre and embraced melodrama set to music. The spectacle culture imposed itself in the lagoon and by the end of the century the city was hosting about 15 musical theatres, of which, unfortunately, no tangible traces remain.

The essay traces the trajectories for the construction of a digital archive, capable of connecting a heterogeneity of sources useful for the reconstruction of the theatres, the machines and the scenes that animated them, by means of 3D models that are configured as performative digital spaces of a memory from which to extrapolate the dynamics of its actualisation.

In this way, the material and immaterial traces of the architecture, sets and machines that characterised the origins and conditioned the subsequent development of public theatre become the paradigms of a new idea of the performing arts scene, understood as an image of the world.

Keywords: theatre, scenography, perspective, 3D modeling, Venice.

Introduction

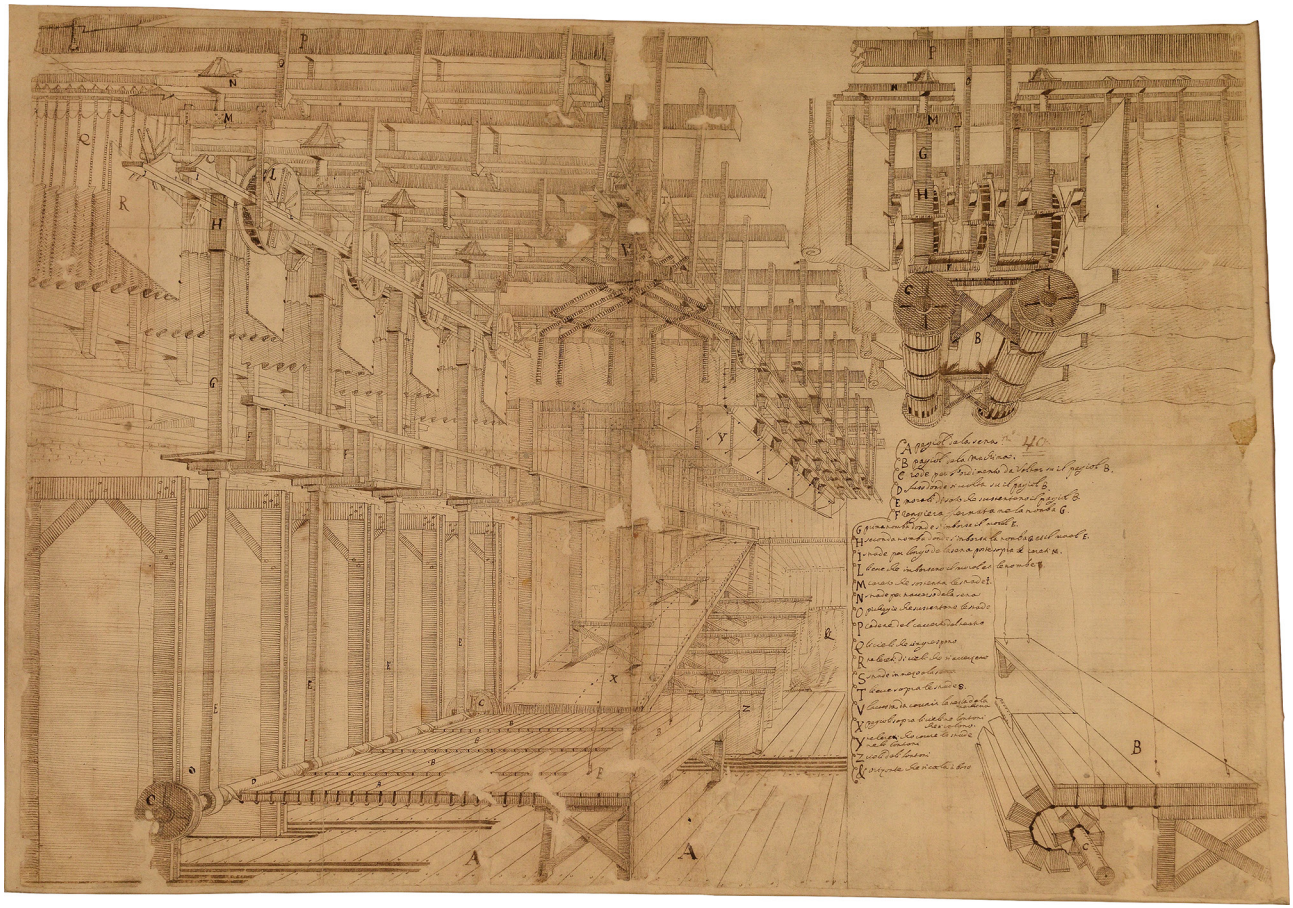
> "The assembling of phenomena is the affair of concepts, and the division effectuated in them by dint of the discriminating intellect is all the more meaningful in that, through one and the same operation, it achieves a two-fold result: the salvation of phenomena and the presentation of ideas"
> [Benjamin 2019, p. 11]

The Baroque scene studies, which are mainly Italian in origin, often lack an organic nature of academic research aimed at returning the centrality, firstly European and then global, of this fundamental aesthetic and political event.

Recovering the documents of the institution of public theatre that developed in Venice in the seventeenth century, along with its constitutive reasons for representing and interpreting the world, means broadening the field of the relevance of the study and the social understanding of this subject. This aim goes through studying and reconstructing spaces offered to the public in cultural and virtually visual terms, basing the research on often unpublished or undervalued sources and writings. This makes it possible to redraw a credible removed map of modernity. But even if the very concept of archiving is at the limit of surpassing an oxymoron, if it refers to practices that by their very nature can be counted among the ephemeral domains, the performing arts, which for many centuries have negotiated their own raison for existence in the *hic et nunc*, constitute the testing ground for this dissertation, which articulates its convictions by extrapolating them from the variable territories of immateriality.

Memory can be translated into an imaginative and didactic transposition of a pre-existing architecture. Or in the interpretation of the transformation traces of an artefact, whose original configuration you can attempted to deduced. As tale of a life the staging is temporary and leaves ample room for manoeuvre to glorify its posthumous absence, especially when it has occupied the illusory spaces of a vanished theatre that imposed the 'game of life' in the musical and sung form of melodrama. This is what happened in Venice in the seventeenth century and the evidence of it can be found in the drawings collected in travel notebooks, documents, albums, texts, booklets, and manuscripts kept in famous European libraries and archives, but also through the cultural reception: in treatises, Lenten books, and academic speeches (fig. 1).
A huge heritage, largely hidden and fragmented, therefore, constitutes a valuable whole of knowledge to be updated and delivered in all their benefit to the wider community.

Fig. 1. Giovanni Battista Lambranzi, drawing of the San Salvador Theatre stage machine, 1675. Complesso monumentale della Pilotta, Biblioteca Palatina, Parma [Ms. Parm. 3708, c. 6].



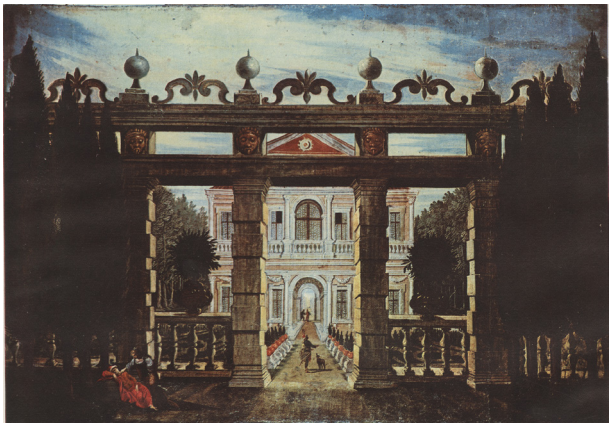
Starting from this premise, it is worth noting that the debate on open access to information over the last twenty years has involved digital archives and universities, with a view to an increasingly flexible dissemination of research results, to the point of formulating a European manifesto in support of it [1].
At the same time, the consolidated institutional contexts, dedicated to the orderly collection and preservation of documents, have completely devoted themselves to dematerialisation processes, transferring a good part or all their contents to the web. But these, for some archivist experts, in the "server or in the clouds bubble with obsolescence, tending to dissolve along with the facts of which they are the product and testimony. Digital archives are a fluid, tangled skein. Unravelling it means handing over the present to the future. Digital documents fly away as soon as they are produced; they must be tamed to make them tangible memory" [Valacchi 2018, p. 23].
Perhaps, then, the problem lies in the renewed meaning of document term, which today takes on a plurality of meanings, also by function of the narratives that can be constructed on it, in the return journey of a forgotten or removed history.
The performing arts, in fact, problematise its value, considering it as an episode of a totality.
Since the logic of the spectacle, in its making and becoming, involves a set of subjectivities and actions, for which it may be difficult to recompose the dynamics a posteriori. In this context, archiving becomes an operation of collecting fragments and, being able to classify them by type, images assume a preferential role in clarifying their complexity [Kihm 2015].

Archives of the ephemeral

> "Between the language (langue) that defines the system of constructing possible sentences, and the corpus that passively collects the words that are spoken, the archive defines a particular level: that of a practice that causes a multiplicity of statements"
> [Foucault 2004, p. 146]

In 2007, the non-profit organisation *Perspectiv* [2] was founded with the aim of mapping the theatres of Europe. Its main actions are to encourage the conservation and restoration of historic theatres, to support research projects and to make this extraordinary cultural heritage known to the public. Hence the need to census it through a database that monitors theatres all over the world, including those that have been partly transformed or have completely disappeared over the centuries.
European Theatre Architecture [3] is structured in the form of an open archive, within which the user can implement the contents by registering in the digital platform with his or her e-mail address. The information mainly concerns the architectures and performance sites that are geographically located; however, the collected materials draw on free internet resources and, in several cases, present some inaccuracies in dating and attribution of authors.
More generally, it can be noted that databases dedicated to mapping the performing arts in Europe, from the 17th century to the present day, can be grouped into two distinct categories: those oriented towards theatrical architecture, as we have just seen, and those that privilege the events produced in it. In any case, recent studies have shown that these experiences –in which Italy is almost non-existent– are largely the result of academic research projects financed with temporary funds that, once concluded, are abandoned to their obsolescent presence in the web boundless space [Baptist, Noordegraaf, van Oort 2021].
It is clear that the sustainability of a 'living' archive depends on the continuous updating of data and the software used to manage them, also by launching collaborative and par-

Fig. 2. Print of La Deidamia. Exterior of a palace with characters. Set design by Giacomo Torelli, Novissimo Theatre, Venezia 1644. Fondo Povoledo, Istituto per il Teatro e il Melodramma, Fondazione Giorgio Cini, Venezia (inv. 56_024).



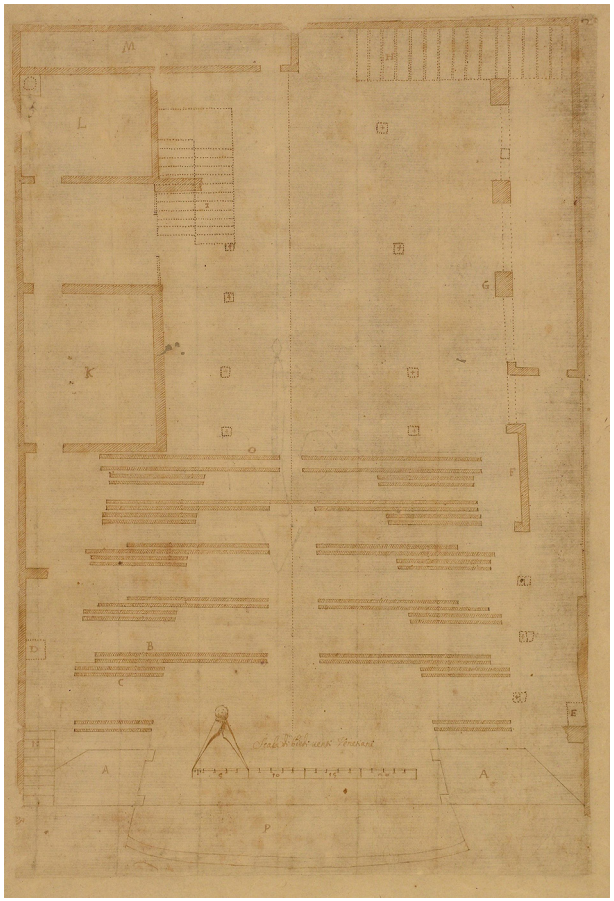


Fig. 3. Giovanni Battista Lambranzi, stage plan of the San Salvador Theatre, 1675. Complesso monumentale della Pilotta, Biblioteca Palatina, Parma [Ms. Parm. 3708, c. 27].

ticipatory projects, capable of involving real research infrastructures animated by scholars, foundations, public and private institutions.
It is precisely in this direction, with the idea of developing innovative forms of digital archiving, that was launched the research project INCOMMON. *In praise of community. Shared creativity in arts and politics in Italy (1959-1979)* [4], which investigates the performing arts of the 1960s and 1970s in Italy, with the aim of studying, preserving, and enhancing the interactions between theatre, music, visual arts, cinema, and video art, in an inclusive perspective according to which it is precisely the performing arts that manifest their will to the common [Campbell 2009].
As far as studies on the Italian Baroque scene are concerned, the Venetian archive of the Giorgio Cini Foundation's Institute for Theatre and Melodrama [5] offers a wealth of catalogued materials, mostly from donations (fig. 2).
The Elena Povoledo fund, for example, is the result of a very rich multi-year collection of playbills, photographs, drawings, engravings, and stage sketches collected by the scholar, presenting itself as a fundamental resource for the theatres study and reconstruction, stage designs and machines that gave rise to public theatre in the 17th century.

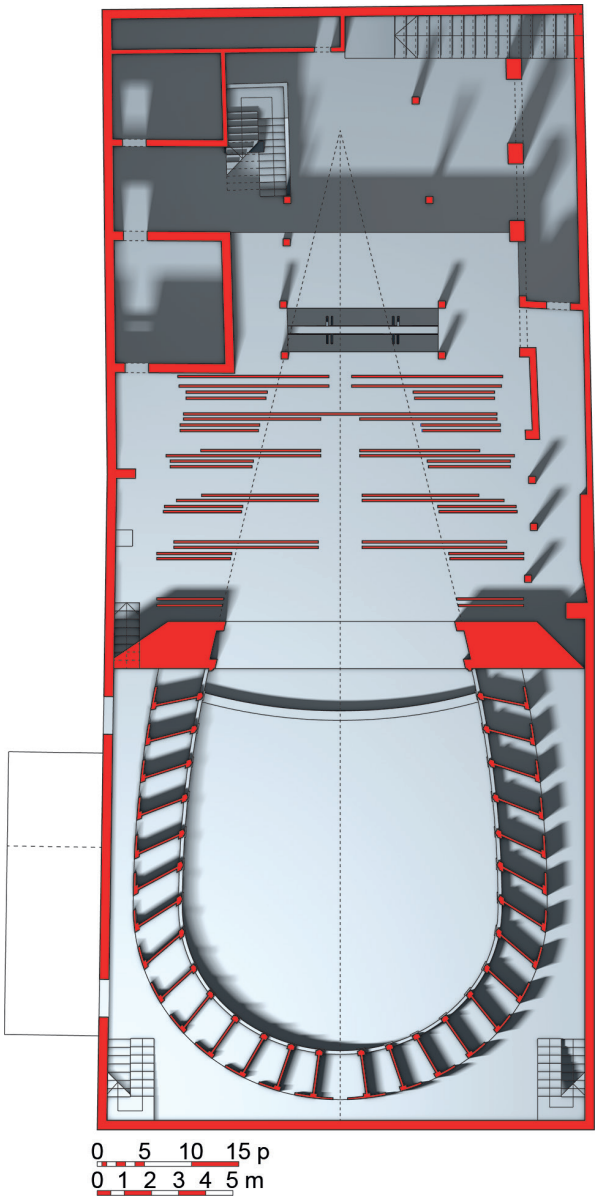
Aesthetics of melodrama in archive

> "The space of creative experience is never just individual, not only because the context defines who or what counts as creative, but because the same construction of the process occurs from the beginning as a relationship"
> [Melucci, Fabbrini 1994, p. 30]

The relationships that defined the birth of Baroque theatre, understood in its typological configuration determinant the institutional spaces that characterise it, cannot be separated from the morphological, social, and political context in which it was born, Venice.
The prodromes of this fundamental adventure can already be seen in 1580, when Alvise Michiel had a theatre for comedy built in the parish of San Cassan, which debuted the following year together with the neighbouring theatre of Ettore Tron.
Francesco Sansovino informs us that the first had a semi-circular cavea, while the second had an elliptical shape, in any case both were equipped with several tiers of boxes [Sansovino 1581].

Their success was short-lived, both in terms of revenue, due to a series of bad investments, and the Jesuit censorship that disapproved of 'lewd comedies'. However, following several fires that marked the sad history of the Tron Thetare, in the carnival of 1637 the family of the same name inaugurated the new San Cassan musical theatre, with the *Andromeda*, a melodrama written by Benedetto Ferrari and music by Francesco Manelli [Galvani 1969]. This was certainly an event of fundamental importance for the evolution of musical opera. The patron was replaced by the impresario, who in turn received the theatre on rent from the owner, almost always a nobleman, eager to increase his own capital with a lucrative investment" [Zorzi, Muraro, Prato, Zorzi 1971, p. 51].
Success was ensured by the production of spectacular events that, in the urge of competition, perfected the illusory art of accelerated perspectives, in sets made up of moving backdrops whose rapid changes took place completely on sight and were supported by the special effects of the machinery. So, the spectator could see singers appearing suspended in the clouds, sea monsters emerging and juggling in the swirling waves, and be amazed at the credibility of magic.
An intense cultural activity animated the Serenissima which, at the end of the 17th century, counted on the presence of fifteen musical theatres, now disappeared.
The protagonists of this innovation, described in the literature in terms of scenes and machines inventors, engineers, stage masters or painters, are those who contributed to building a model of opera house, also known as *all'italiana*, offering a desirable archetype to export abroad [Ciammaichella 2021].
Their names often do not appear in the opera librettos, and this is also recorded by the library collections, institutions and archives that document their prolific activity through sketches, stage designs and architectural surveys, as e.g., in the case of the San Salvador Theatre [6].
Here, in the years between 1673 and 1676, Marquis Guido Rangoni III held the charge of impresario and likely, before returning to Parma, commissioned a drawings album illustrating his three-year artistic production, now kept in the Palatina Library [Ms. Parm. 3708].
In particular, the plan drawn in Venetian feet [7] delimits a proscenium 8.42 m wide; the stage was 17.36 m wide and 24 m deep. Moreover, historical sources attest that the horseshoe-shaped cavea had 5 orders of 29 boxes, 28 of which at the '*pepiano*' [8] [Mancini, Muraro, Povoledo 1995].

Fig. 4. Massimiliano Ciammaichella, reconstruction of the San Salvador Theatre floor plan, 2021.



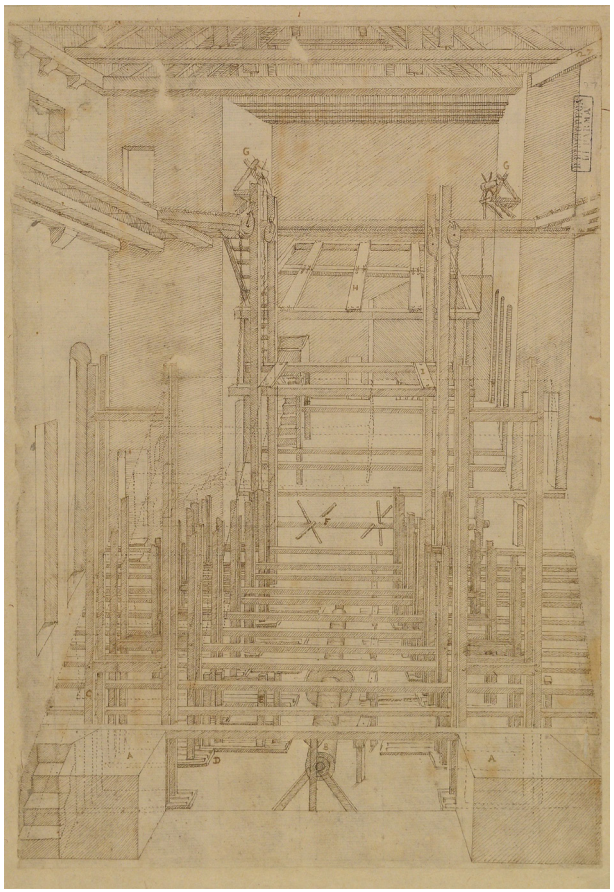


Fig. 5. Giovanni Battista Lambranzi, perspective drawing of the San Salvador Theatre stage, 1675. Complesso monumentale della Pilotta, Biblioteca Palatina, Parma [Ms. Parm. 3708, c. 2].

Access to the theatre was from a side courtyard and not from today's entrance to the Goldoni Theatre, located in *Calle del Teatro or de la Commedia*, because an archive document shows a wooden box, measuring 30 x 10 feet, which served as a ticket office with an adjoining kiosk for the distribution of food and drink [ASVe 1768].
What is surprising is the ability of set designers and architects to expand the boundaries of the performance space, according to the spectacles produced. In effect, the inventor of the 'long scene', Giacomo Torelli, made his debut at the Novissimo Theatre –which he built in wood, in the Cavallerizza area– [9] on 27 January 1641, with *La Finta pazza* by Giulio Strozzi and music by Francesco Sacrati [10]. The following year, for the staging of *Bellerofonte* [11], he worked with the same composer and the librettist Vincenzo Nolfi, but for the great staging "the friars granted that the building be enlarged by 12 feet and the rent be renewed for a year at 300 ducats" [Bianconi, Walker 1975, p. 415].
The drawing contained in the Parmesan manuscripttogether with the reconstruction of the San Salvador Theatre planshow a similar situation: the stage expands to include portions of rented houses, used as warehouses, guest quarters and artists' dressing rooms, whose overlooks and entrances with stairs are internal to a theatre that expands itself on the city (figs. 3, 4). The perspective sketches, on the other hand, allude to the functionality of complex machine that animates the spectacle.
As far as the under-stage is concerned, two rotating cylindrical trunks, orthogonally arranged, collect the ropes that allow the translating motion and the removal of the painted sceneries; the massive trusses system, instead, holds a big central winch on which to hang the theatrical wings, the curtain, the backdrops, and the equipment for the flying exploits of the stage protagonists (figs. 5, 6).
The album also contains sketches of the machines and sets of two shows, whose comparison with the spatial descriptions, contained in the librettos of the operas, allows us to identify them as *Eteocle e Polinice* [12] and *La divisione del mondo* (1675) [13], informing us of the author's name. He is the quadraturist painter Giovanni Battista Lambranzi, who was already an active stage designer in the early Sixties, when he collaborated with Ippolito Mazzarini to the realization of the shows at the SS. Giovanni e Paolo Theatre, owned by the Grimani family.
Also, under the Rangoni management, in his last year in Venice activity, two other dramas in music debuted at the San Salvador Theatre in 1676: *Adone in Cipro* [14] and *Ger-*

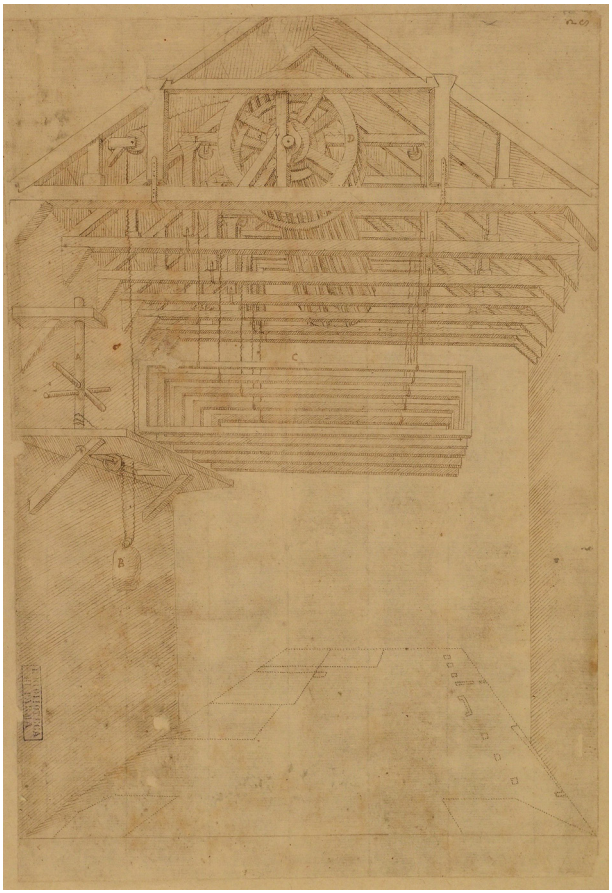
manico Sul Reno [15]. The librettos do not mention the scenes authors, and according to some historians they may been the Gasparo and Domenico Mauro brothers [Brugnoni 1992]. The first one was a skilled machines inventor and had served at the Arsenal, acquiring the knowledge of naval engineering to be transposed into the production mechanisms, the second, however, was a talented scene painter.
The sketches of these two works are kept in the *Bibliothèque de l'Opéra* in Paris [Lambranzi? 1675], revealing what is hidden behind the amazing and sudden variations of the sequences. For Germanicus' entrance, the first act opens with the circular motions of a large, suspended wheel and, all around, in the whirlwind of clouds, we witness his triumph (figs. 7, 8).
The narrative and stylistic register displayed in both drawings' collections, however, suggests that the author is still Giovanni Battista Lambranzi.
''There are about sixty sheets, forty of which depict 'scenic appearances', i.e., mainly scenes but also images of glories, appearances, and apotheosis. They are not sketches ready for production, but preparatory drawings for a memorable edition of the four performances in the form of illustrated scenarios'' [Mancini, Muraro, Povoledo 1995, pp. 247, 248] (fig. 9).

Prefigure the archive

> ''Memory, history, and archive, while maintaining distinct if unstable definitions, have long engaged in a dance of changing relationships and power''
> [Caruso Haviland 2018, p. 63]

The case study described is significant for the richness of the materials and sources that bear testifies to both its active presence and its transformative processes, dictated also by the choices to remodel the stage extension and the machinery, in function of the shows performed. However, it is still a documentary heritage located in the premises of various Italian and foreign organizations and institutions that, for the most part, have not digitised and made it public, except under the specific request of scholars for research finalities, as can be seen from this discussion, which highlights its importance. Therefore, the premises for the construction of an open-access archive of the Italian baroque scene which collects this precious cultural heritage are based on the idea of assuming the theatre as the main subject from which to draw the information that

Fig. 6. Giovanni Battista Lambranzi, perspective drawing of the San Salvador Theatre stage, 1675. Complesso monumentale della Pilotta, Biblioteca Palatina, Parma [Ms. Parm. 3708, c. 32].



determined its reasons for being and production. Here, it is conceived as a sort of interrogable and interoperable device: a 3D model that presents itself as a container to record the stratifications of its history and from which to extrapolate the librettos of the programmed operas, the sketches of the sets design and machines that defined their cinematics, the consequent spatial mutations, and the chronicles of the time (fig. 10).
Furthermore, the stage reconstruction of San Salvador's theatre philologically followed the indications offered by the precious drawings contained in the aforementioned manuscript of Parma, particularly about the planimetric based on Venetian feet and the central perspectives. These reconstructions were subjected to perspective restitution processes to verify certain inconsistencies in the scale ratios of the depicted props, whose corrective factors are dictated by the comparison with textual and iconographic traces found in historical documents and volumes [Mancini, Muraro, Povoledo 1995]. The obtained digital model can be dynamically explored through 3D web algorithms implemented, such as those used in video games that contemplate the interactive exploring environments in virtual reality.

Fig. 7. Giovanni Battista Lambranzi, machine for the introduction and triumph of Germanico sul Reno, 1676. Bibliothèque de l'Opéra, Paris [Lambranzi? 1675].

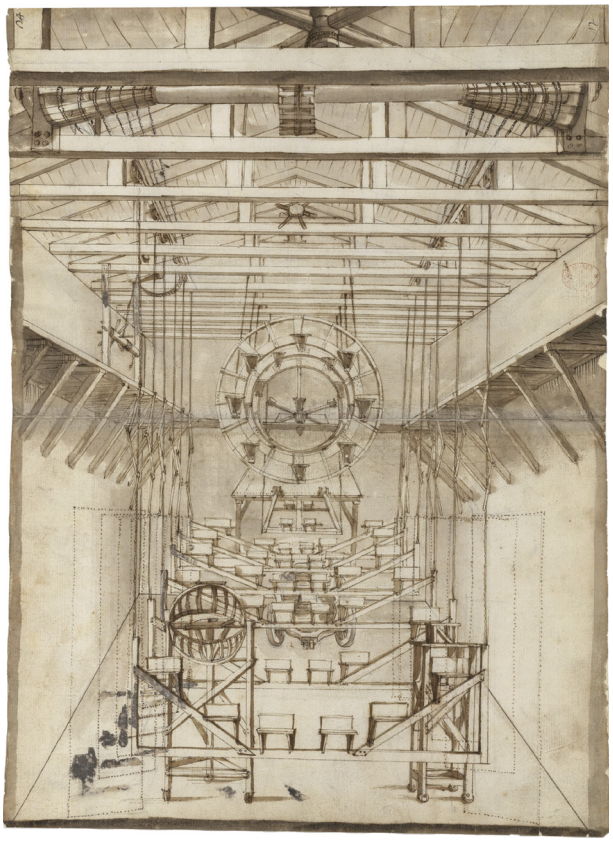


Fig. 8. Giovanni Battista Lambranzi, set design for the introduction and triumph of Germanico sul Reno, 1676. Bibliothèque de l'Opéra, Paris [Lambranzi? 1675].

This is today possible, thanks to the introduction of the Aton open-source framework [16] that "defines an important distinction between collection and scene concepts. A collection is a set of items –including 3D models, panoramas, audio sources etc.– that we intend to use to create an interactive 3D presentation or space […]. A scene on the other hand, is an arrangement of collection items, with hierarchical organization and transformations offered by scene-graphs. A scene may indeed include specific viewpoints (POVs), keywords, semantics, soundscape, and much more" [Fanini, Ferdani, Demetrescu, Berto, d'Annibale 2021, p. 8].

The possibilities offered are considerable and allow one to quickly interrogate every single element that makes up the simulated scene, making it an activating subject of the most diverse multimedia contents. Therefore, significant vertical sections can be obtained from the 3D model, describing the geometric and spatial complexity of the performing spaces for melodrama in music (fig. 11), or, for example, it is possible to relate the scenic machine perspectives with the correct points of view from which to view the sketches and sets reconstructions (fig. 12).
Finally, the semantic models thus produced could be integrated into the already structured *European Theatre Architecture* data-

Fig. 9. Giovanni Battista Lambranzi, set design representing the Temple of Juno, Germanico sul Reno, 1676. Bibliothèque de l'Opéra, Paris [Lambranzi? 1675].

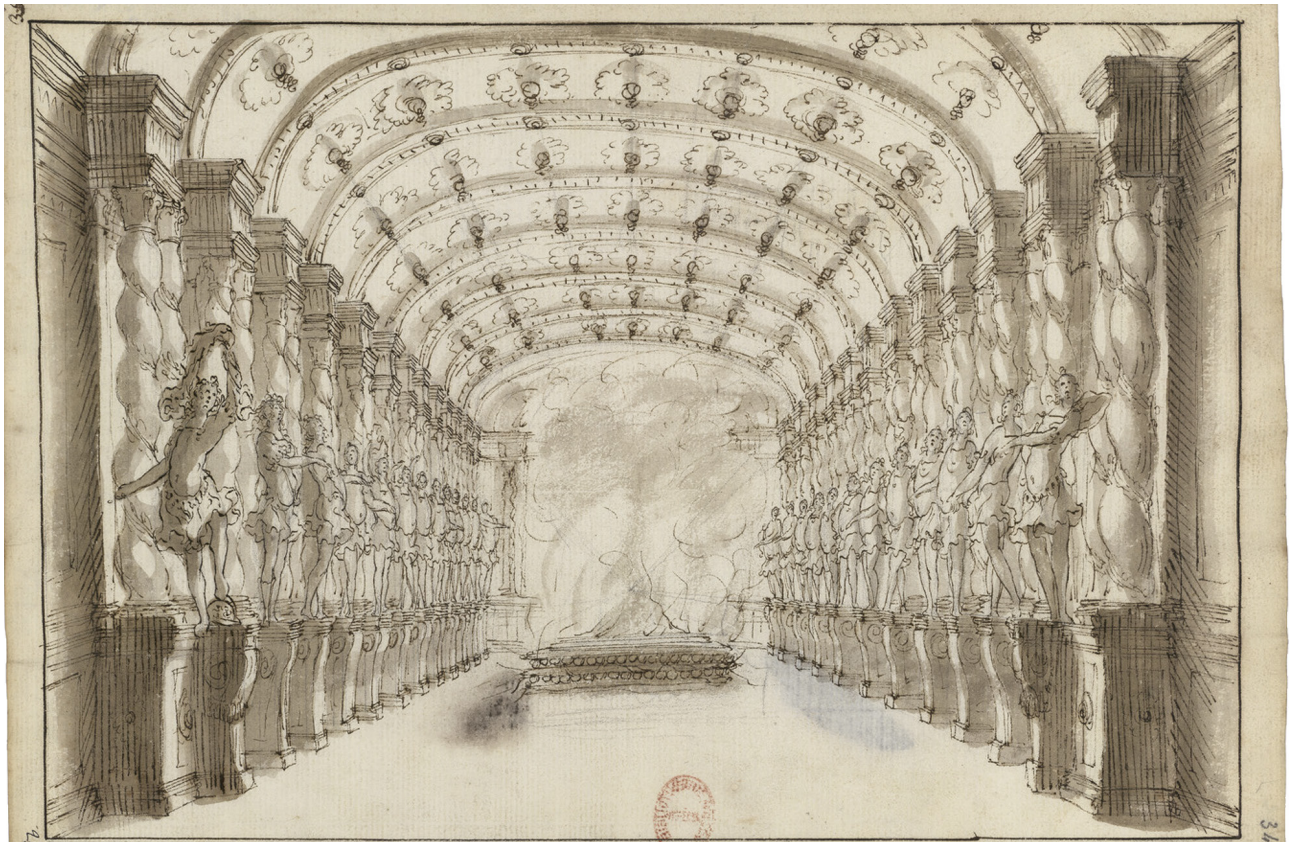
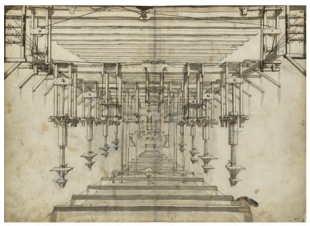


Fig. 10. Massimiliano Ciammaichella, reconstruction of the San Salvador Theatre stage machine, 2021.

set design



stage machine

libretto

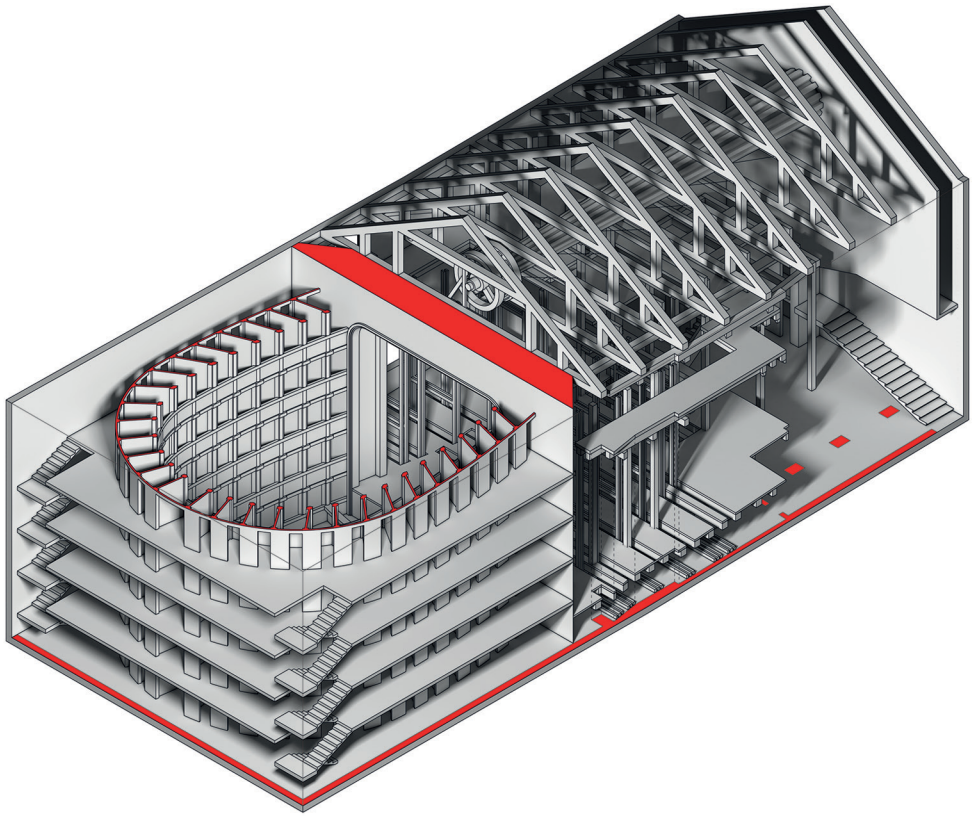


Fig. 11. Massimiliano Ciammaichella, San Salvador Theatre, perspective sections, 2021.

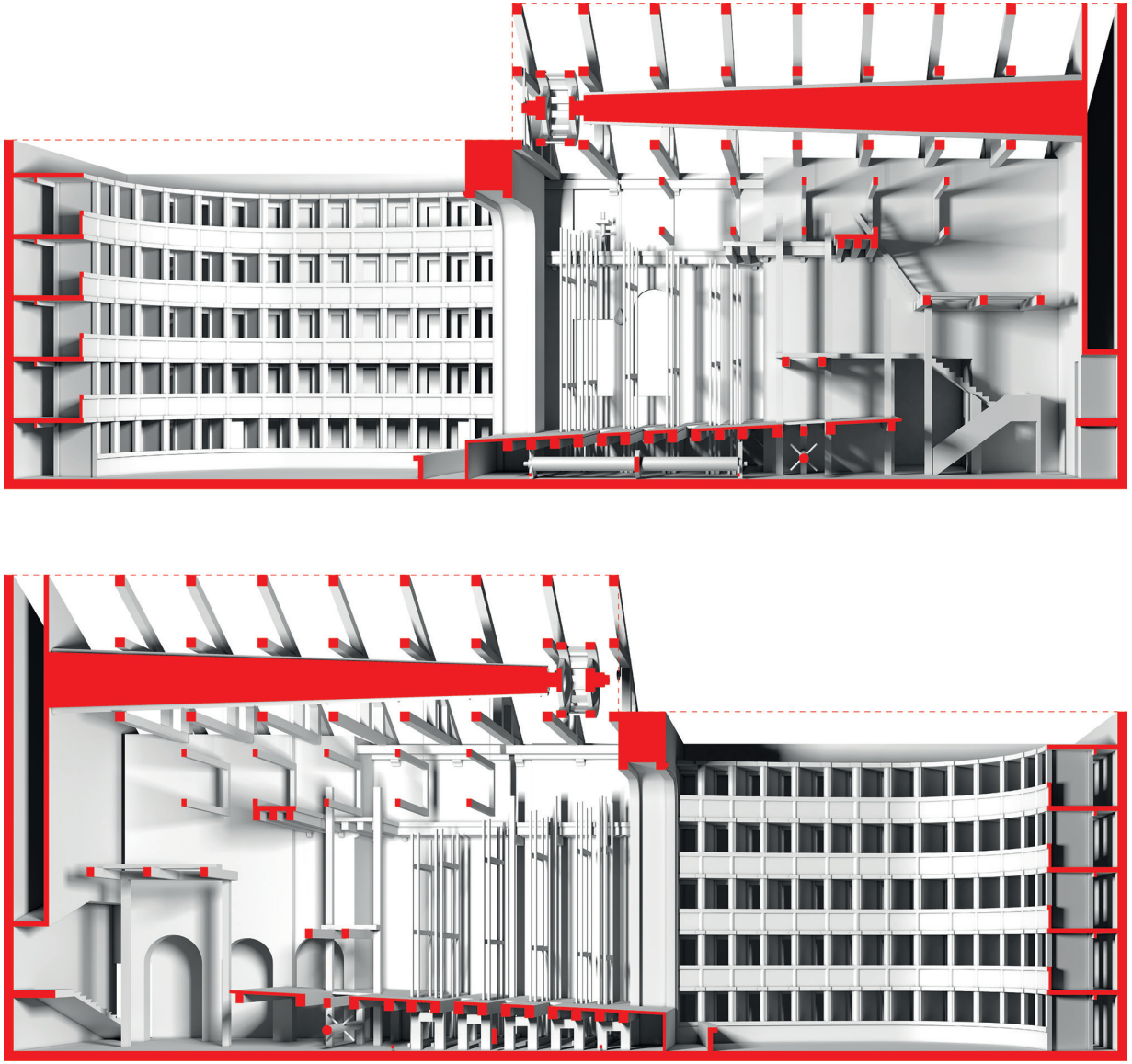
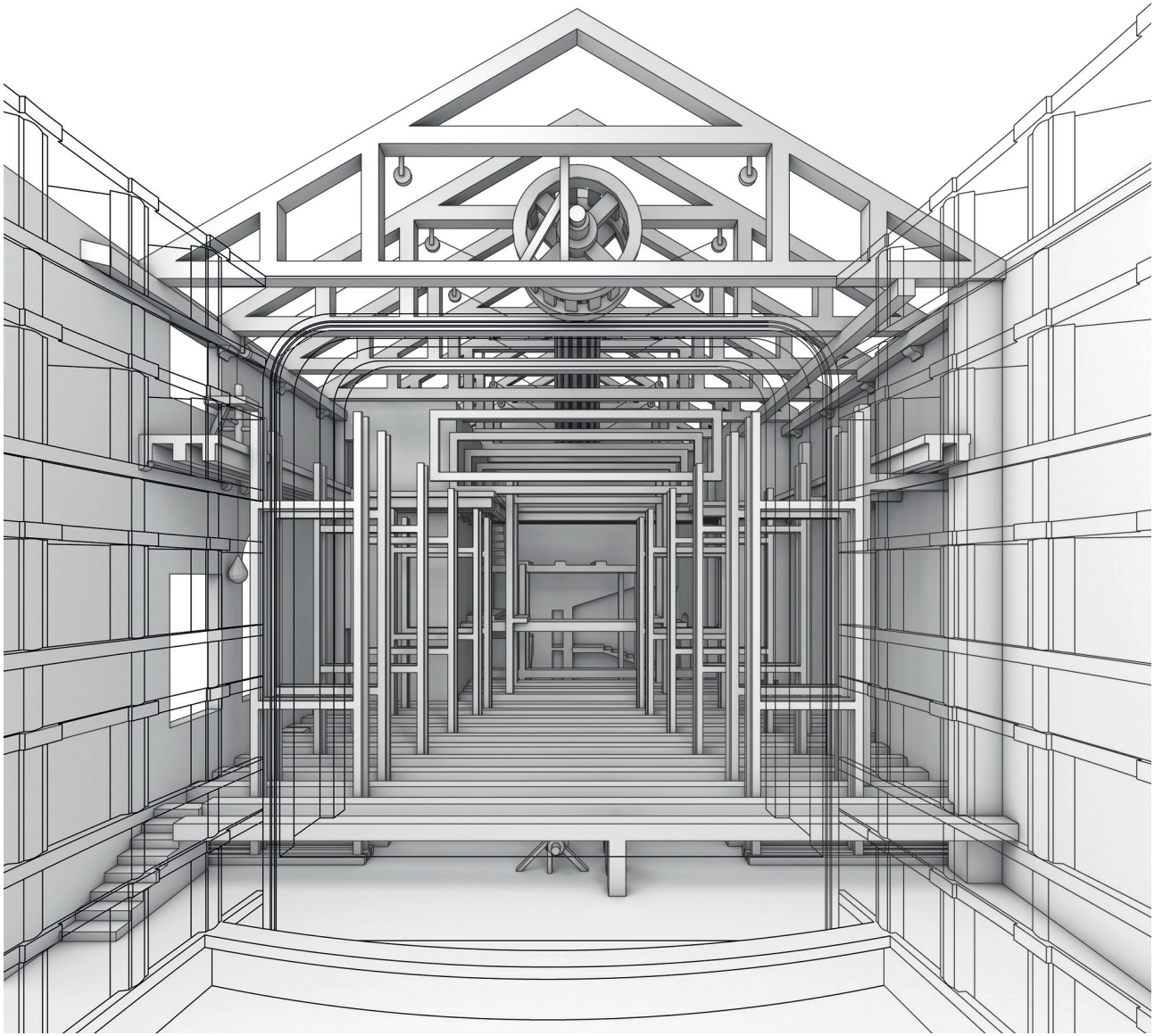


Fig. 12. Massimiliano Ciammaichella, San Salvador Theatre, isometric axonometric section, 2021.



base, activating forms of collaboration with the organizations and institutions involved, in the firm conviction that archives must now evolve into real digital collaborative platforms.

Conclusions

The events narrated here delved into the history of the San Salvador Theatre, of the Vendramin family. The chosen case study exemplifies the idea of putting together a sources heterogeneity from several institutions, even on a global scale, preserving and activating them within a collaborative platform composed of reconstructions of 17th century theatres, in three-dimensional models that can be interrogated and interoperated.

By taking advantage today's digital archiving technologies, it is possible to implement responsive interfaces for data visualisation in virtual and immersive environments, as is the case offered by Aton. In this way, the places of a memory that has been removed or forgotten are once again the protagonists of the cultural and political scene of the seventeenth century: the one that, starting from Venice, developed and exported Italian theatre abroad, thanks to the inventions of architects and set designers of the calibre of Tasio Gioancarli, Giuseppe Alabardi named Lo Schioppi, Alfonso Rivarola also known as Il Chenda, Giacomo Torelli, Giovanni Burnacini, Francesco Santurini named Il Baviera, Gasparo and Domenico Mauro, Ippolito Mazzarini and, finally, our Giovanni Battista Lambranzi.

Notes

[1] *BOAI. Budapest Open Access Initiative*: <https://www.budapestopenaccessinitiative.org> (accessed 2022, February 6).

[2] *PERSPECTIV. The association of historic theatres in Europe*: <https://www.perspectiv-online.org> (accessed 2022, February 20).

[3] *EUTA. European Theatre Architecture* is a database produced with the support of the European Union Culture Programme and the Ministry of Culture Czech Republic: <https://www.theatre-architecture.eu> (accessed 2022, February 20).

[4] ERC Starting Grant 2015, principal investigator: Annalisa Sacchi: <https://www.in-common.org> (accessed 2022, March 2).

[5] Istituto per il Teatro e il Melodramma: <https://archivi.cini.it/teatromelodramma/home.html> (accessed 2022, March 2).

[6] Also known as Vendramin Theatre, by the name of family that opened it in 1622. It stood on the same parcel as today's Carlo Goldoni Theatre.

[7] The Venetian foot measures approximately 34.7 cm.

[8] *Pepiano*: ground floor. The term derives from the Venetian dialect *pepiàn*, a syncratic neologism between 'foot' and 'floor'.

[9] The theatre occupied a plot of land annexed to the convent of the Dominican Fathers of SS. Giovanni e Paolo, now part of the Civil Hospital. Horse races were held in this area, hence the name '*Cavallerizza*'.

[10] Giulio Strozzi, *La Finta pazza*, music by Francesco Sacrati [Strozzi 1641].

[11] Vincenzo Nolfi, *Bellerofonte*, music by Francesco Sacrati [Nolfi 1642].

[12] Tebaldo Fattorini, *Eteocle e Polinice*, music by Giovanni Legrenzi [Fattorini 1675].

[13] Giulio Cesare Corradi, *La Divisione del Mondo*, music by Giovanni Legrenzi [Corradi 1675].

[14] Giovanni Matteo Giannini, *Adone in Cipro*, music by Giovanni Legrenzi [Giannini 1676].

[15] Giulio Cesare Corradi, *Germanico sul Reno*, music by Giovanni Legrenzi [Corradi 1676].

[16] *ATON*: <http://osiris.itabc.cnr.it/aton/> (accessed 2022, March 4).

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The Third Competition for Ernesto Basile's Palace of Justice. Analysis, Conjectural Reconstruction and Photo Insertions

Fabrizio Avella

Abstract

The competition for the Palazzo di Giustizia in Rome takes place in four phases that develop between 1884 and 1887. The project of the third competition (1886-1887), drawn up by Ernesto Basile (Palermo 1857-1932), reveals a great maturity design that transforms the complex functional program into a rigorous neo-Renaissance style building. The jury recognizes the quality of the project and selects it for the final phase by invitation (1887) together with that one of Guglielmo Calderini, who will be the winner. The original drawings of the unrealized work are kept at the Basile Endowment of the Department of Architecture of the University of Palermo: among them there are sketches, preparatory drawings and final project drawings, mainly in pencil and ink on paper and cardboard, with, in some cases, monochrome watercolor glazes.
The studio applies a consolidated methodology: analysis of the original drawings, survey, plane vectorization, graphic analysis of compositional functions and parties, interpretation of graphic inconsistencies, three-dimensional modeling, rendering and photo insertions. Thanks to an in situ photographic campaign it was possible to perform some photo insertions, processed respecting both the congruence of the perspective view of the photos and the lighting conditions. The photo insertions allow a visual comparison between the realized work and the unbuilt one, as well as the relationships established with the urban context.

Keywords: Ernesto Basile, archive drawings, conjectural reconstruction, rendering, photo insertion.

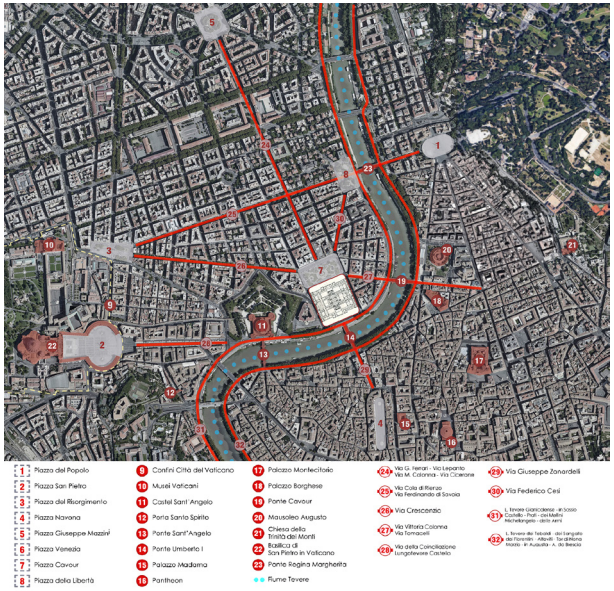
Introduction

This study is part of the trace of operations of graphic analysis and conjectural reconstruction of unrealized architectures starting from drawings and archival documents; it has, as its object, the project of the third competition of the Palazzo di Giustizia in Rome (1886-1887) by Ernesto Basile (Palermo 1857-1932).
Basile elaborates the project during his stay in Rome, stated in 1882, the year in which he is called to carry out the function of assistant to the chair of Technical Architecture at the Royal Application School for Engineers and Architects, held by Enrico Guj. The following year he himself became a lecturer in charge until 1890, the date of his return to Palermo.
These years are marked not only by academic activity, but also by the elaboration of projects for two important institutional headquarters to be built in Rome, which in 1871 became the capital of the Kingdom of Italy: the Palace of Parliament and the Palace of Justice.
The two events of the competition projects overlap temporally and for Basile they are an opportunity to develop a language suited to institutional and representative offices of this caliber [1].
The essay focuses on the study of the building fronts and on the relationships with the urban context, visualizing them through photo insertion operations.

The project

The competition for the Palace of Justice, announced by the Minister of Grace and Justice Giuseppe Zanardelli, takes place in three phases, in 1884, in 1885/86, in 1886-1887, followed, in 1887, by the invitation-only competition reserved for finalists Ernesto Basile and Guglielmo Calderini, whose project was declared the winner in December 1889 [2].
The Palace of Justice will have to be built in the expansion area of Prati Castello [3], on the Lungotevere, and is one of the key buildings of a political program that, in search of a new "national style", wants to redesign the face of the capital also thanks to the construction of buildings that represent the new institutions: in the client's request it is expressly written that the new Palace of Justice must have an "almost monumental" character and "a grandiose and severe aspect, as befits the temple of justice" [Zanardelli in Kirk 1996, p. 84].
It is also clear the intention to redesign a piece of the city that has a strong historical connotation and that the construction of the Palace of Justice should be included in a broader program of urban redesign: "The building would have had a large square in front and behind; finally, due to its location, conceived in line with a new road artery, now Via G. Zanardelli, it would have been, across the Umberto Bridge, in ideal continuity with the innermost Piazza Navona" [Lo Tennero 2014, p. 116] (fig. 1).
The two instances, the architectural one and the urban one, are well summarized by Kirk: the construction of the new institutional headquarters must mark "the development of modern building typologies, the creation of a political program of architectural representation and the redesign of the urban landscape of the capital" [Kirk 1996, p. 83] [4].
The project of the third competition elaborates the layout of the second [5], probably a necessary choice dictated by the limited time available: the third competition is, in fact, announced in May 1887 and the delivery is set for the month of september of the same year. Basile himself defines it as "an immediate derivation of the one presented at the last competition, with the variants suggested by a further study made on the basis of the reasoned previous verdict" [Basile 1887, p. 7].
Basile, already in the second version of the competition, completely rethinks the project compared to the one presented for the first [6]: he sets aside the idea of the central courtyard, replaced by a new nucleus consisting of the great Hall of Lost Passes and abandons the neo-Florentine style, considered not well suited to the building, in favor of a neo-Renaissance language, thus responding to the requests of the examining commission.
The floor plan has a quadrangular development, 170 meters on the main front and 146.5 meters on the side faces. The scheme has two main axes of symmetry, perpendicular to each other, which intersect, in the center, in the Hall of Lost Steps, the compositional fulcrum of the entire project; as Basile writes "it holds the center of the building and forms its heart" [Basile 1886, p. 17].
The basement includes accessory functions and local for prisoners awaiting trial; on the ground floor there are many of the auxiliary functions in judicial processes activities of, such as chancelleries, council chambers, rooms for investigative documents, rooms for appraisals and other rooms for prisoners. The mezzanine floor is the one that houses the Civil Court and the Assize Courts and the Hall of Lost Steps (fig. 2).
On the first floor the functions considered to be the most important, namely the Court of Cassation, on the left, and

Fig. 1. Partial plan of Rome with highlighted the insertion area of the Palace of Justice.



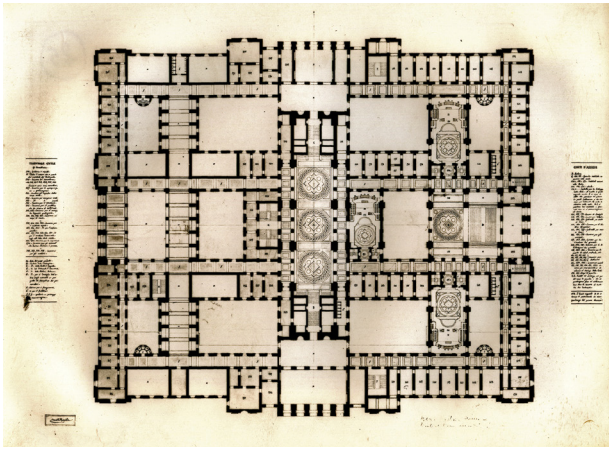
the Court of Appeal on the right, mirroring the Hall of Lost Steps.
On the second floor the offices of the Council of the Lawyers' Association, the Disciplinary Council of Attorneys, the Library, the Registers Office on the left and the offices of the Commercial Court and the Urban Court on the right.
The system remains similar in the development of the third version unless the Hall of Lost Steps is moved from the mezzanine to the ground floor, at the same level as the main entrance, a change that involves the redesign of the stairs (fig. 3).
The articulation of the fronts takes up the volume of the previous project, but some variations are introduced to meet the requests of the examining commission: "the basement area is strengthened, a Doric entablature is added to crown the ground area, and the height of the principal order is reduced in relation to the one of the underlying parties […]; the Hall of Lost Steps is made evident on the outside with a rectangular elevation and the interior decoration in the lower area changed" [Basile 1886, p. 17].
The reinterpretations of the main façade in the third version concern the redesign of the central portion, in which an entrance with three arches is preferred to the previous with five ones and semicircular niches with statuary elements are inserted between the windows of the last level.
On the main front, the central body marks the entrance with a strong overhang and with a colonnade resting on a base set between slightly projecting foreparts; the lateral wings have a succession of openings with a tympanum on the first floor and they are closed by slightly projecting angular bodies. In both versions all the walls are treated with ashlar (fig. 4).
Both the lateral and the rear fronts reiterate the theme of the façade with projecting elements in the central portions set between slightly projecting foreparts, similar in language to the angular ones. The tympanum above the colonnades, present only on the main front, is omitted in order to underline its hierarchically dominant role (figs. 5-7).
The modular scanning of the vertical axes and openings are consistent with both the plan and the elevations of the second version.

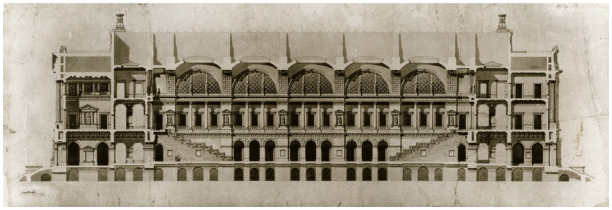
Archival and documentary units

The original drawings of the third competition are part of the *Drawings Archive of the Basile Fund of the Scientific*

Fig. 2. Ernesto Basile, Plan of the mezzanine floor of the second competition (Fondo Basile - DARCH UNIPA, ADP 105).

Fig. 3. Digital modeling of the Hall of Lost Steps (graphic elaboration M. Marchese); Ernesto Basile, Section of the third competition (Fondo Basile - DARCH UNIPA e, ADP 166).





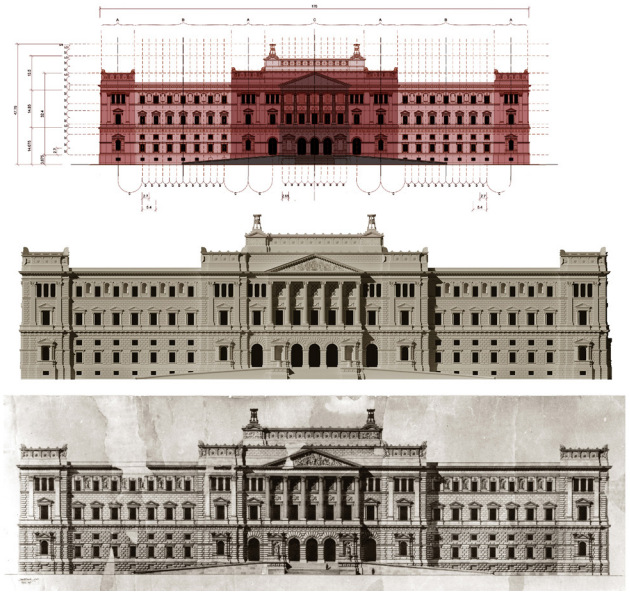


Fig. 4. Analysis and digital model of the main front (graphic elaboration D. Di Bella); Ernesto Basile, Main prospectus of the third competition (Fondo Basile - DARCH UNIPA, ADP 145).

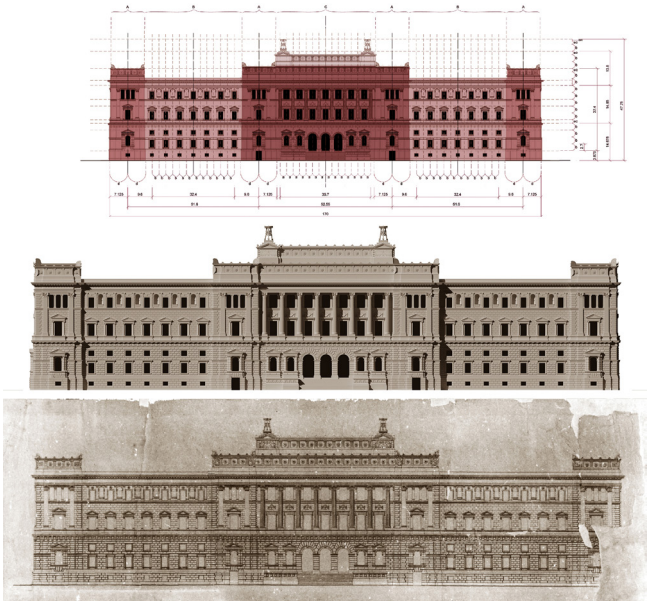


Fig. 5. Analysis and digital model of the rear face graphic elaboration D. Di Bella); Ernesto Basile, Rear prospectus of the third competition (Fondo Basile - DARCH UNIPA, ADP 161).

Collections of the Department of Architecture of the University of Palermo [7].
The documentary units examined belong to the Drawings Archive - Projects section and are cataloged within the archive unit 19 with the codes from ADP139 to ADP 173 [8]. There are 35 documentary units including design sketches, preparatory drawings, study drawings and definitive drawings. The sketches and the draft drawings are on paper and, in some cases, on the back of illustrated postcards, confirming the character of a quick note of ideas; the line is in Indian ink or blue ink, they are not scaled and small in size, varying between 133 x 107 mm. and 147 x 326 mm.
The study drawings are almost all made on paper, with the exception of a drawing of the forepart drawn on glossy paper; they are all in 1:200 scale, with the exception of a partial section in 1:250 scale, and are made with blue ink, except for the aforementioned drawing of the forepart made with pencil, Indian ink and blue ink. These are mainly studies of portions of the prospectus on small format supports, between 133 x 107 mm and 175 x 151 mm.
The final drawings relate to the elevations: two of them represent the main façade, on a scale of 1:250 and 1:100, both in pencil, Indian ink and monochrome watercolor on cardboard, in sizes 412 x 777 mm and 589 x 1835 mm; the right side elevation, in scale 1:100, is made in pencil, Indian ink and monochrome watercolor on cardboard, size 658 x 1460 mm; the left side elevation, in scale 1:200, is in Indian ink and monochrome watercolor on cardboard, size 581 x 907 mm; the longitudinal section, in 1:100 scale, in Indian ink and monochrome watercolor on cardboard, measures 608 x 1771 mm. With less than two plan studies (ADP141 and ADP143) no planimetric drawings are available, although they had been drawn up and presented.
With regard to the planimetric studies, reference is therefore made to the plants belonging to the archival unit no. 17, including 34 documentary units relating to the works of

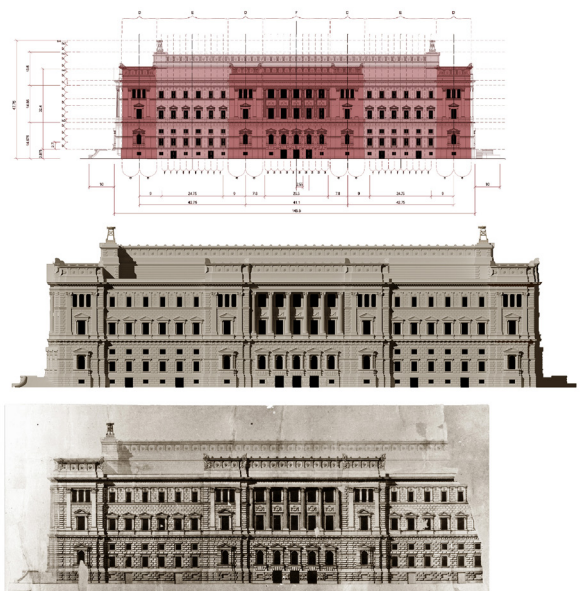


Fig. 6. Analysis and digital model of the right front (graphic elaboration D. Di Bella); Ernesto Basile, Right side elevation of the third competition (Fondo Basile - DARCH UNIPA, ADP 162).

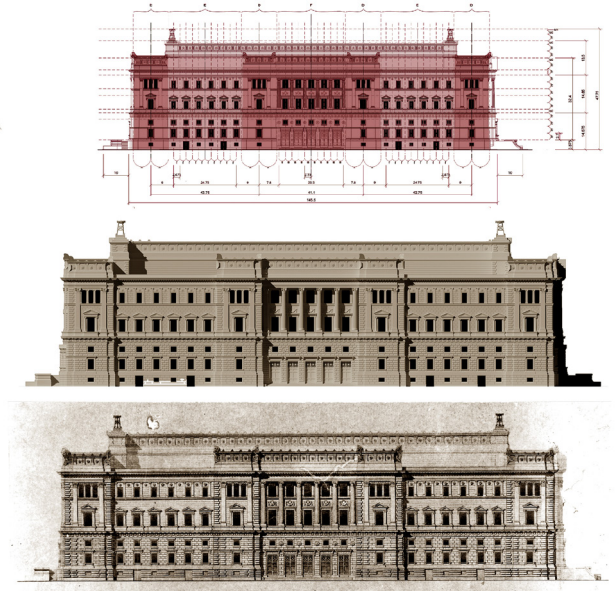


Fig. 7. Analysis and digital model of the left front (graphic elaboration D. Di Bella); Ernesto Basile, Left side elevation of the third competition (Fondo Basile - DARCH UNIPA, ADP 163).

the second competition. In particular, the plans, considered definitive, on a scale of 1:200, of the underground floor, the ground floor, the mezzanine floor, the first floor and the second floor, identified by the ADP 103 to ADP 107 codes were taken into consideration. it deals with large format plates, measuring from 853 x 1133 mm of the first floor to 967 x 1140 mm of the ground floor.
The drawings were restored in 1999 by the Paper Restoration Laboratory of the National Institute for Graphics of the Ministry of Cultural Heritage [9].

Some notes on the drawing according to Ernesto Basile

It is worth making some considerations on the role of drawing according to Ernesto Basile, which can be deduced from his manuscript *Architettura. Dei suoi principi e del suo rinnovamento*, dated 1882 [Basile 1882], in which he notes various reflections about the methods and techniques of representation. Regarding the methods, it is undeniable how important the drawings in plan, elevation and section are considered: he uses them in the study sketches and in the preparatory and executive drawings, in scale, masterfully executed and with an extraordinary attention to detail. For him, however, the projection drawing has a value aimed more at the design and execution than at communication, because "coordinating the separate impressions received from the plans, sections or elevations, in an impression, is very difficult" [Basile 1882, p. 92]: so difficult that "it is not appreciated by the public for which it is almost always a kind of mysterious writing, a hieroglyph, in which it does not understand anything" [Basile 1882, p. 92]. On the contrary, the perspective view offers the possibility of having an image that is closer to the real perception and this gives it a greater ability to communicate. Basile attributes a particularly important role to perspective and

uses it very often, both in the form of quick sketches and in the form of constructed drawings, and recognizes a double value: one relating to the ability to communicate, as "it is free of many of the disadvantages of the simple projection method and the relationships between the dimensions are manifested in a way very close to true" [Basile 1882, p. 98]; the other concerns the process of verifying the design choices of masses and volumes: "The two profiles ab and a'b, for instance, looked at by O produce the same effect while one is very developed in height and the other instead in ledge. Sometimes it is possible to resort to the expedient of developing the profiling of the overhanging frame instead of in height, which from certain particular points of view often refines the masses and makes them less heavy" [Basile 1882, pp. 84, 85].
His perspectives are almost always with vertical plane and often include human figures, to help understanding of dimensional relationships and to enrich the scene (fig. 8).
Regarding the representation techniques, Basile uses several ones: from the quick pencil or ink on paper of the sketches to the sharp pencil on cardboard of the preparatory drawings, to the precise ink lines of the definitive drawings.
There are often shadows, which almost always respect the canonical rule of the inclination at 45° coming from the left, but, rather than the application of an academic dogma, about which his perplexities will be reported, they seem to express the need to see the plastic aspects of architecture. The shadows are performed in various ways: with single ink lines, with sketches, or with watercolor glazes in the final drawings, sharper to mark the projections and recesses and lighter for the secondary elements such as ashlar, statuary and decorative elements.
For Basile, in summary, drawing is not just a simple application of geometric and projective rules, but is, indeed, a complex and refined language of the process that anticipates, generates and communicates architecture.

Fig. 8. Ernesto Basile, perspective view of the third competition (Fondo Basile - DARCH UNIPA, ADP 170).

Methodological process

The preparatory phase for the digital reconstruction was the analysis of the available documentary material: among the drawings of the second competition there are the plans of all levels in a scale of 1:200 and among those of the third competition there are the main elevation in scale 1:250 and 1:100, 12 studies of the central forepart of the main elevation, in scale 1:200, the right side elevation, in scale 1:100, the left side elevation in scale 1:200, the rear elevation in scale 1:100, the longitudinal section in scale 1:100, a perspective view and several detailed sketches.
The available material, in excellent condition and without significant gaps, was considered sufficient to undertake a conjectural reconstruction of the project.
The scans provided by the Basile Equipment were subject to dimensional control thanks to the scaling of the raster images and the verification of metric correspondence with the relief of the original drawings.
We moved on to verify the congruity between the plans of the second competition and the elevations of the third, with particular attention to the overall and partial sizing of the architectural parts, to the positioning of main and secondary axes of symmetry, as well as to the measures and modular scanning of the openings.
The metric measurement system, in use at the time of the drafting of the project, was used to search modular parties, useful for the vectorization of both planimetric and altimetric drawings. A modular system based on the A-B-C-B-A succession on the main front is hypothesized, elaborated by 5.10 m. submodules (2a) for the intercolumniation and 5.40 m. (2b) for the distance between the windows; on the lateral fronts the ternary system is repeated but with a dimensional contraction that generates the succession D-E-D-F-D-E-D, marked by submodules of 4.95 m. for the center distance of the windows and, again, 5.40 m. for the intercolumniation of the colonnaded projection. The rear

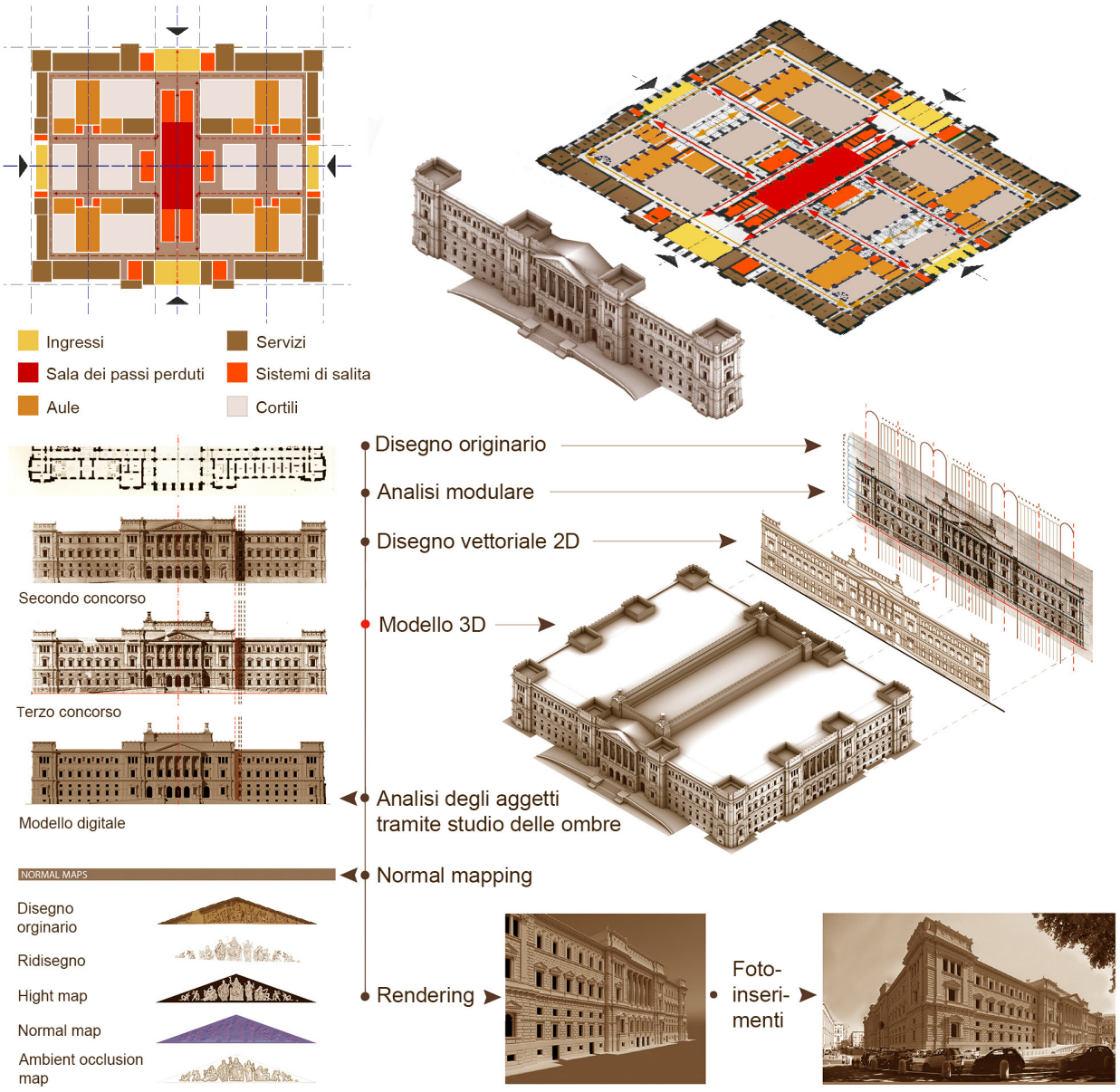


Fig. 9. Analysis of the functions and methodological process (graphic elaboration F. Avella, D. Di Bella).

Fig. 10. Photo insertion, seen from Ponte Umberto I (graphic elaboration D. Di Bella, graphic post-processing by the author).

front repeats the layout of the main one, except for the presence of submodules necessary to define some secondary elements.
Although the hypotheses on modular systems formulated *a posteriori* may have margins of error, in the absence of univocal indications from the designer, the vectorization carried out according to this structure has given excellent results in comparison with the original drawings.
The subsequent phase of modeling the fronts also made use of the information relating to the depth of the projections, which can be deduced from the shading, where present. In fact, having only a cross section available, it was essential to refer to this system of interpretation in the absence of direct metric data. To verify the correctness of the attribution of the measures that cannot be directly deduced, it was decided to apply to the models the shadow deriving from a source at an improper distance, with rays inclined at 45° on the horizontal plane and 45° on the vertical one, applying, therefore, the same academic rule used by Basile and found both in the examined drawings and in those of many of his other projects.
The overlapping of portions of the digitally processed elevations with the original ones made it possible to verify the sizing of the overhangs.
The digital model, performed through surface modeling of a CAD software [10], was limited to the main architectural parts, while polygonal modeling was performed for the sculptural elements and capitals.
Regarding the bas-reliefs, it was decided to avoid polygonal modeling, to avoid the overloading of the computational aspect during the rendering phase, and to elaborate normal maps obtained from the shaded pencil redrawing of the original drawings. The need to redesign them arose because the representation scale does not provide a sufficient level of detail to obtain good maps; furthermore, the shadows rendered with watercolor glazes do not lend themselves to an effective post-processing for the generation of normals, which is more effective when making pencil drawings in which deliberately accentuated shadows are applied (fig. 9).
With regard to the material rendering it was considered that from the original drawings it is not possible to deduce the solutions hypothesized for the material treatment of the wall surfaces. In fact, as already mentioned, there are watercolor glazes for the shading but there are no chromatic indications for the choice of plasters. It was therefore decided to render the surfaces with a monochromatic material that had only a hint of roughness to avoid a too homogeneous effect.

Analysis of the urban context and photo insertions

The area of the building indicated in the competition notice is of great importance from an urban point of view: the courthouse is located on the Lungotevere with the main front in line with the Umberto I bridge, an extension of the road entitled to Giuseppe Zanardelli, leading to Piazza Navona. With respect to this road axis and the bridge, the building is constituted as an urban backdrop and must express its monumentality in a context that sees the architectural presence of Castel Sant'Angelo not far to the west.
The front on the Lungotevere therefore acquires a hierarchically dominant character and is configured as the main elevation with a strong monumental value.
On the opposite side, the rear elevation of the building is the background to the long axis, consisting of via Giuseppe Ferrari, via Lepanto, via Marcantonio Colonna, via Cicerone, which connects Piazza Giuseppe Mazzini with Piazza Cavour.
The front on Piazza Cavour is treated, both by Basile and by Calderini, with less marked monumentality to leave recognizability of main front to the one on the Lungotevere, while, in both projects, the fronts on the secondary roads, via Triboniano and via Ulpiano, are clearly treated as secondary side fronts.
The building therefore aims not only to design an important institutional site, but also to reconfigure an urban portion. It therefore seemed necessary to visualize the value of an architectural symbol capable of redesigning the rich surrounding urban context by choosing photo insertions as an expressive language (figs. 10-12).
To make them, some photographs were taken with a digital camera with focal lengths of 28 mm. The decision not to use wide-angle lenses arose from the need to create images whose perspective was not too aberrated. The same parameter was used to create the rendered perspective views [11].
The camera points were chosen by positioning on elements that are easily recognizable from the satellite zenith views. In the absence of recognizable elements it would be advisable to carry out a topographic campaign to uniquely position the camera points, but, in this case, it was not necessary.

The exact date and time of the photographic shots were also recorded in order to subsequently reproduce the same lighting conditions.
In this way, you have all the information necessary to reproduce the perspective views of the digital model respecting the parameters of the photographic images.
After rotating the model to make the y axis, initially parallel to the lateral sides, coincide with the direction of geographic north, we moved on to the phase of collimating the digital perspective views with the photographic images.
The camera matching method was used [12], inserting at least 8 reference points on planes assumed to be orthogonal [13]. The correspondence of the inserted camera with that of the photographic image is ensured by reporting on the model some planimetric and altimetric measurements taken on the existing building.
The orientation of the model according to the actual topographical position made it possible to reproduce the existing light conditions. By inserting a light source that simulates the sun at the time and date of the photographic shots, two important results are obtained: the first is the exact reproduction of the shadows according to the same inclination of real sunlight; the second is the reproduction of indirect light on the fronts not directly affected by the sun's rays. The rendering engine used [14], in fact, does not limit itself to calculating the shadows deriving from the light source, but also calculates the indirect light of the celestial vault, which varies, according to the position of the sun, in terms of intensity and chromatic values.
In this way, a luminous condition is reproduced that differs from that of the drawings, in which the shadow, as already mentioned, is visible according to the rule of the inclination of the rays at 45°. But Basile himself, while applying it often, recognizes it as misleading: "In truth, it can be said on the contrary that that light will never be obtained, first of all because the architect is not always free to give the exposure that he believes appropriate to a building or a monument, second because even when it was it could not obtain an effect similar to the one drawn for a few moments, the lighting naturally varying with the position of the sun, that is with the hours and with the state of the Sky" [Basile 1882, pp. 96, 97].

Fig. 11. Photo insertion, corner view between via Triboniano and Piazza dei Tribunali (graphic elaboration D. Di Bella, graphic post-processing by the author).

Fig. 12. Photo insertion, view of the front on Piazza Cavour (graphic elaboration D. Di Bella, graphic post-processing by the author).

The last phase was that relating to the superimposition of the perspective views to the photographic ones. Reference points have been identified on the existing building, in this specific case the edges of the wall faces, built on the lot identified in the competition that it occupies in its entirety, as well as Basile's project.
The insertion was subsequently checked by verifying that the horizon of the digital perspective coincided perfectly with that of the photograph.
In addition to the operations of defining the contours, it was necessary to modify the brightness and exposure levels to make the rendering of the view uniform with the photographic one, an operation often inevitable because, although the calculation of the light may be refined, during the rendering phase, it is difficult to perfectly reproduce the conditions of brightness, exposure and contrast of the photographic image.
Finally, some considerations on the choice of grayscale rendering. As already mentioned, Basile's drawings do not give us any indications on the material aspect hypothesized for this building, nor can it be deduced, to date, from written documents or from the final report. The choice of neutral material rendering is therefore obligatory, discarding a priori the hypothesis of imaginative reconstructions, perhaps captivating, but without foundation. The insertion of a view in shades of gray in a color image would have given a jarring effect and it was therefore decided to exclude the color from the final images.

Conclusions

Conjectural reconstructions make important contributions to the knowledge of only designed architectures that often reveal the theoretical apparatus of an architect. Addressing the theme of their relationships with the urban or landscape context, where possible, proposes a further theme of architectural analysis, not only compositional thought, but also, if not above all, a tile of a large mosaic that is the city or the territory. Whether it manifests itself by mimetic analogy or by linguistic contrast, it changes and rewrites the context in which it is inserted. Making these relationships visible also for unrealized projects can make a contribution to knowledge in this respect as well.

Notes

[1] About the stage of Basile's formation, see Sessa 2002, pp. 13-62.

[2] The building will be built between 1889 and 1911.

[3] This provision is included in the Rome City Plan launched on March 8, 1883, known as the "Viviani Plan", named after the engineer who was then director of the Municipal Technical Office.

[4] Original text: «the development of modern building types, the creation of a political program of architectural representation and the redesigning of the urban landscape of the capital» [Kirk 1996, p. 83].

[5] For the description of the project for the second competition see Basile 1886.

[6] For the description of the project for the first competition see Basile 1884.

[7] The Scientific Responsible is Prof. Ettore Sessa, who is thanked for his availability.

[8] For a complete description of the archival and documentary units see Mauro, Sessa 2015.

[9] For a complete and detailed description of the restoration interventions see Mauro, Sessa 2000.

[10] Rhinoceros 6 software was used for 3D modeling.

[11] The relative wording of cameras in rendering software is often referred to as FOV (Field of view). The shots taken with wide-angle lenses of 28 mm in length. they generate perspective images with a viewing angle of 65.47 °, wider than the 60 ° conventionally indicated, but still acceptable.

[12] The process was carried out with 3DStudio Max 2020.

[13] The process works with a minimum of 5 collimation points, called CamPoints (4 on a reference plane and a fifth for the depth), but we preferred to insert more to obtain a more accurate result.

[14] The rendering engine used is Vray.

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The Enhancement of Cultural Heritage: from Documentation to Digital Simulation of MAC USP by Paulo Mendes da Rocha

Wilson Florio, Ana Tagliari

Abstract

The enhancement of the archival architectural heritage, in terms of preservation, has favored the documentation and investigation of projects and buildings. The significance of constructing 3D digital models in the domain of architecture is already a well-established idea. In addition, the digital reconstruction of hand-made drawings contributes to the deepening of the study of unbuilt. In this sense, the representation only by orthogonal projections is insufficient to perceive the spaces, on the other hand, animation allows us to include time by simulating the displacement of a virtual spectator. In the unbuilt project for the Museum of Contemporary Art at the University of São Paulo, MAC USP (1975), designed by architect Paulo Mendes da Rocha, the circulation system is organized by a set of ramps, footbridges, and stairs, which promotes the contemplation of the internal spaces. Using digital simulation, this article analyzes the temporal sequence of approach to this building, its accesses, penetration into interior spaces, and the multiple views from six paths resulted by animations. Rendering, animation, and axonometric resulting from 3D digital model, allowed us to analyze the circulation system, particularly the emphasis of the ramps in this project from the concept of promenade architecturale. The original contribution of this article is highlighting the singular circulation system adopted by the architect in this unbuilt project by digital simulations.

Keywords: unbuilt, promenade, circulation, animation, perception.

Introduction

The intensification of digital documentation of unbuilt projects, which took place in the last two decades, has become fundamental for the preservation of cultural and architectural heritage. Important researchers in different areas have used digital tools to investigate unbuilt or demolished projects. Martens and Peter (2010), in their research on virtual reconstruction of synagogues in the City of Vienna, emphasized the importance of 3D modeling to investigate the cultural heritage. Advanced technologies, using laser scanning or digital photogrammetry can quickly and accurately create a 3D survey [Wilson et al. 2018, p. 24]. In addition, 3D digital reconstruction of an archaeological site, using extensively the 3D documentation of the site is an efficient method to investigate cultural heritage [Guidi, Russo, Angheleddu 2013, p. 99].

Heritage architecture can be reconstructed with a range of digital technologies to record and remember buildings and sites. [Rushton, Schnabel 2020, p.193]. In XXI century, digital modernism heritage [Bartolomei, Ippolito, Vizioli 2022] has been a focus of researchers interested in digital reconstruction of the past or unbuilt. Studies on unbuilt architecture developed by Sdegno (2011); Foscari (2010); Harbison (1991); Galli and Mühlhoff (2000); Pfeiffer (1999); Larson (2000) demonstrate the importance of the theme in the last 40 years. Unbuilt projects are especially important due to the idea that they structure them, which, despite not

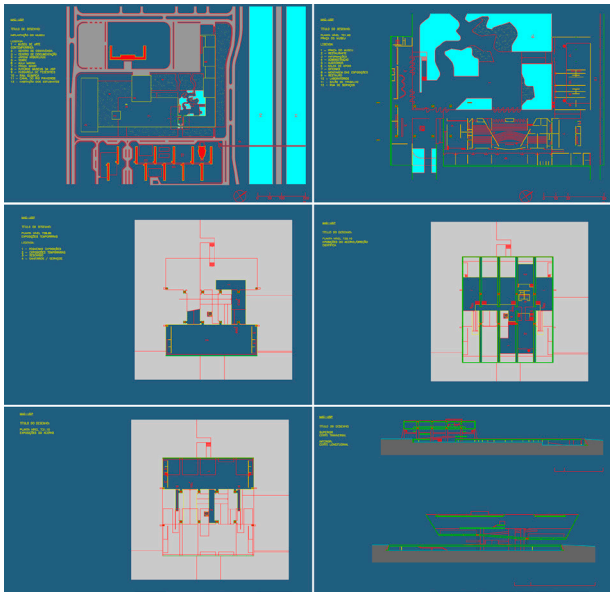


Fig. 1. Original drawings provided by Paulo Mendes da Rocha's office.

being implemented, are present in the architect's work as a whole.
The redrawing (2D) and digital models (3D) of these unbuilt projects enabled the visualization and analysis of buildings for years imagined by the architect and that so far remained unknown. Renderings, animations and perspective vertical sections were produced from the digital models, which enabled a better understanding of spaces in their three-dimensionality. In addition, the great advantage of creating a 3D digital geometric model is being able to generate virtual paths through such spaces.
In this research, the graphic analysis by animations and axonometry of MAC USP allows us to appreciate, synchronously, various formal and spatial aspects, leading us to understand the environments designed by the architect, gradually, through the virtual displacement of the observer.
The main methodological procedures and stages of the research: 1) Survey and digitization of information at the architect's office; 2) Identification of design concepts, and strategies in his projects; 3) Three-dimensional modeling of the building; 4) Study of the circulation system and routes; 5) Graphical analysis through renderings and animations; 6) Production of axonometrics and perspective sections; 7) Analysis of the path of the sun and shadows projected inside the building; 8) Discussion of the results obtained. As a result, we identified eight concepts in his unbuilt project.

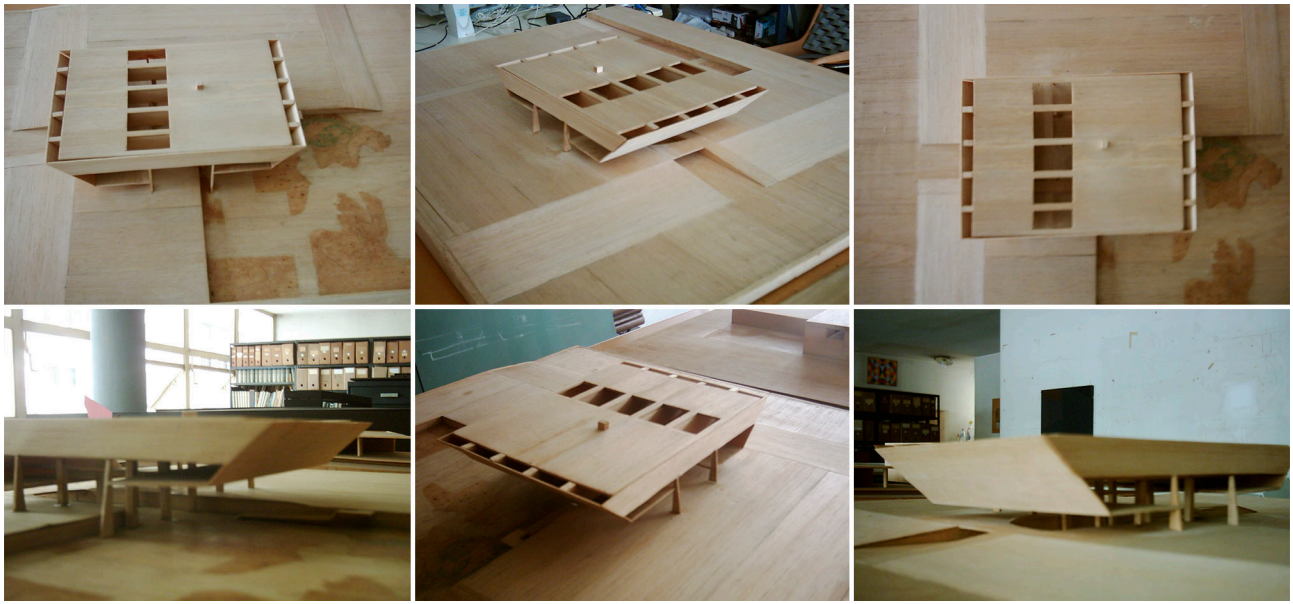
Precedents and historical context

Paulo Mendes da Rocha (1928-2021) was an important modern architect. He was awarded, including the Pritzker Prize (2006). Three themes that underlie his architecture: territory, technique, and the contemporary city [Artigas 2007, p. 7]. The drawings of the vertical sections are the starting point of the design process [Solot 2020, pp.35-37]. The architect Catherine Otondo [Otondo 2013, p. 14], who worked with the architect, states that the Mendes da Rocha design reveals, as a particular characteristic: the desire for movement.
From the 1950s, mainly due to the work of Vilanova Artigas (1907-1985), the reinforced concrete (brut) served as a way of giving a meaning of constructive 'truth'. But there is another important fact: the prominence of architect Oscar Niemeyer's ideas.
Oscar Niemeyer (1905-2012) emerges as a great modern architect from the 1940s onwards in Brazil. His ideas and concepts had repercussions on São Paulo architects from 1950 onwards, among them Paulo Mendes da Rocha. It is possible to establish a reinterpretation of the inverted pyramid of the Museum of Modern Art of Caracas (1954), by architect Oscar Niemeyer, in the MAC USP project. The idea of a large pyramidal volume also appears in the design for the Georges Pompidou Cultural Center Competition (1971). Therefore, there are strong indications that the innovative character of PMR architecture has its origins in the work of Oscar Niemeyer and Vilanova Artigas.
However, there is a fourth architect who inspired Mendes da Rocha: Affonso Reidy (1909-1964). Reidy carried out innovative and outstanding projects in Rio de Janeiro, such as the Museum of Modern Art in Rio de Janeiro. MAM is a building characterized by the large main monoblock, made of exposed reinforced concrete, suspended by a robust and daring set of porticos that characterize its structure as unique.

Circulation in Architecture: space time and movement

Historically, circulation in architecture has been explored by architects as one of the main design premises. From the concept of *parcours*, in the Beaux-Arts course, to the concept of the *promenade architecturale*, formulated by Le Corbusier, circulation has increasingly become one of the aspects explored for the experience through space.
In general, modern architects operate with at least three fundamental notions: space, time, and movement. Free movement through spaces, over time, has become one of the aspects widely explored by modern architects. The space-time notion was debated in modern architecture. The so-called "fourth dimension" [Zevi 1994], "time", has been fully introduced in modern architecture.
In the 1920s, Le Corbusier said: "Architecture is circulation". The architect points out the "rule of walking", writing that: "Good architecture is walked and traversed inside and outside. It is living architecture" [Le Corbusier 1961, p. 43]
There are intimate relationships between space, time and movement. The displacement through space, over time, implies different directions of gaze. Our vision is attracted to certain focal points or points of interest, above all caused by contrasts. It is concluded that the architecture is dependent on the circulation system.
The concept Le Corbusier's *promenade architecturale*, the user's experience in space is defined: "In [the Villa Savoye] we are presented with a real *architecturale promenade* […] It is by moving about […] that one can see the orders of architecture developing" [Le Corbusier, Boesiger 1936, p. 24]. Therefore, the promenade can be understood as a path, a route that promotes an experience of space, especially the visual fields and focal points for walking.
The multisensory experience that involves several elements that make up the space and form, such as light and materials, impact the user's perception in their journey through spaces. Naturally, elements with ramps and stairs are important in this process, as they are part of the planning and promote the route. But there is also the ritual of appreciation, as Philip Johnson (1965) said: "Architecture is surely not the design of space, certainly not the massing or organizing of volumes. These are auxiliary to the main

Fig. 2. Photos of the model obtained during a visit to Paulo Mendes da Rocha's office.



point which is the organization of procession. Architecture exists only in time" [Johnson 1965, p. 184].
The 'procession' that Johnson refers to is the trajectory prepared by the architect to enjoy the spatiality intended for the project. It is a ritual of appreciating the beauty of the building as we move through it. In this sense, the promenade is directly related to the circulation system and its elements but is not restricted to them. Material and immaterial elements make up the experience of space.

MAC USP, 1975, São Paulo

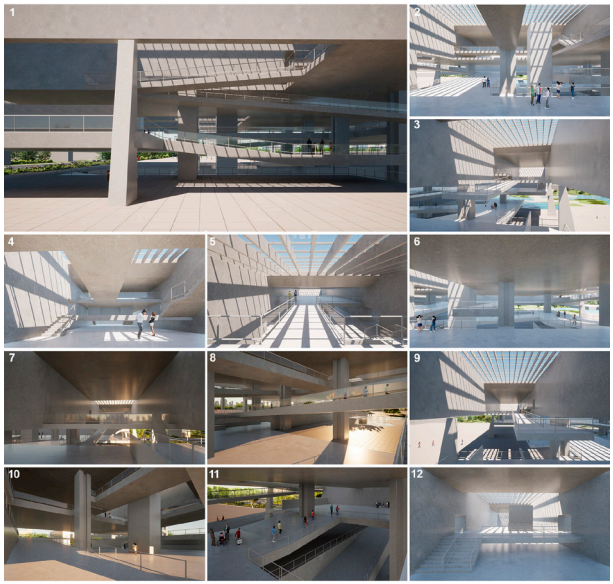
The Museum of Contemporary Art of the University of São Paulo –MAC-USP (1975)– is one of the unbuilt projects of great importance and architectural oeuvre by the architect Paulo Mendes da Rocha.
The architectural parti was defined by a spatial distribution of the architectural program in 5 floors above ground and a semi-underground floor, connected by a set of 6 ramps, two stairs and a large central elevator of 4 x 4 meters. The ordering of the space is given by the axes of the eight internal pillars. Embedded in the pillars, the ramps define inclined planes. The large wall without openings, facing east and west, contrast with the two side faces, facing North and South, with large areas of natural lighting and ventilation.
The project has a visual apprehension fluidity, since the large internal 'voids' allow an immediate understanding of the constituent elements of the Museum's sections.
The present study was developed from the original project, a preliminary study (fig. 1). The photos of the physical model, obtained during one of the visits to the architect's office, allowed the complementary interpretation of some of the formal and spatial characteristics of the building project (fig. 2).
For the construction of the 3D digital model, drawings provided by the architect's own office were used. However, due to the fact that the drawings related to the preliminary study do not have detailed technical specifications, it was decided to analyze similar two projects by the architect: Museum of Sculpture (MUBE) (1988) and the Georges Pompidou Cultural Center (1971). For the modeling of the glass roof, an idea was used similar to the proposal used by the architect for the Pinacoteca do Estado (1993). In this way, it was possible to interpret the language and similar decisions present in other projects and works.
Similar projects designed by Paulo Mendes da Rocha and the architects who inspired him, such as Oscar Niemeyer and Affonso Eduardo Reidy, were analyzed, as well as interviews with professionals who worked with the Mendes da Rocha, in order to obtain additional information. It is worth mentioning the contribution of the testimony of the architect Roberto Leme Ferreira [1], who worked on this project in the 1970s.
The unbuilt MAC USP spaces were simulated both through renderings (static simulations) and animations (dynamic simulations), in order to highlight the quality of the internal spaces.
During the modeling, we realized that the implantation of the MAC on the topography of the site allowed the use of the semi-underground floor which would take in the installation of support activities.
There are 5 ramps connecting the 5 floors of the main volume and 2 ramps in the semi-underground volume. The width of the ramps varies between 2.5 and 11 meters wide, with slopes between 6.4% and 13%.
Figure 3 shows the accesses to the building, the suspended volume and the semi-underground volume, and the prominence of collective spaces on the ground floor. With the design of the Square (fig. 3.1), the architect established the horizontal plane as a divider of the Museum's functional program: a semi-underground one, where the restaurant, the central reception, the administration, the laboratories, the auditoriums, the support areas, and the internal square are located; and the other suspended, where the exhibition, library and scientific management areas are located. At the top of the suspended block, the exhibition halls are separated by voids, which generate variations in ceiling heights (double or triple), but which are connected by a set of ramps that create a spiral path around a large void center on the first and second floors.
The building is marked by the suspended block, whose regularity and simplicity of the external form contrasts with the dynamics of the internal spaces, with alternating ceilings, diagonal ramps, and atriums. From the reception, on the ground floor, it is possible to identify almost all the floors of the building.
The central idea of MAC's ground floor is to make the open space, a place for staying in, and contemplating views. The digital simulations confirm the idea that the semi-underground area of the MAC (figg. 3.7-3.11) would also serve as 'large terraces' for exposure and contemplation of the surroundings. The landscaping project is noted as an integral

Fig. 3. The MAC, the Square, and the ground and semi-underground spaces as terraces for contemplation and living.

Fig. 4. Axonometrics of the MAC USP floors.

Fig. 5. Sections and plans of the perspective floors, and the MAC structural system.

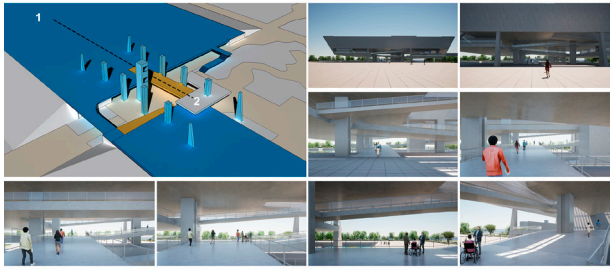
Fig. 6. Emphasis on the circulation system: MAC ramps, walkways, and stairs.



part of the landscape design. This public space would be the link between the landscape, the building, and the city.
The building is 75 meters wide, 95 meters long and 18.60 meters high in relation to the level of the raised square. The courageous structure, consisting of 8 square pillars (2.10 x 2.10 m), spaced by 25 x 15 meters from axis to axis, with cantilevered volumes 23.4 meters at both ends towards the longitudinally, and only two trapezoidal pillars on each side of the building, support the building. In addition, there is a set of 4 large internal longitudinal beams, in the suspended volume, that embrace the pillars, two by two.
The construction of the 3D digital model allowed an accurate understanding of the building's structural system. Figure 4 shows the axonometrics of the MAC floors. Figure 4, shows the large semi-underground support area, the living space, and its proximity to the proposed landscaping. The perspective sections allow us to understand the structural system (fig. 5).
The explanation of Le Corbusier's promenade for Villa La Roche is timely to explain the spatiality of the MAC project: "[the Maisons La Roche-Jeanneret] will be rather like an architectural promenade. You enter: the architectural spectacle at once offers itself to the eye. You follow an itinerary and the perspectives develop with great variety, developing a play of light on the walls or making pools of shadow" [Le Corbusier, Boesiger 1936, p. 60].
The images rendered (fig. 6) show the emphasis on the circulation system and the different paths through the 5 floors of the high volume. The ramps cross the wide spaces, at different heights, creating diagonals that dynamize the space. On the other hand, the walkways connect spaces on the same plane, but cross the space in order to provide the enjoyment of wide internal views. The stairs, in turn, are introduced at the end of a path or on the sides of walkways. This circulation system is entirely interconnected, allowing the user to freely access the building on one side and exit on the other.
It is possible to establish some relationships between the MAC USP project with other projects by the architect, as well as by Oscar Niemeyer. The first feature is the division of the functional program between the suspended part and the underground part of the building, separated by a large free ground floor. The idea of creating a public square on the ground floor is present in all PMR Museum projects.
The suspended part of the building mainly comprises large exhibition and administrative rooms, while in the underground part, auditoriums, laboratories, workshops, technical support, warehouses, and parking. At MAC, the large areas for exhibitions are flexible and adaptable to various types of exhibitions.

Dynamic Simulations - Animations

In the dynamic simulation of a virtual observer, the camera follows a pre-established trajectory. This process is called 'walkthrough', that is, walking through space. Animations are made up of hundreds of frames, which, when displayed sequentially, allow us to create the illusion of movement. Furthermore, this process is important to understand the so-called fourth dimension, time. This virtual 'walk' is of great importance for the investigation of unbuilt spaces, in order to examine the perception of spaces.
Twelve animations were produced. These simulations made it possible to analyze sensations promoted by the displacement of the virtual observer in the architectural space, bringing the idea of the 'architectural walk' or *promenade*. Human-scale animations were generated, as well as aerial walks, inside and outside the building. However, in this article, only 6 routes were selected.
Route 1 (fig. 7, above) starts at the Square (viewpoint 1) in a straight line until accessing the building via the ramp that leads to the 1st floor. On this path, the focal point are the ramps that intersect on the upper floors. The wide permeable ground floor spaces and the wide internal visual fields stand out. Walking along the ramp, one can discover the lateral transparency of the building and the surrounding landscape. The human scale of the people walking around helps to notice the proportions and scale of the building.
Route 2 (fig. 7, below) starts on the 1st floor (viewpoint 2) with a ramp leading to the 2nd floor. During the walk along the ramp (between viewpoints 2 and 3) you can see the large atrium on the right and the surrounding landscape on the left, both with wide open spaces. The focus of attention is the play of light and shadow and the large spaces destined for temporary exhibitions. When going through the 2nd floor, from points 3 to 4, the magnitude of the spaces can be noticed. At the end of route 2 (viewpoint 5) you come across the 3rd. ramp, which gives access to the 4th floor. From this point of view, the walkway on the 5th floor stands out, which crosses the space transversally, flanked by the large beams that rest on the large square pillars, and the large zenith lighting.



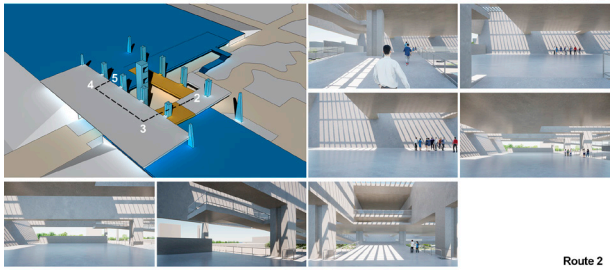
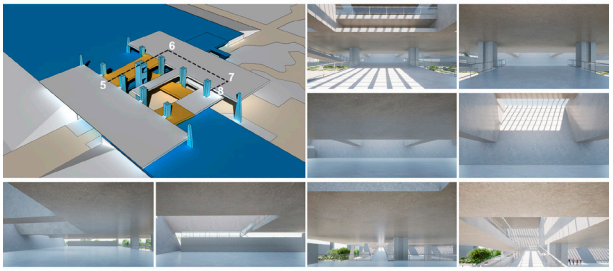
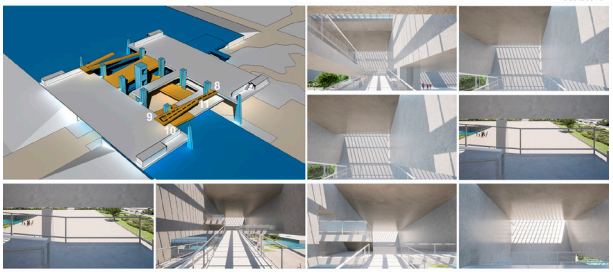


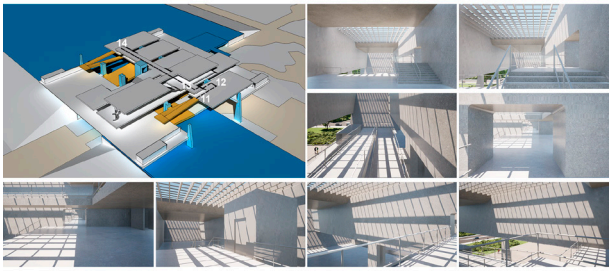
Fig. 7. Route 1: from the Square to 1st floor; Route 2: from 1st to 2nd floor.

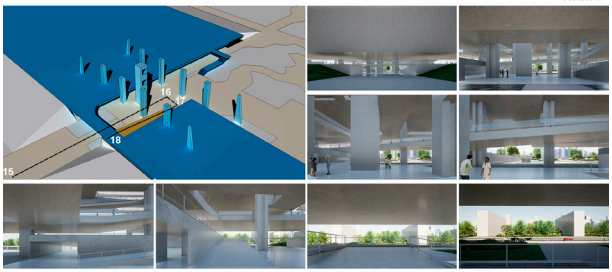
Fig. 8. Route 3: from the 2nd to 3rd floor; Route 4: from 3rd to 4th floor.

Fig. 9. Route 5: from 4th to 5th floor; Route 6: from 5th floor to mezzanines.









In both routes, the alternation of heights, the amplitude of the internal visual fields, and the magnitude of the spaces, whether for exhibitions or for circulation, draw attention.
During route 3 (fig. 8, above), between viewpoints 5 and 6, it can be seen how the 11-meter-wide ramp intersperses two large spaces: on the right, the elevator volume stands out; on the left is the large void with access from the square. The sensation of walking along the smooth ramp, released in space, is one of freedom and pleasure when walking. In point of view 6, the projection of shadows caused by the zenith lighting on the inclined blind gable stands out. The large beams modulate the space of the permanent exhibition hall so as to contribute to the perception of smaller spaces within the overall magnitude. Between points 6 and 7, the alternating ceiling height of the mezzanine above, on the 5th floor, and the voids interspersed by the large beams stand out. At the end of this route, from point of view 8, you can see the ramp leading to the 4th and 5th floors.
Located in the highest area of the building, route 4 (fig. 8, below) takes the user through a 2.5-meter-wide ramp. In this section, the large atrium below can be seen on the right; the great beam above; and the great zenith lighting. The sensation is of bodily crossing the space, close to its constructive elements, whose rite of appreciation is the enjoyment of the innovative beauty of the building as we move through its interior.
On both routes, from an elevated point of view, you can enjoy the wide views of the interior of the building. Noteworthy are the internal voids, interspersed with ramps, walkways and beams, as well as the impact of the large, glazed areas that make up the zenith lighting.
Route 5 (fig. 9, above) allows you to appreciate the spaces on the 4th and 5th floors. The walkway crosses the beams, leading the user through the various elevated 'galleries' of the permanent exhibition areas, located on the mezzanines above the exhibition areas located on the 2nd and 3rd floors. During the walk along the footbridge, with a lower ceiling, the exhibition areas can be observed, modulated by the beams, with zenith lighting that penetrates the interior of the building.
The main access, at street level, occurs during route 6 (fig. 9, below). Between viewpoints 15 and 16, one enters the building between two slopes, until reaching the reception of the Museum. The 4 x 4 m elevator, next to the reception, would take the user to all floors of the building. The images show the large public space, permeable to conviviality. From point 16, you can appreciate the large atrium above, the restaurant on the left, the large outdoor area treated with a landscaped design in front, and the circulation on the right, next to the auditoriums on the semi-underground floor. From viewpoint 17, you can go up the ramp that gives access to the raised ground floor, next to the square. This section invites the user to appreciate the USP student housing, located in front of the Museum.
Therefore, it can be concluded that the temporal sequence of displacements through routes 1 to 6 allows the user to enjoy multiple views. It is the spatial richness, resulting from the alternation of ceiling heights, full and empty spaces, light, and shadow, and the circulation system that generate a ceremonial of appreciation of the beauty of the building as we move through its interior.
One of the outstanding features of the building is the zenith lighting. The animation of the penetration of solar rays inside the MAC (fig. 10) made it possible to verify the effect caused by the penetration of light during the 1st of January on the perception of spaces. The main frames of this animation during the day and night of January 1st, contribute to the appreciation of the intensity of the light and the play of light and shadow. The sloping walls and large beams reflect the dramatic incident light into the building (fig. 10.3-10.17), particularly onto the exhibition halls. Interestingly, it was noted that the simulation carried out during the night (fig. 10.19-10.27) allowed the visualization of the light emitted by the moon (fig.10.24-10.27) during a January summer night.
The perception of the built environment depends as much on shapes and spaces as on light and materials, which make up the sensory experience of the architectural tour. The phenomenological appreciation, through computational resources, allows the analysis of this sensorial experience. The textures and other properties of the materials, the penetration of direct light, the distribution of indirect light in environments awaken different interpretations and provide different sensations, captured by our senses.
It is through a leisurely walk on foot that one can appreciate the spatial characteristics and phenomena of an architectural work: shapes, spaces, light and shadow.

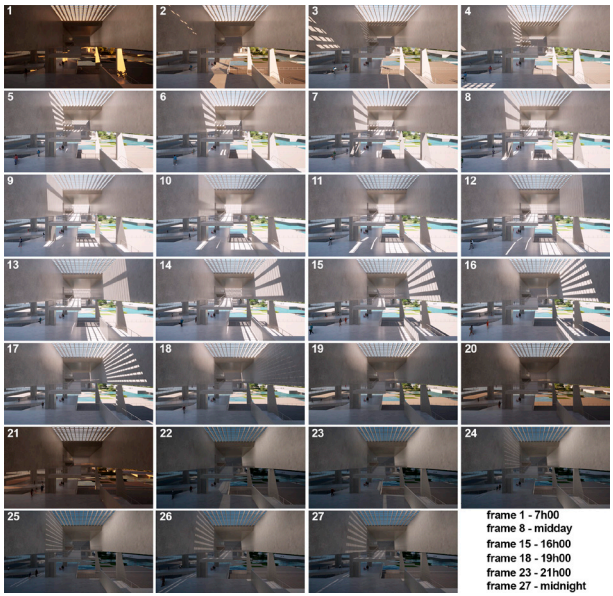
Discussion and conclusions

The 3D digital model made it possible to generate two- and three-dimensional drawings. But it was the static simulations –renderings, and the dynamic ones– animations that favored the perception of spaces more acutely. As defined by Docci

et al: "Procedendo digitalmente ogni elaborato non viene più prodotto separatamente e individualmente, ma gli elaborati sono ottenuto operando per estrazione a partire da una base comune" [Docci, Gaiani, Maestri 2017, p. 365].
Simulations allowed crisscrossing trajectories, in order to favor the dynamic interpretation of architectural forms and spaces. In reality, computer animations are generated from a succession of frames per second. The illusion of movement occurs from the succession of images that are sequentially shown during a certain time. It was possible to identify a set of spatial characteristics from the renderings and animations. Vision occurs from the integrated action between the eye and the brain, creating a psychic image [Docci, Gaiani, Maestri 2017, p. 3]. In this sense, human perception is sharpened from the exploration of these simulations, leading to a phenomenological analysis of spaces. Mendes da Rocha proposed large circulations, connected to each other, to better enjoy the spatiality of the building. The procession takes place as the user moves through the space, covering the floors by ramps, walkways, and stairs. In fact, the temporal sequence of approaching the building, the frontal or diagonal access, the penetration of its interior spaces, the perspectives, and multiple views possible at each moment during the route, the relations between "full and empty", corroborate the idea of a rite of appreciating the beauty of the building as we move through it. The result is that from the five interconnected floors, arranged at different levels, it is possible to enjoy the interior spaces from multiple points of view in space. The main accesses are perpendicular to the building, initially pushing a straight-line path. However, after penetrating the building, one notices the multiple focal points in the space, causing the observer to direct his gaze in diagonal directions of the space. The animations drew attention to phenomena caused synchronically by forms, spaces, materials, and light. It was the slow motion that allowed us to be aware of every small movement and space, while the still camera froze the look at a certain time of the simulation. In this way, means envisioning different interpretations of the same observed scene. A striking feature in the analyzed work is the definition of an integrated, ascending, and spiral circulation system, in order to allow users to circulate freely, entering and leaving through more than one access. The circulation system, as an "internal street", with emphasis on the ramps, forms a spiral, taking up Le Corbusier's idea of the modern museum. Consequently, this building can be characterized by the architecture of movement. The spatial dynamism occurs because the permeable building, with few spatial subdivisions, is endowed with alternating heights. The geometry of the ramps generates even more spatial dynamism, as they cross the space and connect floors at different heights. In addition, the ramps connected to the floors that allow the free movement of people through the building while the movement of the sun that floods the spaces and generates different perceptions. Motion parallax, that is, the information produced by the relative movements of the images when we move laterally, is also very important in the formulation of MAC's notion of space. The accesses to the interior of the MAC lead users to an "architectural spectacle", employing Le Corbusier's terms. The elevated walkways, the spatial expansions, and contractions, with alternating heights, the penetration of natural light through the large zenith openings offers great formal and spatial dynamism. In fact, the architectural walk through the ramps, walkways and stairs leads users to discover multiple and interesting perspectives of the open, fluid, and integrated spaces: a real *promenade architecturale*. Mendes da Rocha's architectural promenade is normally generous, with wide circulations – stairs, ramps, and walkways– which interconnect spaces. Air connections, such as ramps and walkways are emphasized in his work. They allow users to enjoy visuals from double or triple heights. This occurs, above all, in public building projects. As a consequence, there is an emphasis on collective spaces to the detriment of private ones. The concept of continuous 'floor', which leads the user between external and internal space, is emphasized by the smoothness and uninterrupted displacement that leads the user to the interior of the building. As a continuity of the public space, the wide accesses, the building's transparency, and the wide ramps dilute the separation between internal and external spaces. As a critical reflection, we point out three main themes concerning the conduction of the research:
1. The investigation of unbuilt projects as a contribution and appreciation of our modern architectural cultural heritage. Modern architecture is of great interest to researchers and architects in the sense of analyzing, investigating and valuing concepts and materializations. Unbuilt projects are among the object of greatest challenge in preservation, as they are archived on boards and drawings, many in unfavorable conditions and close to being destroyed by time;
2. The project analysis highlighting the circulation system and its elements with great importance in the definition of the architectural parti and materialization of modern concepts. From the studies carried out so far, it is possible to verify the importance of the circulation system and its elements in the

definition of the architectural parti and in the materialization of modern concepts. In the case of Paulo Mendes da Rocha's architecture, this assumption is verified in the analysis of this project, in addition to the important issue for his architecture that involves the relationship between the public, semi-public and private, in a fluid and continuous way;
3. Difficulties and challenges of studying unbuilt projects using digital technologies.
- The interpretation of projects, of unbuilt buildings, from a few drawings, is an arduous task, as it requires knowledge of other projects by the same architect to overcome the lack of more detailed information;
- As this is a preliminary study, there are many uncertainties about the intended materiality of the project;
- 3D modeling requires attention to constructive details, demanding precision;
- Although dynamic simulations favor better interpretation than orthogonal projections on the formal and spatial characteristics of unbuilt projects, they are not sufficient for the interpretation of sensitive phenomena, arising from the textures of materials and the nuances of light penetration, natural or artificial;
- In order to achieve a greater depth of analysis of the spaces, the definition of pre-established paths for the animations requires a detailed study of the project in advance; - In the absence of other important information, such as the architect's intention to occupy flexible spaces with subdivisions for exhibitions (permanent and temporary), it prevents simulations from being carried out on the occupation and effective use of spaces;
- Care must be taken in defining the trajectories for the animations, as the interpretation of spaces, at the height of the virtual observer, walking slowly through the space, interferes with the interpretation of the spatial characteristics of the project.
Additionally, nine concepts were identified that underlie the design of projects carried out by Paulo Mendes da Rocha. The so-called 'objectivity' is present in the way of organizing the forms and spaces of buildings. Integrated spaces, without compartmentalization, provide ample internal and external visuals, allowing users to visualize the completeness of the spaces immediately. The objectivity is also in the adoption of concise geometry, 'simplicity', and formal restriction, like the 'monovolume'.
The economy is due to the formal and spatial simplicity, especially in the elimination of superfluous elements, present in the simplicity of the details, and the absence of ornaments. On the other hand, the idea of 'rusticity', exposed concrete without finishes or corrections, is present in the architect's work.
The 'technological exploration' of the reinforced concrete is present in the conception of a rational, 'daring structure', 'cantilevers', with minimal support, large spans, with a visible structure, which suspends the great form of the building. A striking feature in PMR projects and works is the 'experimentation' of innovative construction techniques. The large blind walls also serve as large beams, contributing to the structural design. The 'plasticity' of Niemeyer's architecture, resulting from the belief of the partnership with engineers for the innovative development of structures, is also present in the work of Mendes da Rocha. The creation of a welcoming environment, of transition between public and private, without defining rigid limits, and 'valuing the public space'.
Air connections, such as ramps and walkways are emphasized in his work, demonstrating the idea of a continuous floor.
As a continuity of the public space, the wide accesses, the building's transparency, without doors or defined physical limits, and the wide ramps dilute the separation between internal and external spaces.

Fig. 10. Frames of an animation of the penetration of solar rays during summer January 1st, and during the night, with moonlight.



Note

[1] Interview with the architect on 01/08/2007, in São Paulo.

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Palazzo Lanza dei Principi di Deliella. From Ernesto Basile's Archive Drawings to Virtual Reconstruction

Vincenza Garofalo, Elisa Luna

Abstract

The paper investigates Ernesto Basile's unbuilt project for Palazzo Lanza dei Principi di Deliella in Palermo, through the study of the original drawings (1895-1897). These consist of 15 graphic documents containing 5 plans, 6 elevations and 4 perspective views, representing four versions of the project with different solutions, each of which can be found in fragmentary and incomplete documentation, attributable to different ideational periods.
The paper traces, through the redrawing, the path taken by Basile from the first to the last version and graphically tells the evolution of the building's plan: from the symmetrical courtyard layout of Palladian matrix of the first version, to the "L" configuration of what is presumed to be the final version, the threshold of the modernist turning point.
Monge's projection redrawing of the plans and elevations held in the Fondo Basile of the Department of Architecture at the University of Palermo and the three-dimensional digital reconstructions, accompanied by graphic readings, describe Basile's architecture, revealing his design process. The analysis carried out was useful for understanding the evolution of the distributive characteristics of the plans and the compositional balance of the elevations. The 3D models allow to visualise the spatial peculiarities of the design solutions analysed and return the image of a hypothetical fragment of the city that was never realised.

Keywords: virtual reconstruction, archive drawings, digital model, Ernesto Basile.

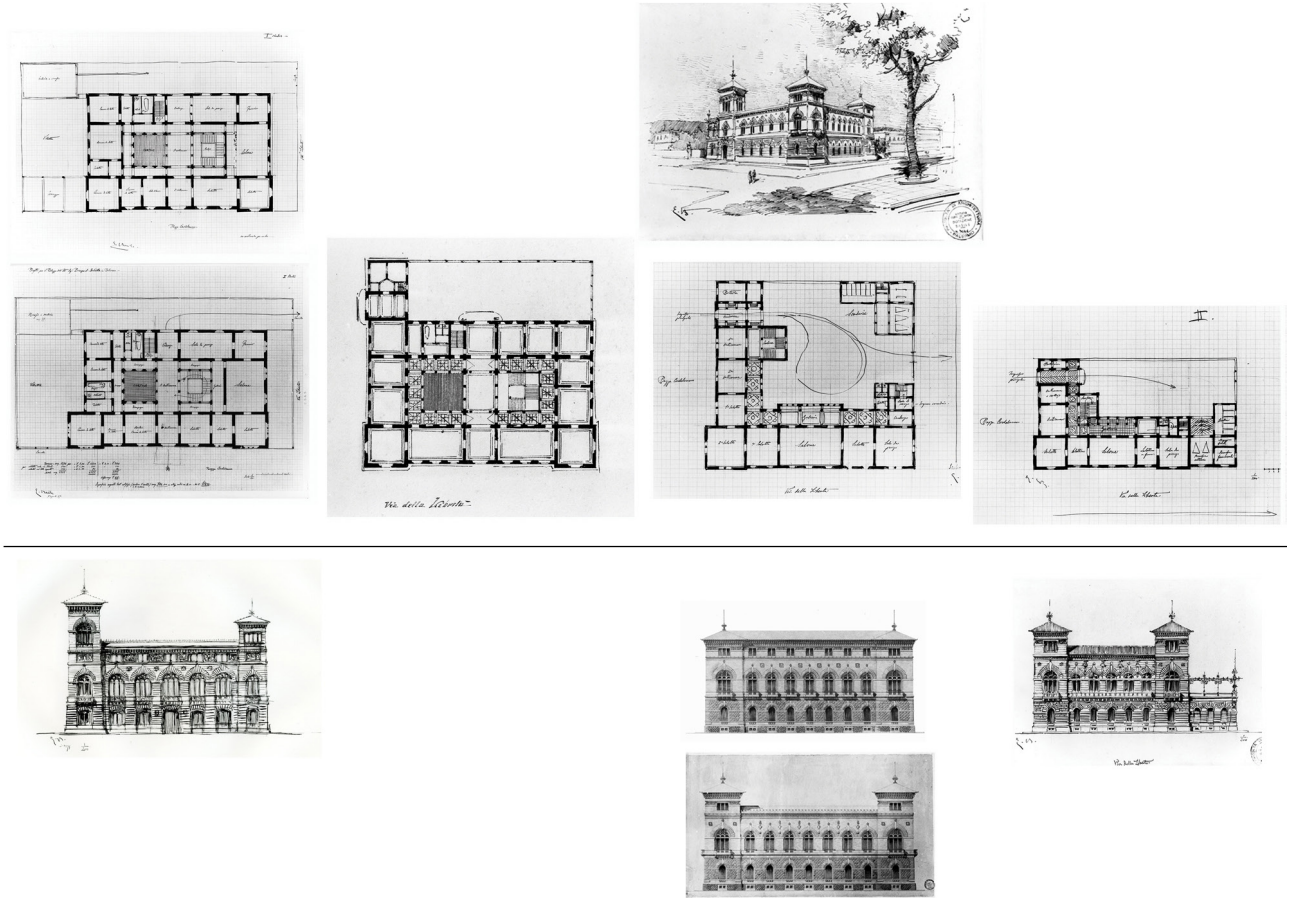
Introduction

Between the end of the 19th century and the beginning of the 20th, Ernesto Basile established an intellectual and cultural dialogue with his father, Giovan Battista Filippo, his university teacher, on the theoretical principles of architecture and the search for a "new style" [Sessa 2010, p. 7] [1]. Following in his father's footsteps, he interprets this research "*nell'arco temporale compreso fra il tramonto dei neostili e del romanticismo e la maturità dell'eclettismo. Di quest'ultimo lo stesso Ernesto Basile sarà uno dei più interessanti protagonisti italiani nella stagione di transizione verso il modernismo*" [Sessa 2014, p. 29].
The Italian architectural contribution to the renewal of the arts and architecture seemed unable to compete with the European protagonists, but, actually, the figure of Basile appears to be of great importance and comparable to that of the masters of his time, because "*il suo approdo al modernismo può essere considerato frutto di un'autonoma, profonda ricerca che parte da lontano ma che è proiettato al futuro, condannando sempre la volgarità dell'imitazione del passato*" [Sessa 2002, p. 7]. For Basile it is important to find a new style that has an identity, because he disapproves of the tendency of his contemporaries to uncritically copy architectural elements of the past.
While Art Nouveau develops in Europe, Basile's research appears slower and more difficult due to the socio-cultural context in which he works, resistant to any change [Sessa 2010, pp. 7, 8]. His studies are therefore an expression of his era, in relation to the international and Palermo con-

text, of which he was an undisputed protagonist in the artistic and architectural fields.
From the second half of the 19th century onwards, Palermo experienced a particularly lively, economic and cultural climate. The city grew exponentially towards the North, continuing the axis of Via Maqueda, beyond the Quattro Canti [Ingria 1987, p. 37]. It was the period of the entrepreneurial bourgeoisie, the Florio, Ingham, Whitaker families, who made the economy prosperous and built prestigious residences.

Ernesto Basile achieved an unprecedented professional success in the history of 19th century Sicilian architecture, experimenting with a personal formulation of a "Sicilian way" to Art Nouveau, which led him to move away from the traditionalist language [Sessa 2010, p. 10]. The dual internationalist and regionalist nature of Basile's cultural line made possible the spread of modernism throughout Sicily and the creation of a real architectural branch with echoes at a national level.

Fig. 1. E. Basile, drawings of the four project versions for palazzo Deliella (Fondo Basile).

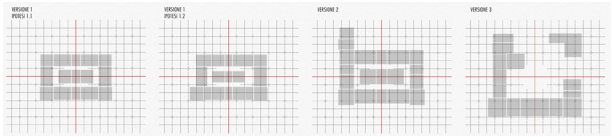


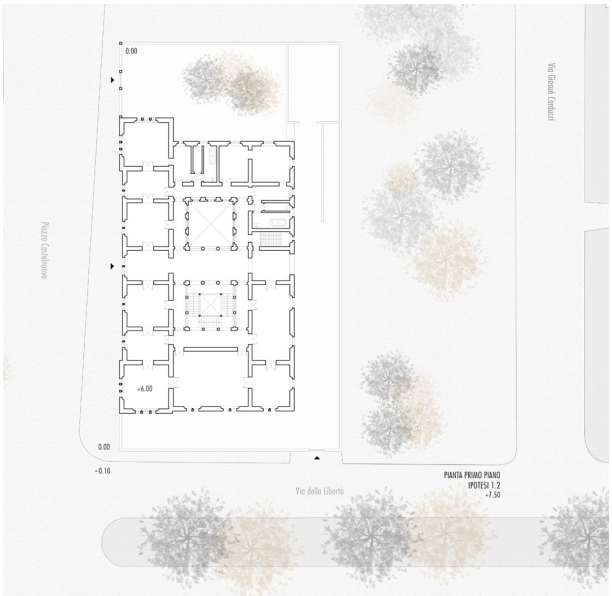
Palazzo Deliella

Ernesto Basile was commissioned by many of the leading figures of Belle Époque Palermo, including the Lanza di Deliella Princes to build their own home.
The building was to have been built on a prestigious plot of land at the corner of Via Libertà, the city's new northward expansion axis, and Piazza Castelnuovo, where Giuseppe Damiani Almeyda's Politeama Garibaldi Theatre had recently been completed.
The lot was the initial part of an area of about 130.000 square metres, owned by Prince Radaly, on which Ernesto Basile had already built temporary pavilions for the National Exhibition of 1891-1892. After the Exhibition, the area was involved in a vast parcelling plan and in 1893 Count Ignazio Testasecca bought some of the plots, including the one on which Palazzo Deliella was to be built, and probably began negotiations with Prince Lanza for the sale [Persico 2010, p. 65].
The land, which initially had a quadrangular perimeter with a side of about 45 metres, was later divided into two parts by the insertion of a road, giving rise to two rectangular lots [Persico 2010, p. 65].
The building's design process is illustrated by the original drawings (1895-1897), kept in the Fondo Basile of the Department of Architecture at the University of Palermo (fig. 1). The analysis of the drawings, which will be discussed later, has allowed the identification of different design phases, due to the changing size of the lot, but also to the evolution of Basile's thinking and the changing needs of the clients.
Palazzo Lanza di Deliella represented the dawn of Basile's modernist turning point [Sessa 2002, p. 7], an exercise in style on the theme of the residence that led him to move away from pure eclecticism and traditional building layouts [Mauro, Sessa 2006, pp. 49, 50]. The reflection on the historical typology of the urban palace became necessary for Basile due to the intolerance "*dell'alta società palermitana per le forme residenziali delle grandi dimore della villeggiatura e dei sontuosi e ingovernabili palazzi urbani di età umbertina*" [Sessa 2002, p. 131].
The studies of Jean Nicolas Louis Durand and Archimede Sacchi on the compositional rules for drawing the plans of residential buildings were important to Basile. Sacchi had theorised the Palladian method, in which the plan is rigorously organised with respect to axes of symmetry, the English method, which sacrifices regularity in the pursuit of comfort, the polygonal method, in which several regular symmetrical figures are combined, the reticulated method in which a square mesh network is used, and the axes method, which takes account of perspective views [Sacchi 1874, pp. 30-44] [2].
To draw the plans for Palazzo Deliella, Basile used graph paper as described by Archimede Sacchi, when he introduced the square mesh method (fig. 2). "*Molto usato è questo metodo, perché col mezzo di fogli di carta quadrettata riesce facile scompartire egualmente le parti di una pianta, ed è assicurata sempre una buona disposizione nell'insieme. […] Esso aiuta nella collocazione dei muri e delle stanze, per determinare addirittura le spessezze e l'andamento dei*

Fig. 2. The four project versions. Compositional hypothesis on a grid based on the method theorised by Durand (graphic elaboration by E. Luna).

Fig. 3. Plan of the first project version, second variant (graphic elaboration by E. Luna).





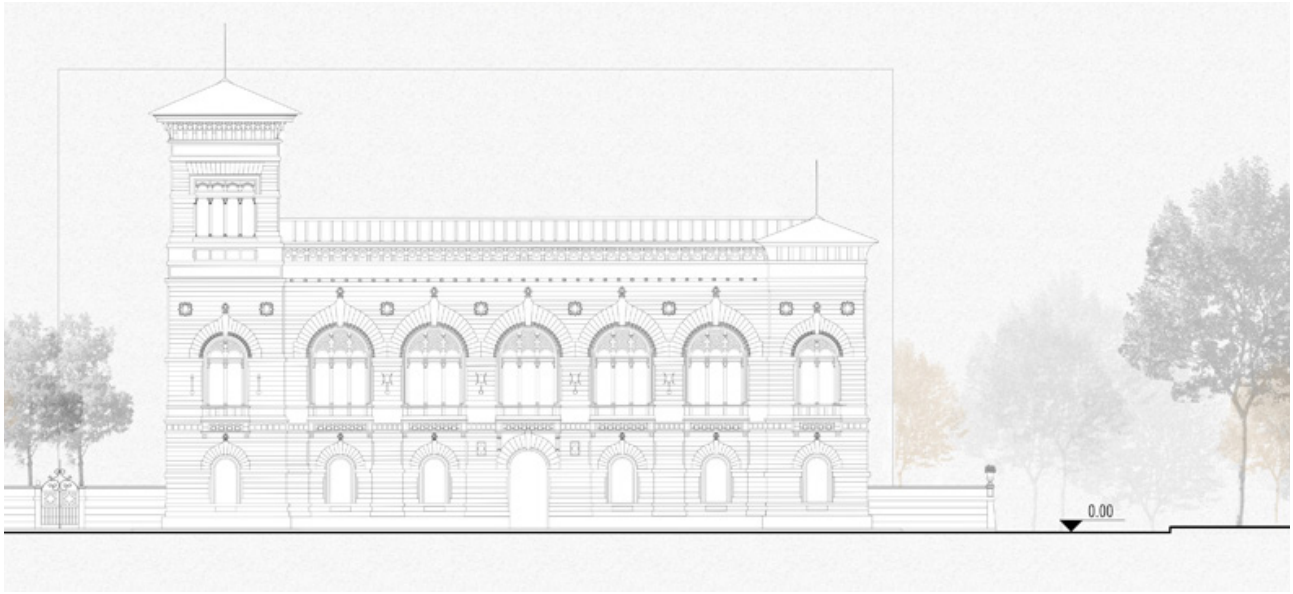


Fig. 4. Front on piazza Castelnuovo of the first project version (graphic elaboration by E. Luna).

primi, le dimensioni della pianta delle seconde; gli schizzi sono ottenuti così in una scala, o in un rapporto col vero, e nel fare in seguito i disegni delle piante, rifinite in tutte le loro parti, è ben difficile che si abbiano a riscontrare alcune disposizioni difettose" [Sacchi 1874, p. 37].
The façades of Palazzo Deliella, in Neo-Renaissance style, show a very rigorous division of the openings in the central body, delimited by two corner towers. Decorative elements are limited to the attic cornice with merlons and the radial ashlar of the openings, without resorting to floral elements and sinuous shapes typical of Art Nouveau. If, in designing the elevations of Palazzo Deliella, the difficulty emerged of completely moving away from a traditional layout, linked to the appearance of Renaissance palaces, in studying the plans, Basile started from a symmetrical courtyard plan in the style of Palladio, to arrive at a solution that recalls the empirical distribution of English matrix [Sessa 2002, p. 133]. However, the client preferred to give up the initial idea of the nineteenth-century aristocratic home and opt for the villa, a modern residential typology that was closer to the transformed housing needs and the new models resulting from international changes [Mauro, Sessa 2006, p. 59]. This was also designed by Basile in 1898 and completed in 1907. It was built in Piazza Croci and demolished overnight in 1959, with the intention of carrying out a property speculation in the vacant area [Zevi 1960].

The original drawings

The collection of drawings in the Fondo Basile consists of 5 studies of plans in pencil and ink (3 of the ground floor and 2 of the main floor), 4 of which on graph paper, 6 studies of elevations in pencil and ink (2 on Piazza Castelnuovo, 4 on Via Libertà), one perspective ink sketch of the building seen from Piazza Castelnuovo, one perspective of the corner tower in pencil and polychrome watercolour, one perspective detail in ink of the three-mullioned window on the main floor in the corner tower, 1 perspective sketch of the entrance gate in ink [3] (fig. 1). The plans of the first version are represented at a scale of 1:100, those of the second at a scale of 1:400, those of the third and fourth

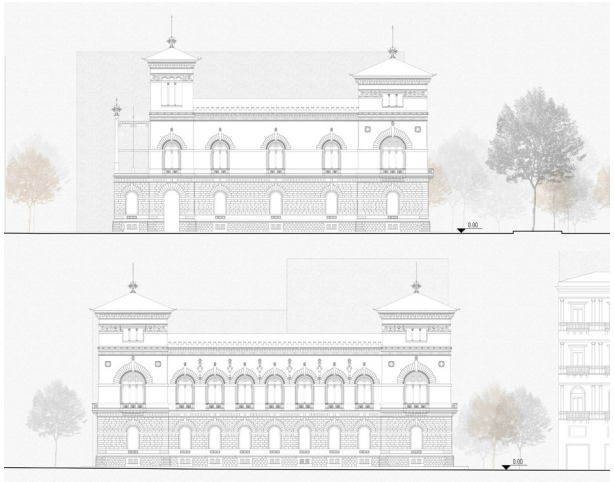
Fig. 5. Plan of the second project version (graphic elaboration by E. Luna).

Fig. 6. Plan of the third project version (graphic elaboration by E. Luna).

at a scale of 1:200. The studies of the elevations are at a scale of 1:200.
Since only two of the drawings bear the date (August 4, 1895 in an elevation on Piazza Castelnuovo and April 5, 1897 in the second version of the first plan study), it is not possible to reconstruct the design process with certainty. However, according to Ettore Sessa [Sessa 2002, p. 133], from a study of the original drawings it is possible to recognise a process, characterised by rethinking and variations, distinguished by three phases: a first phase with a Palladian courtyard layout that obeys precise laws of symmetry, a second phase in which the layout undergoes a few minor variations, and a third phase in which the building is arranged along the perimeter of the lot, articulating itself towards the inside.
The first version of the project shows a closed, rectangular layout, in Palladian style, organised along the axis of transversal symmetry and around a central core. This consists of two voids of equal size which house the monumental three-flight staircase and the courtyard, separated from each other by an antechamber and circumscribed by an ambulatory which disengages the perimeter rooms, with the exception of the corner ones. The plan represents the main floor: the wing along Via Libertà is occupied by the rooms for social life (antechambers, lounges, living room, smoking room, dining room and sideboard), the other wing houses the private rooms. The larger side, with slightly protruding corner towers, overlooks Piazza Castelnuovo, towards which the entrance opens. A second variant sees the slippage of a corner tower, due to the insertion of a gallery between the living room, and the staircase and the addition of a third sitting room along the side facing Piazza Castelnuovo, which would indicate the client's request to satisfy more modern living needs (fig. 3). The drawings of the two elevations, kept in the Fondo Basile, showing the central entrance, could refer to this version of the project [4]. The first, drawn freehand, shows the central body with three elevations (ground floor, main floor and mezzanine) with five openings per floor and two towers, one of which is taller than the other, with four openings, one per floor (fig. 4). The second elevation, drawn with a ruler and compass, differs from the first in having only two elevations in

the central body and three in the tallest tower. The second tower maintains the same height as the central body and has only one mullioned window on the main floor.
The second version of the project, which occupies the entire square plot, has some minor variations on a general grid derived from the first version. The plan shown is that of the ground floor, which has been rotated to bring the main elevation onto Via Libertà (fig. 5). Basile does not give any indication of the end use, but it is possible to assume that the floor houses the representative rooms. The regularity of the symmetrical rectangular layout is partially disregarded with the addition of the porter's lodge slightly forward along Piazza Castelnuovo.
The third version, which once again insists on the entire square lot, represents Basile's true design turning point, abandoning the rectangular plan, organised around the central nucleus of courtyard-antechamber-staircase (fig. 6). The rooms are arranged along Via Libertà and Piazza Castelnuovo in an 'L' layout, and are separated by a long ambulatory opening onto the inner garden, which expands at the living room to become a large gallery, a filter between inside and outside. The plan represents the ground floor, into which the representative rooms (antechambers, sitting rooms, living room, gallery, dining room) move. The main carriageable entrance, on Piazza Castelnuovo, is at the far end of the building, in a slightly projecting position with respect to the line of the façade, and forms, in plan, a square block together with the porter's lodge. This leads first to the grand staircase and then to the ambulatory which ends at the opposite corner of the house, in which the dining room/sideboard block is located, considerably smaller than the previous versions, and the service rooms with the secondary entrance on what is now Via Carducci.
The living room, the most representative space, "*si offre alla vista della piazza antistante sfumando i contorni di un evento privato in una sorta di messaggio pubblicitario. La politica dell'immagine era chiara: dimostrare l'aggiornamento dei principi di Deliella e la vivacità economica […], confermare l'appoggio all'esponente più autorevole dell'architettura siciliana moderna*" [Persico 2010, p. 147].
The corner tower juttes out more than the line of the elevations, affirming the importance of its strategic position "*anche da un punto di vista sociale, dal momento che l'angolo turrito di un isolato sarebbe stato visibile (ed identificabile con il proprietario) da grandi distanze, amplificando quel senso di individualità che sarebbe stato difficilmente attuabile con un palazzo inserito in una cortina edilizia*" [Persico 2010, p. 105].
Basile rethinks the outdoor spaces, designing the carport and stables, which are located in a corner of the garden, and also tracing the manoeuvring path from the main entrance to the secondary one.
The perspective view from Piazza Castelnuovo could represent this version of the project, since it shows the same number of openings on the fronts and has a third taller tower at the entrance hall, marking the main doorway. Two axonometric sketches, part of a private collection, show the same layout.
Three drawings of the elevation on Via Libertà could be ascribed to this version of the project. They all show a symmetrical layout, with seven openings per floor in the two-storey central body, basement and two equal and symmetrical three-storey corner towers. One solution is drawn twice, freehand and with a ruler and compass, and differs from the other version, also drawn with a ruler and compass, in that the towers are taller than the central body. All the elevations show a definition of the ashlar or isodomic ashlar facing (fig. 7).
What should be the fourth and last version of the project derives from the contraction of the third, probably made necessary by the changed size of the lot. The plan shows the ground floor with the representative and service rooms (fig. 8). All the rooms are reduced, the main entrance re-

Fig. 7. Fronts on piazza Castelnuovo (top) and via Libertà (bottom) of the third project version (graphic elaboration by E. Luna).



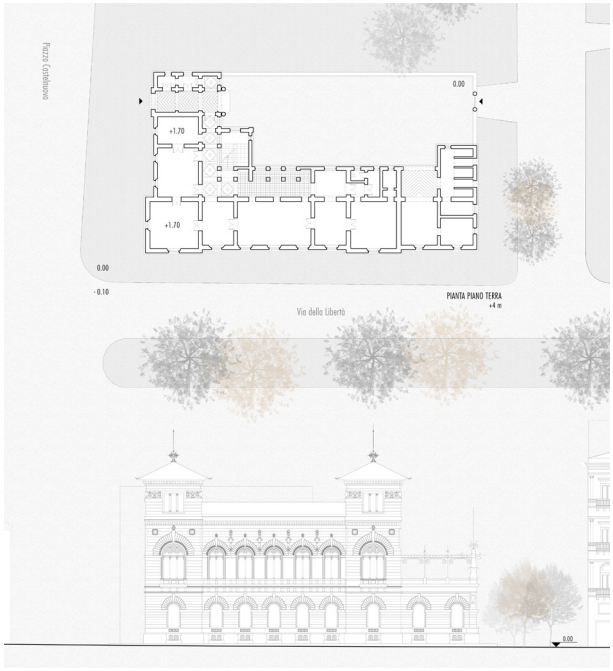
mains on Piazza Castelnuovo, the staircase changes, becoming two parallel ramps and maintaining its position near the main entrance; the stable and coach house are moved to the end of the wing along Via Libertà.
The façade on Via Libertà is therefore remodelled, according to the contraction of the central body and the presence, at the far right, of the stables with a terrace on the first floor. Basile draws an ink and freehand version, which shows some discrepancies with the plan in the number of openings in the service building.
The modification of the layout in the third and fourth versions denotes a change in thinking which comes close to modernism and which will also influence later projects, such as villino Monroy, casa Basile and villino Deliella itself [5].

Virtual reconstruction

The collection of drawings of palazzo Deliella kept in the Fondo Basile concerns the four versions of the project with different solutions, of each of which there is fragmentary and incomplete documentation (studies of plans and elevations, perspective, sketches and details of the exteriors, no sections or other information on the interiors), which can be traced back to different design periods (fig. 1).
The available drawings are not sufficient to describe any project version in its entirety. Of each variant, Basile drew only one plan, usually the one that included the representative rooms, i.e. the one that was to arouse the greatest interest on the part of the client, who wished to demonstrate his prestige through the building.
The process that led to the elaboration of the 3D model consisted of 4 distinct study phases: 1) identification and organisation of the drawings relating to the individual versions of the project; 2) deduction of the dimensions from the analysis of the plans on graph paper; 3) identification of modules and proportions, functional analysis (figs. 9, 10); 4) vector redrawing in Monge projections of the original drawings (figs. 3-8).
The discrepancies between the various original drawings have made it difficult to relate the plans, elevations and perspectives of the different versions, which do not always match exactly. This mismatch is the evidence of a troubled process that was never completed, suggesting that Basile must have been very keen on this project, which he returned to several times, with second thoughts and new insights, leading to his modernist turning point.

The quantity of drawings and project versions documents the importance of a building that was to be built on a very prestigious lot, where Basile had already intervened with the design and construction of the Pavilions for the National Exhibition of 1891-1892. Palazzo Deliella was to be the key element in the access to Via Libertà, and Basile was to leave his mark on an expanding part of the city representing the Sicilian aristocracy and upper middle class with their respective desires for visibility.
The use of graph paper for the plans, the representation of the graphic scale or the indication of the representation scale (1:100, 1:200 or 1:400) made it possible to easily determine the dimensions. The identification of modules in the plans and elevations made it possible to relate some drawings and to define alignments and symmetries (fig. 9). The functional analysis was useful to understand the evolution of the distributional characteristics of the plans and the compositional balance of the elevations (fig. 10).

Fig. 8. Plan and front on via Libertà of the fourth project version (graphic elaboration by E. Luna).

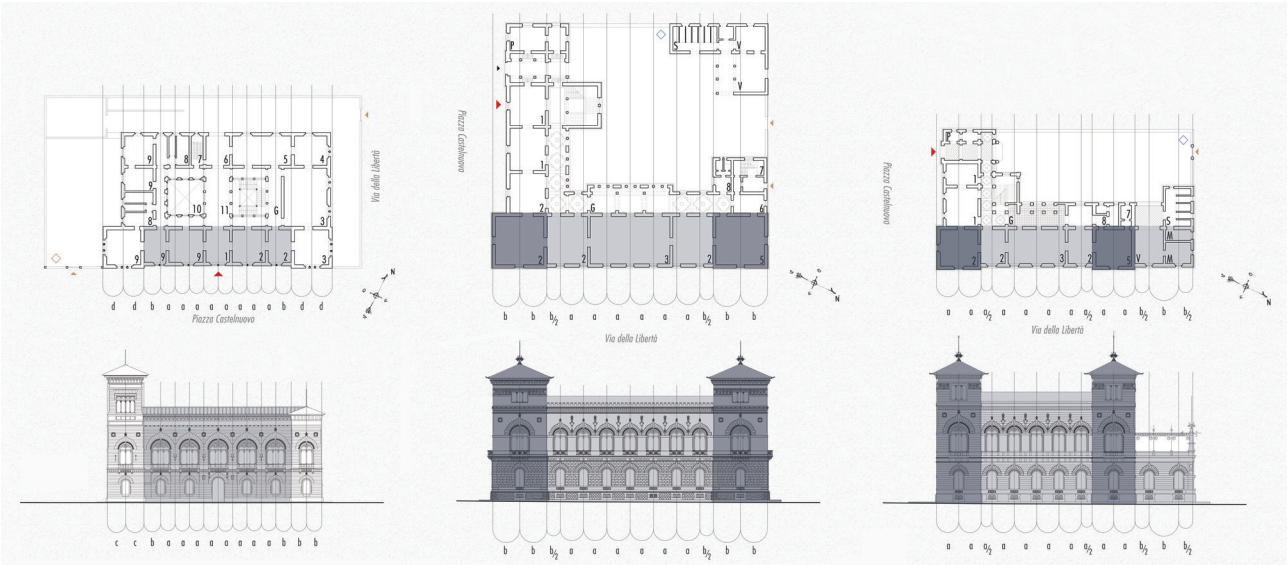


Having only the original drawings of some plans and elevations available, the digital model virtually reconstructs the volume of the building and the fronts –with wall partitions and decorative apparatus– on Via Libertà and Piazza Castelnuovo (fig. 11). The latter constituted the building's public skin towards the town, its outward appearance to which Basile attributed great importance. It has not been possible, however, to virtually reconstruct the interiors and elevations on the courtyard, due to the absence of original drawings and other information.
The version of the project chosen to make the digital model is the third one, the solution most investigated by Basile, the one that was probably the most convincing for him, for which he drew several drawings, including a perspective from Piazza Castelnuovo. Careful reading of this and of two axonometric sketches showing the entire building, the position of the openings in the plan, and the alignments with the configuration of the elevation on Via Libertà have allowed a conjectural reconstruction of the drawing of the elevation on Piazza Castelnuovo, which has not been found among the documentation in the Fondo Basile (fig. 7) [Luna 2021].

The 3D model

The digital model simulates an architecture that never existed, it virtually reproduces a design intention and as a copy it is not affected by influences, related to the contingency of external factors that occur during the construction process. "The construction of the model is not the construction of a simple image, operation often carried out for the project's representation, but it is the hermeneutic and critical result of the drawing tending to the formal analysis, true object of 'imitation'" [Maggio, Vattano 2017, p. 451].
The redrawing leads to a further level of knowledge of the project. The elaboration of the 3D model of Palazzo Deliella, as described in the previous paragraph, was preceded by the vector redrawing in Monge projections of the original drawings (figs. 3-8). The orthogonal projections are, in fact, the instrument through which it is possible to verify the project and make it visible in the absence of its realisation, they are the means through which the compositional rules are made manifest.
The definition of the model takes place in two distinct phases: the digital realisation, using specific software, and

Fig. 9. Study of the modules of the first, third and fourth project versions (graphic elaboration by E. Luna).



the communication phase, in which the representative choices are made and the images are extrapolated. Basile's original drawings give no indication of the finish of the elevations, so a monochromatic treatment was chosen for the views extrapolated from the 3D model. "The unbuilt projects indicate the idea of architecture, and not its construction; they are manifest, and as such should be represented. In the model, surfaces do not show material because it is never defined in those projects in which the graphic indicia are few but express, at the same time, the architectural idea in its most real completeness" [Maggio, Vattano 2017, p. 454].
The perspective and axonometric views extrapolated from the digital model of palazzo Deliella reproduce the image of the architecture in its real context. A perspective view and a safe point of view at eye level have been chosen to describe the perception of the built volume from Piazza Castelnuovo (fig. 11). The representation of the urban fabric, its spaces and volumes, its solids and voids, in its current configuration and with the insertion of Basile's intervention, has been entrusted to the axonometric view (fig. 12). The virtual model is added to the external reality to provide new images of it.

Conclusions

The virtual reconstruction of unbuilt architectures, carried out on the basis of archival drawings, is now a well-established practice in the panorama of research on the digital representation of architecture [6]. The extensive literature available concerns the redrawing, graphic analysis and creation of virtual models which, according to Migliari, are useful tools for the study of architecture because they 'build' projects that have remained on paper [Migliari 2006, p. 198]. This study is part of a line of research –the results of which will be included in a digital database– that has already seen the conjectural reconstruction of some of Ernesto Basile's unbuilt or demolished architecture, starting with archive drawings [Agnello 2013; Avella 2016, 2019, 2020; Garofalo 2016; Girgenti et al. 2020].
Making architectural ideas visible through mind's eyes other than those of the designer, generates a process of understanding that is not a mere reproductive act. It implies coming into contact with the philosophy of the project, in harmony with the thought and language of its author.
The redrawing is a critical tool for understanding Basile's

Fig. 10. Functional analysis of the four project versions (graphic elaboration by E. Luna).

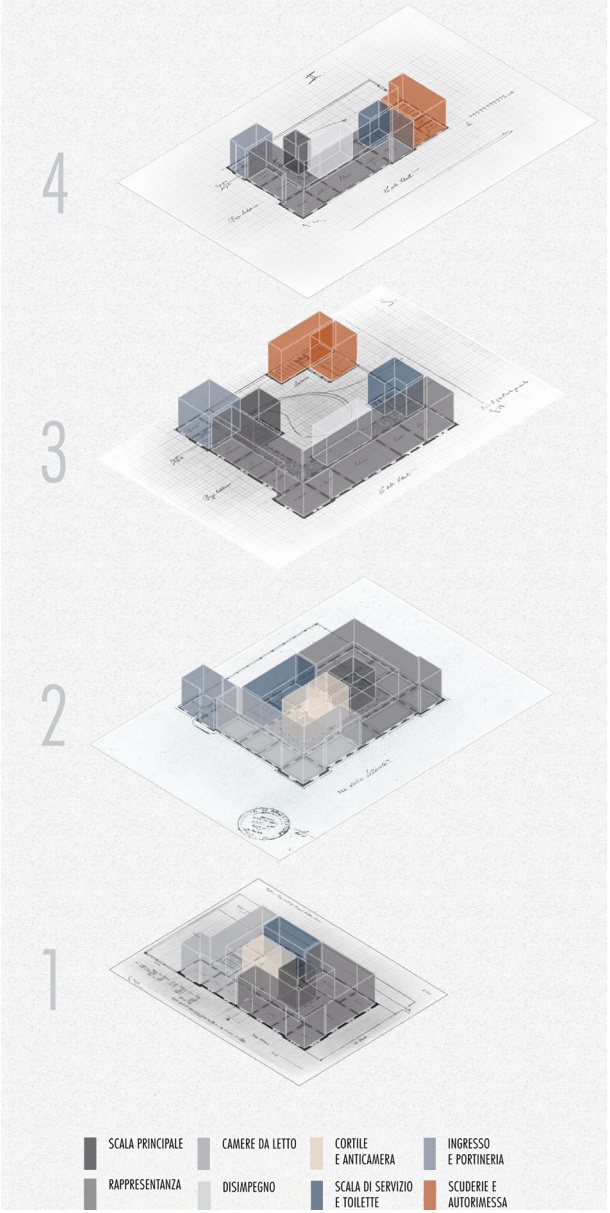
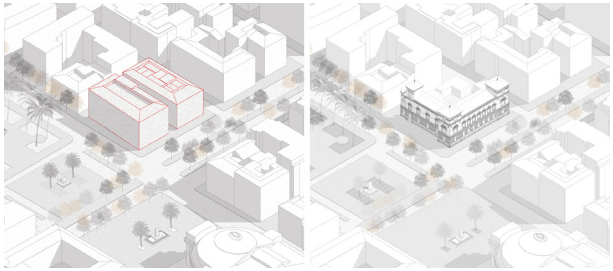


Fig. 11. Virtual reconstruction of the third project version (graphic elaboration by E. Luna).

language, architecture and its evolution. The digital model provides a new reading of the architectural work, verifying the design intentions. In fixing an ideational moment, however, one assumes the responsibility of making a choice, obviously subjective, of marking the direction of a fragmentary and articulated design path, which does not necessarily correspond to Basile's intentions.
The process of analysing and graphically reading Basile's original drawings was intended to add a useful piece to the understanding of a complex design process and to the knowledge of an architecture that was never completed. The digital model, the final product of this process, and its virtual insertion in the current urban fabric have made it possible to restore the image of a hypothetical fragment of the city that was never realised, making virtually visible the relationship that would have been established between the palazzo and Piazza Castelnuovo, Via Libertà and the surrounding urban area (fig. 12) [7].

Fig. 12. Axonometric view of the current urban fabric (left) and insertion of the digital model (right) (graphic elaboration by E. Luna).



Credits

This contribution is the result of collaboration between the authors who shared objectives, methodologies and results. The paragraphs *Introduction*, *Palazzo Deliella* and *Virtual reconstruction* are by Elisa Luna. The paragraphs *The original drawings*, *The 3D model* and *Conclusions* are by Vincenza Garofalo.

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Notes

[1] For a biography of Ernesto Basile, see the texts cited in the references list: Mauro, Sessa 2000, 2006, 2015; Ingria 1987; Caronia Roberti 1935.

[2] The reticulated method is a compositional system theorised by Durand and based on reference grids that were used to compose the elements of architecture [Durand 1802].

[3] The list and reproductions of the drawings can be found in: Mauro, Sessa 2015, pp. 158, 286, 287, 348, 394, 395. The descriptions of the drawings, compiled by M. Milone, can be found in: Mauro, Sessa 2000, pp. 130-136.

[4] The plans and elevations reveal, however, some discrepancies: in both plans of the main floor the towers have three-mullioned windows and the central body has two-mullioned windows, while in the elevations Basile draws two-mullioned windows in the towers and three-mullioned windows in the central body.

[5] For a detailed analysis of Basile's design process and language, see [Persico 2010].

[6] Among others see: Dotto 2012; Maggio 2011; Palestini 2016; Sdegno 2015; Spallone 2017. Some disciplinary contributions are collected in the database created for the UID project: Drawing in Architecture Archives: <https://www.unioneitalianadisegno.it/wp/archivi/> (accessed 2022, February 25).

[7] The two rental buildings Agnello Briuccia and Benfratello were built in place of the palazzo Deliella [Persico 2014, pp. 223, 224].

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Naples: Waterfront Projects between the Two Wars. Architectural Visions and Thoughts on the City in the Drawings of the Frediano Frediani Private Archive

Alessandra Cirafici, Alice Palmieri

Abstract

Modern archives are a precious source for investigating not only the evolution with which the language of drawing has accompanied and narrated the architectural project at a particular moment in its history, but, especially when referred to the horizon of unbuilt works, they also represent an extraordinary tool for interpreting the sometimes unexpressed potential or urban utopias that marked the evolution of thought on the city in the 20th century. Valuable evidence of this is provided by the drawings kept in Frediano Frediani's private archive, which tell of the urban utopia of an unprecedented Naples, extremely avant-garde and at the same time deeply rooted in its territorial identity. In the abundant archive material, the aim is to investigate some of Frediani's unrealised architectures, in which the author proposes waterfront solutions that tell of the relationship of the Campania capital with the sea, and which are inserted along a stretch of coastline central to everyday urban dynamics.

Keywords: 20th Century archives, Frediano Frediani, urban utopias, drawn architecture.

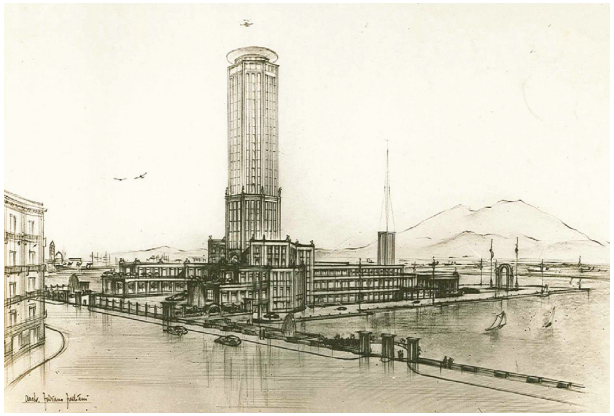
Critical archive/device

> "Here, then, the archive is no longer just an inert heap of documents from which some disturbance that Derrida associates with the mnestic process arises, but becomes, in a Foucauldian sense, a critical device capable of regenerating the usual logics of preservation, use, and dissemination of knowledge, of reactivating memory and political consciousness"
> [Baldacci 2016, p. 20]

Most of the uncertain critical success of some interesting Italian, especially southern, exponents of 20th century architectural thought, is probably due to some historiographical gap, but much more to the lack –due to neglect or the destructive events of the last century– of well-organised and consultable public archives. The questions regarding the very idea of 'archive' and the role it can play in the protection of important portions of collective memory are interesting in themselves and offer particular food for thought when addressed to the theme of the architectural archive and the particular relationship between history, memory and knowledge that it conceals. These are questions that closely concern the field of architectural drawing in its dimension of 'document'. Even more so, they regard the double value that an archive, composed essentially of 'figures', possesses with respect to a traditional documentary archive. A difference that is enclosed in its conspicuous "oscillating between deposit and museum, inventory and collection: but above all in its planning intentionality that almost always tends to project the dimension of the document into the more heroic one of the 'monument'

according to the well-known meaning indicated in 1978 by Jacques Le Goff in his famous essay for the Einaudi encyclopaedia" [Irace 2013, p. 5]. At the very moment in which it is executed, "the drawing ceases to be just an operation, to become a work, […] it is generally transformed into information that is even more stable than its denotation" [de Rubertis 1994, p. 23]. Once drawn, the lines not only bear witness to the drawing or interpretative act that generated them, but also return to present themselves to the observer as objects ready for a new hermeneutic action that can go beyond the intentionality of those who produced them. In this sense, modern archives are a precious source for investigating not only the evolution with which the language of drawing has accompanied and narrated the architectural project at such an important time in its history, but, especially when referred to the horizon of unbuilt works, they also represent an extraordinary tool for interpreting the sometimes unexpressed potential or urban utopias that marked the evolution of thought on the city in the 20th century. The theme is rich in suggestions, but to deal with it in a general sense would take us far from the considerations that we wish to pursue here through the particular case of the private archive of an architect, Tuscan by birth but Neapolitan by adoption, whose critical fortune is not at all proportionate to the significance of his eclectic and copious production in the panorama of architecture real-

Fig. 1. Santa Lucia skyscraper (1945): perspective view to verify the visual impact of the building in its relationship of continuity with the urban structure and the landscape context (Frediano Frediani Private Archive).



ised at the turn of the two wars –and then again until the 1950s– in Campania, between Naples and Benevento. This is the figure of Frediano Frediani [1] and his private archive, carefully guarded by his family and generously made available to scholars who, over time, have had the sensitivity to recover important pieces of the architectural history of Naples in the early 20th century from it [2]. Preserving this archive has not only meant documenting the work of a talented architect who expressed himself in a wide range of fields of culture and thought in the early 20th century (from art to architecture and drawings), but it has also meant protecting from oblivion a heritage of thought and action in the field of architectural production, through which it is possible to investigate interesting and useful itineraries for reconstructing some of the reasons and destinies of the urban history of the city of Naples. In the copious material in the Archive, the beautiful perspectives created in charcoal or graphite for some of Frediani's most complex and at times visionary works stand out. Magnificent drawings from which we will attempt to draw some considerations on the way drawing was used as a vehicle for expressing architectural thought as it was developing in the context of Italian culture at the turn of the Second World War. All those materials that document what the critics, when referring to the project of the 20th century, tend to define as the 'useful drawing', realized by Frediani in the long activity of 'architectural and artistic referent' that he carried out in the section Studies and Works of the Ente Autonomo Volturno starting from 1925 are also of great interest. This latter collaboration earned him, among others, the commission to design two beautiful stations for the Cumana railway, the first section of which was built in 1889 –Italy's first urban underground railway and second in Europe only to London!– and which, towards the end of the 1930s, when the Mostra delle Terre d'Oltremare was opened, saw a significant boost in terms of both the technical aspects of electrification and the changes to the route, which led to the opening of two new stations –Fuorigrotta and Mostra– designed by the architect Frediani. These two little gems fortunately escaped the 'flurry' of renewal that swept through the Fuorigrotta district during the work for the Italia '90 World Cup, with dubious results. The incautious decision to demolish them would have deprived us of a precious testimony to the architecture of Frediani, a sensitive interpreter of a particular season, in which the two episodes are inserted with undoubted value. Frediani's entire work is a mirror in which to glimpse the elements

of that important season of change that swept through the city. At times pursuing the rhetoric of Greater Naples, at times more pragmatically pursuing important results in terms of infrastructures and large-scale works, the 'Neapolitan school' at the time boasted names of the calibre of Marcello Canino, Carlo Cocchia, Luigi Piccinato, Giuseppe Vaccaro and Giulio De Luca, to whom we owe interventions in those years that significantly altered the image of the city, constituting an unavoidable premise for its subsequent development.

When he arrived in Naples in 1922, Frediani's work covered the whole complex cultural and political scene that affected the city in that controversial period which saw the language of architecture here, as elsewhere, fluctuate markedly between innovation and tradition, rationalism and classicism, in a process clearly documented in the Frediani archives. His first works are eclectic, even in terms of representation, and include the project for the extension of the Granili thermal power station in 1929 and the work on the Colli al Volturno hydroelectric power station in 1934. He gradually moved towards a proto-rationalist language in his work on the stations of the Cumana railway, with a widespread use of expressionist forms and glass blocks, while the work carried out in Benevento, with the Giuseppe Mazzini school building (1934) and the heliotherapy colony (1936), was refined in the clear classical play of volumes. These were years in which Frediani intertwined his experience with that of Luigi Cosenza (with whom he collaborated on the design of the fish market in 1929) in a lively context in which, alongside the great names of the 'Neapolitan school', apparently minor figures such as Vittorio Amicarelli, Venturino Ventura and Frediani himself contributed with more specific but no less significant episodes to the reorganisation of the city's image and thinking.

In this context, the work carried out immediately after the end of the Second World War is of particular interest, when Naples emerged from the rubble of one of the heaviest Allied bombardments and found itself having to think about its new urban layout, the reconstruction of the port area, which had been almost completely destroyed, and, more generally, rethinking the waterfront to the east

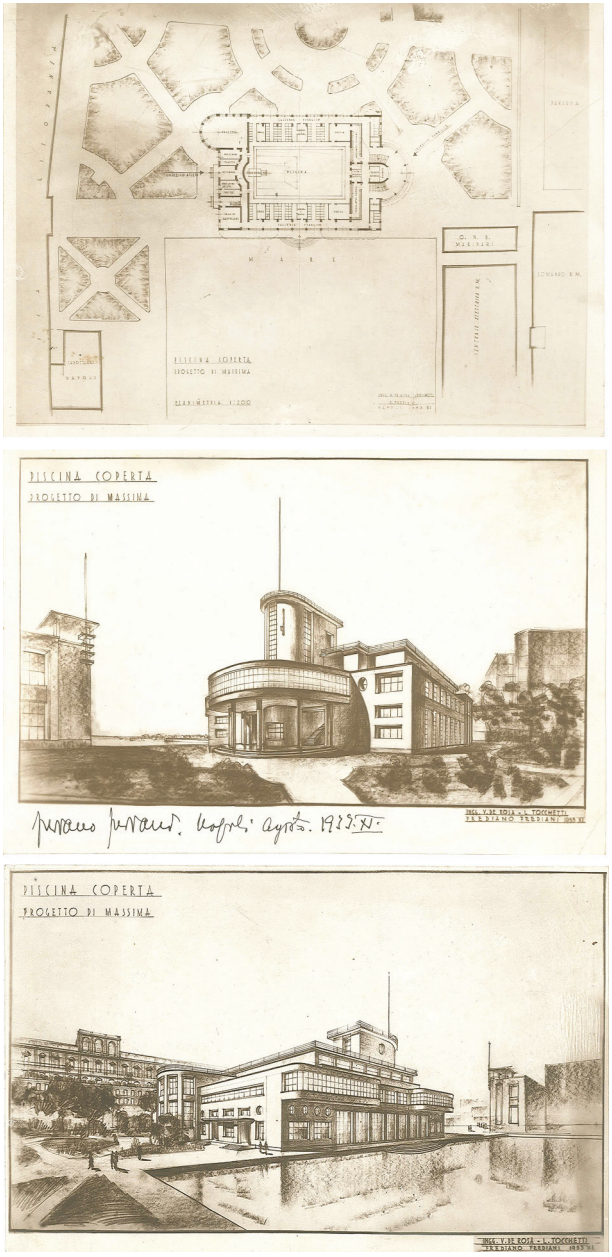


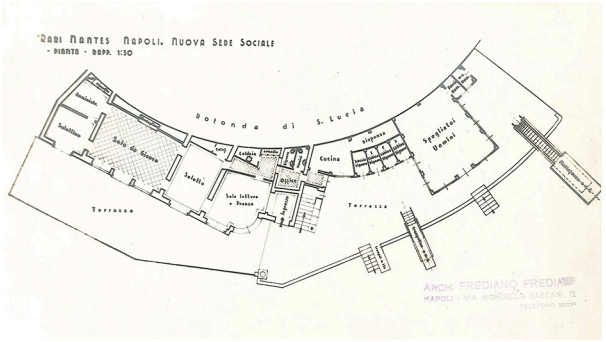
Fig. 2. Molosiglio indoor swimming pool (1933): general plan and insertion in the existing gardens; perspective views in relation to the sea and the Royal Palace behind (Frediano Frediani Private Archive).

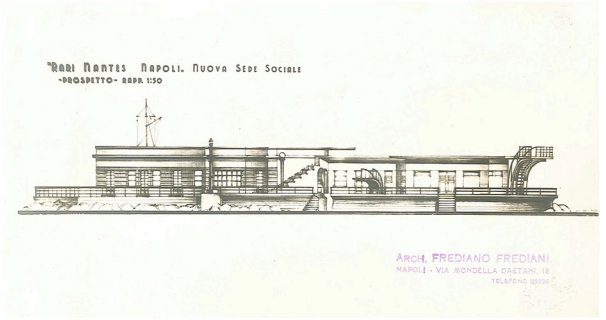
of the city. Frediani had already intervened in here, before the conflict, with some projects that were not always realised, but it was at the urging of the American Colonel Harold H. Towsend, Public Works and utilities officer of the Allied Military Command in Naples and president of the American Italian Development Enterprises, that Frediani drew up his most complex and visionary project between 1945 and 1946: the Santa Lucia skyscraper [3]. The project was never built due to the bitter controversy that followed its presentation to the public. It was a powerful, visionary project that rightfully belongs in the season of Italian architecture immediately after the war and which, if realised, would have significantly modified not only the image of the city, but probably also its propensity to include the 'modern' in its own urban transformation process.

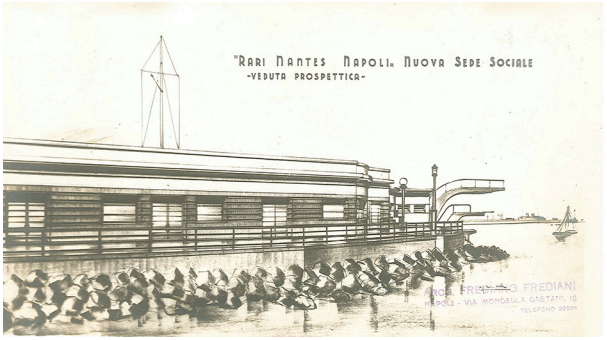
Paradigms of modernity and aesthetic resistance in post-war Naples

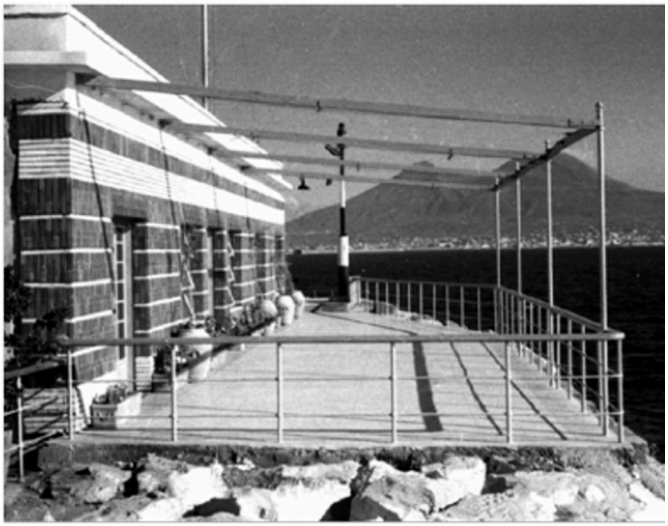
The damage estimate drawn up the day after the end of the hostilities reported that over 80% of the docks, buildings and facilities in the port area had been destroyed. An immediate programme of reconstruction work was therefore necessary, which had to include, in a broad sense, a redesigning of the entire waterfront of the eastern part of the city from Carmine to Piazza Municipio. The debate that followed was intense and revolved essentially around the proposal for a 'Plan for the reconstruction of Via Marittima' presented by Luigi Cosenza in 1945 [4]. The proposal was harshly criticised by the Neapolitan intellectual elite. The Order of Engineers and Architects, in a document drafted by Amadeo Bordiga, criticised the conception of the Plan inspired by "fantastic visions of an Americanised Naples", translated into "a mammoth Via Marittima which will advance destroying monumental buildings, historical environments and a mass of residential buildings which had to be gradually replaced due to the extreme necessity of the moment" [De Lucia, Jannello 1976, p. 16] [5]. What emerges is the image –more presumed than actually contained in Cosenza's intentions– of an "Americanized Naples, a synthesis of a series of real and imaginary *topoi* that at the time fuelled the myth of the American city: a huge urban scene, mastodonic rather than grandiose, built with 'skyscrapers' in place of churches and historic buildings" [Belfiore 2011, p. 107]. All the elements of the debate on the American 'dream' that affected Italy and Naples during the years of the Allied occupation are easily recognisable. A controversial period in which historiographic interpretation has often emphasised elements of fracture with respect to the past, but in which, on the contrary, the resistance of previous models is very much alive. The myth of America, elected as a paradigm of 'modernity' was often contradicted by "lines of 'continuity', traceable through the lens of a disenchanted analysis, even when made latent by the very protagonists of that event" [Gravagnuolo 2011, p. 96]. In the case of Naples, the debate was intertwined with a certain resistance on the part of the city to imagine itself as truly 'modern' and to allow new languages and new building typologies (first and foremost the skyscraper) to find a place in the consolidated fabric of the historic city. In short, we could say that the open controversy that greeted Cosenza's proposal outlines that itinerary in which "the 'Italian way' to the skyscraper and the desire to be 'American' recounts the birth of a recurring sentiment between defence of one's own cultural and artistic identity, fear of colonisation by other models and the need to find a necessarily unstable balance between local and global" [Molinari 2011, p. 38]. In this sense, the fate of Frediani's visionary project for the Santa Lucia skyscraper is emblematic and fits perfectly into the debate mentioned above, both in terms of the aspects related to the project's design dimension and the bitter controversy that his proposal produced in the milieu of Neapolitan intellectuals. So much so that, despite its approval by the commission, the project was never realised. The events that accompanied the phases of entrusting the commission to Frediani and the realisation of the project for what was to become the 'Santa Lucia' International Labour Centre (1945-1946) [Cirafici 2020], a magniloquent building imagined on a peninsula extending over 200 metres into the waters of the gulf, along the stretch of sea between the Molo San Vincenzo and Castel dell'Ovo have already been discussed. Frediani had already designed two buildings in the same area: an unbuilt indoor swimming pool at Molosiglio (1933) and the new Rari Nantes Club headquarters (1938). Both projects responded to an idea of the city that saw sport, swimming and therefore the relationship with the sea as an important part of its identity. These works were designed with a particular sensitivity in interpreting the dialogue, also perceptive, with the stretch of water they both overlooked, while at the same time being attentive to the urban context in which they were inserted. The Santa Lucia project far exceeded the dimensions of the previous

Fig. 3. Rari Nantes Club Headquarters (1938): the archive documentation represents in plan, elevation and perspective the building in its dialogical relationship with the sea. Next to it are some historical photographs of the construction (Frediano Frediani Private Archive).



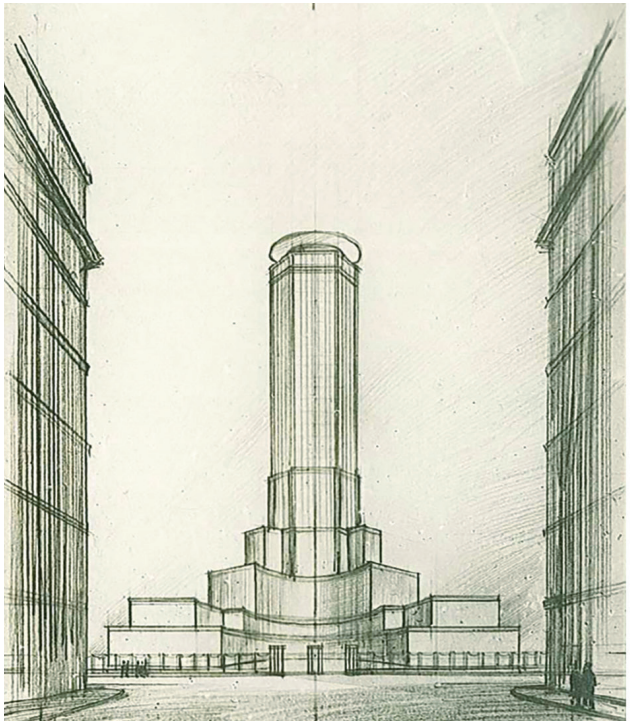


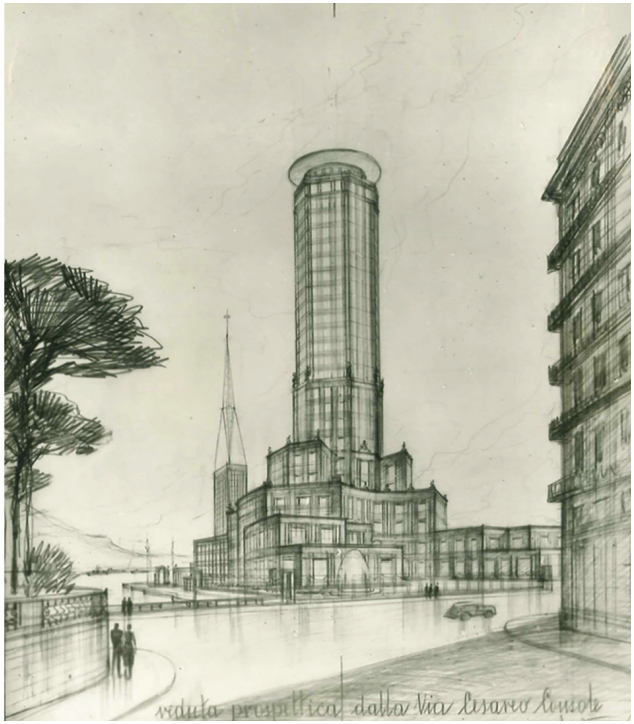




interventions on the coastline and can undoubtedly be considered a protagonist of the season of the great 'utopia' that characterised the urban transformations of the cities. The visual impact of Santa Lucia, with its octagonal tower standing out in the middle of the sea, was a provocation for the imagination of the entire city of its famous 'panorama' (figs. 4, 5, 6) Frediani's project therefore remained a splendid utopia, and as is often the case with unrealised projects, little known or investigated. Frediani's three interventions are not to be understood as part of his unitary thought on the waterfront. They are different in scale and purpose, but without doubt they provide an opportunity to reflect on the fate of the city's waterfront which, once abandoned –rightly or wrongly– the organic proposal by Cosenza, has long remained unresolved and is still in a condition of perceptual disorder, accentuated by the interminable work on line 1 of the underground.
The first objective is to attempt to give a critical reading of Frediano Frediani's projects –both completed and unfinished– starting with an analysis of the beautiful, signed drawings kept in the Archive. Then, through a cultured redrawing operation, we will try to give our own contribution to the intense debate on the relationship between 'architectural drawing' and 'realised architecture', in favour of an interpretation that sees in the graphic analysis and in the prefigurative capacity of the drawing, the possibility of returning to the sphere of militant architecture the wide range of archive projects that were not realised, but that are no less significant for the evolution of the thought on the city.

Fig. 4. Santa Lucia skyscraper (1945): the perspective views from Via Console enhance the monumentality and expressive power of the octagonal tower (Frediano Frediani Private Archive).

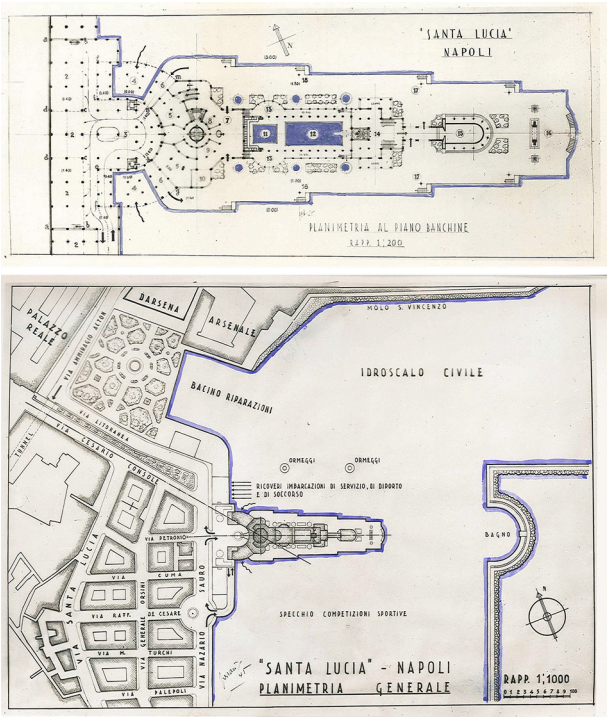




Waterfront projects between utopias and pragmatism

Remaining within the sphere of pure intentionality, some of Frediani's projects, first and foremost the Santa Lucia project, now offer themselves to our attention for a graphic investigation that retraces their vocations and potentialities enclosed in the expressive force of the 'project drawing'. The series of drawings, sketches and beautiful perspectives created by the happy hand of Frediano Frediani for the Santa Lucia project, as well as for the indoor swimming pool at Molosiglio and for the headquarters designed and built (this one!) for the Circolo Nautico Rari Nantes, allows to have a fairly clear idea of the design development of the works and to appreciate their quality. It also allows to make a few considerations on the use of drawing as a vehicle for the expression of architectural thought as it was developing in the context of Italian architectural culture at the turn of the Second World War. The wind of the avant-garde, which had imprinted itself on much of the modernist architectural production in Europe, was slow to take root in Italy, where to identify a true new element in the way of understanding the representation of architecture, we must refer almost exclusively to Futurism and the unmistakable graphic sign of Sant'Elia. The only true ground for experimentation in the field of graphic innovation was soon to be the Roman school with the works of Terragni, Libera, Ridolfi and Sartoris, whose representations expressed the search for linguistic coherence and a new way of understanding architectural drawings.
In this ideal path, Frediani's experience has its own specificity. The drawings in the archive certainly favour a narrative dimension, so to speak. A narrative that does not renounce the praise of volume and that identifies in charcoal or graphite a technique perfectly consistent with its objectives, not without a certain virtuosity and that never abandons perspective representation. The initiatory path that had led modernism to privilege the 'absoluteness' of axonometric representation, to exalt the almost abstract quality of pure geometric form, devoid of any ornamentation and above all devoid of 'context', did not seem to interest Frediani, whose drawings still show a clearly descriptive vocation, with some peculiar elements. Look at the drawings for Santa Lucia. The project was developed, as we have said, after the end of the war, at a time when the critics placed a season of architectural drawing that they defined as 'useful drawing'; a drawing that, although in continuity with the previous period, was characterised by a particular pragmatic, instrumental approach, functional to a physical but also cultural reconstruction of the country and its architectural conscience. In this sense, Frediani's design for Santa Lucia looks to the past, and therefore to the recent pre-war period, in a manner not entirely dissimilar to the perspectives realised for the indoor swimming pool at Molosiglio (fig. 2) or for the Rari Nantes Club headquarters (fig. 3). The decision to make a massive use of perspective, however, has a particular significance here: to verify the volumetric dimension and above all the scale of his intervention, succeeding in communicating to the client, as well as to public opinion, the monumental and symbolic quality of his courageous design idea and the attempt at dialogue with the pre-existing context. The numerous perspectives in the Frediani archives, in the file

Fig. 5. Skyscraper of Santa Lucia (1945): a general plan describes the position with respect to the road axes and the main access routes by land and sea (Frediano Frediani Private Archive).



dedicated to the Santa Lucia project, all have the same vertical framework; with effects that are sometimes more realistic and at other times with an extraordinary power of chiaroscuro in the definition of volumes and cuts of light, they define the material quality of the project, enhancing, together with the clarity of the volumes, the symbolic and monumental dimension with a precise choice of expressive poetics. A classicist character emerges in them, which also recurs in Frediani's other works, a synthesis of the neo-Romanism of the Italian rationalists formed during the Fascist period, which is also evident in the drawings for the indoor swimming pool, which emphasise the volumetric articulation, the large glass surfaces and a certain monumentality of the layout.
In the case of the Santa Lucia, all of this is complemented by an American-style solemnity. It is difficult not to highlight the almost explicit reference to the image of the fluted column suggested by the tower's shaft, an inevitable reference to Adolf Loos' design for the Chicago Tribune. In all the perspectives, the choice of the vertical frame highlights the monumental dimension of the tower much more than the dynamic volumetric articulation of the building in successive aggregations, whose description is entrusted to the single aerial perspective. However, the greatest challenge lies in the refined work of perspective representation, which aims above all to place the building in the context of the pre-existing landscape, be it the languid backdrop of Mt. Vesuvius or the dense urban fabric. The use of the photomontage technique (fig. 6) is of particular interest, to be considered truly experimental for the time, capable of combining modern architecture and town planning, photographs of the urban context and line drawing with undisputed charm in the representative outcome.
Even in the perspectives created for the indoor swimming pool, attention to the context is evident not only in the reference to the façade of the Palazzo Reale, against which the building's articulated volume stands out with a great height difference, but also in the relationship with the elegant gardens and the mirror of water of the Molosiglio harbour on which the entire south elevation rests (fig. 2). The location of the building already contains many complex issues, linked to the city's characteristic differences in height between the Santa Lucia seafront, the site planned for the swimming pool near Via Marina and the decidedly higher level upon which the Royal Palace stands. They describe an important volume characterised by large windows and two long bow windows, with circular ends, facing the sea. The functional nature of the structure invites an introspective vision, in which the spatial complexity of the internal volume is concentrated in the centrality of the pool, an object that catalyses the gaze and a great 'void' that the section tells us is surmounted by a beautiful work of engineering, given by the reinforced concrete truss roof, an identifying and characteristic element of the building form. The relationship with the sea, this time, is described not so much in the sections as in the general plan, which configures the layout with respect to the existing gardens and the quay, for which a flight of steps was planned that gradually descended into the water.
The daring drop in height generated by the Santa Lucia breakwater was also the starting point for Frediani's small project for the headquarters of the Circolo Rari Nantes, which had been based on the reef against the wall in Via Nazario Sauro near the entrance to the Santa Lucia marina since 1908. In the same place, the city's other historic sailing clubs, the Italia and the Savoia, had been there since the end of the 19th century. The drawings in the Frediani archives also include a proposal for a general reorganisation of the marina and Borgo Marinari, as if to demonstrate a desire to intervene organically in the entire area. The project for the Rari Nantes Club headquarters, which still exists today, although with obvious alterations to the original design, is characterised by an interesting semi-circular plan, leaning against the wall of the rotunda above, with which it dialogues, linking

Fig. 6. Santa Lucia skyscraper (1945): schematic sketch of the structural masses realized with the photomontage technique to document the visual impact of the building (Frediano Frediani Private Archive).

Fig. 7. Santa Lucia skyscraper: graphic analysis and critical interpretation. Plan at 2.50 m elevation, cross section, elevation drawing and axonometry to describe the aggregation of volumes (Master's Degree thesis in Architecture by T. Esposito, 2019. Supervisor prof. A. Cirafici).

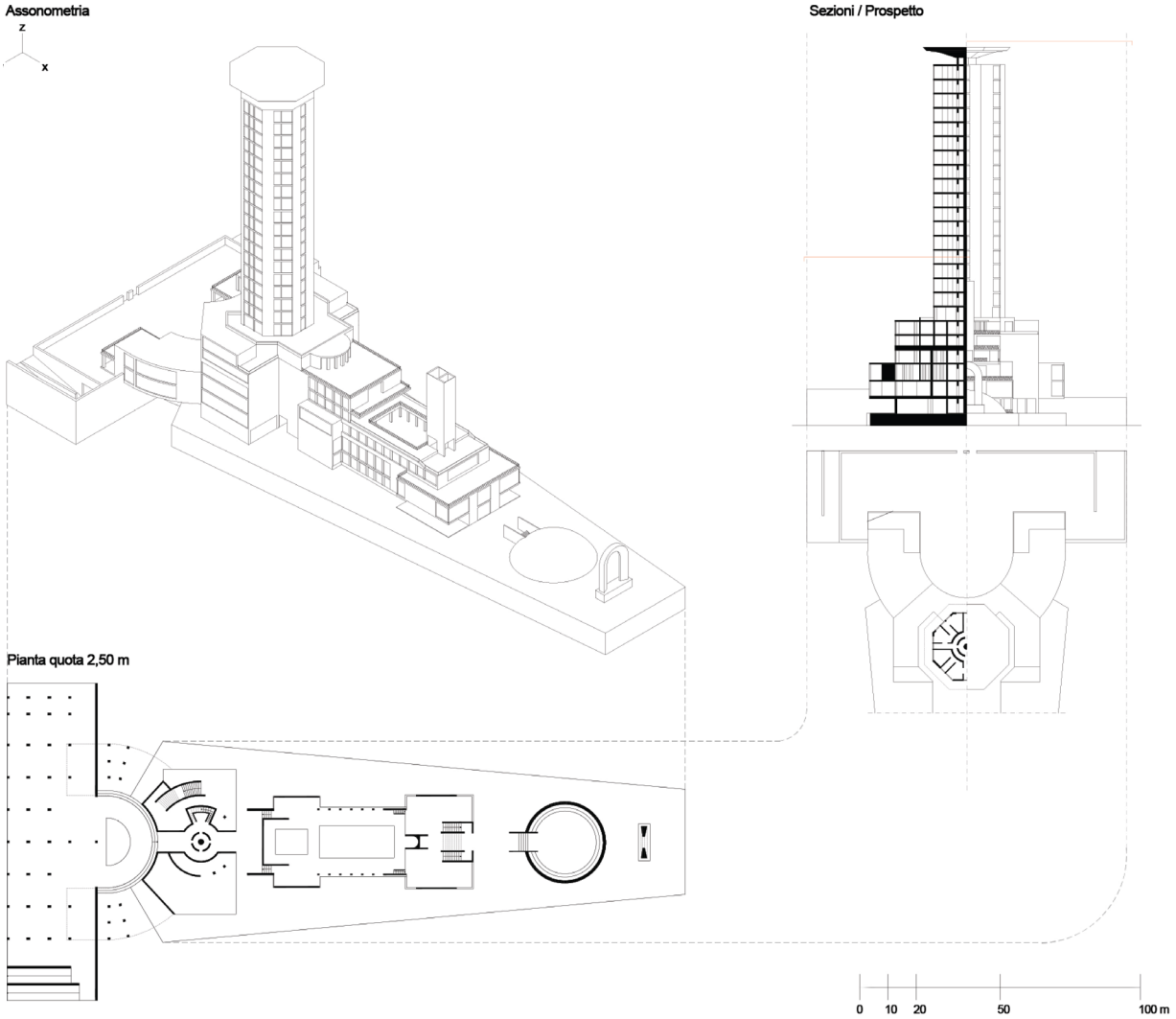
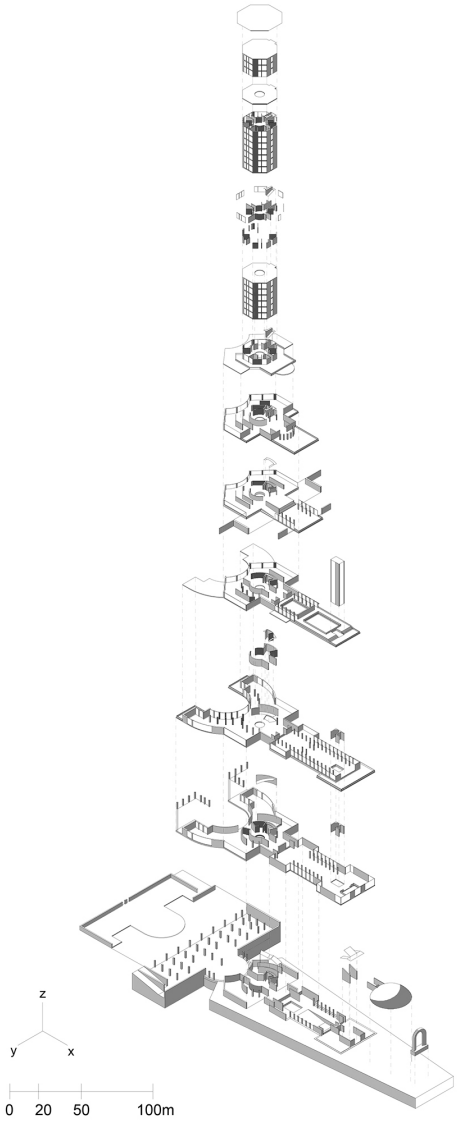


Fig. 8. Santa Lucia skyscraper: graphic analysis and critical reading. The axonometric exploded view highlights the functional distribution and the volumetric overlapping scheme (Master's Degree thesis in Architecture by T. Esposito, 2019. Supervisor prof. A. Cirafici).



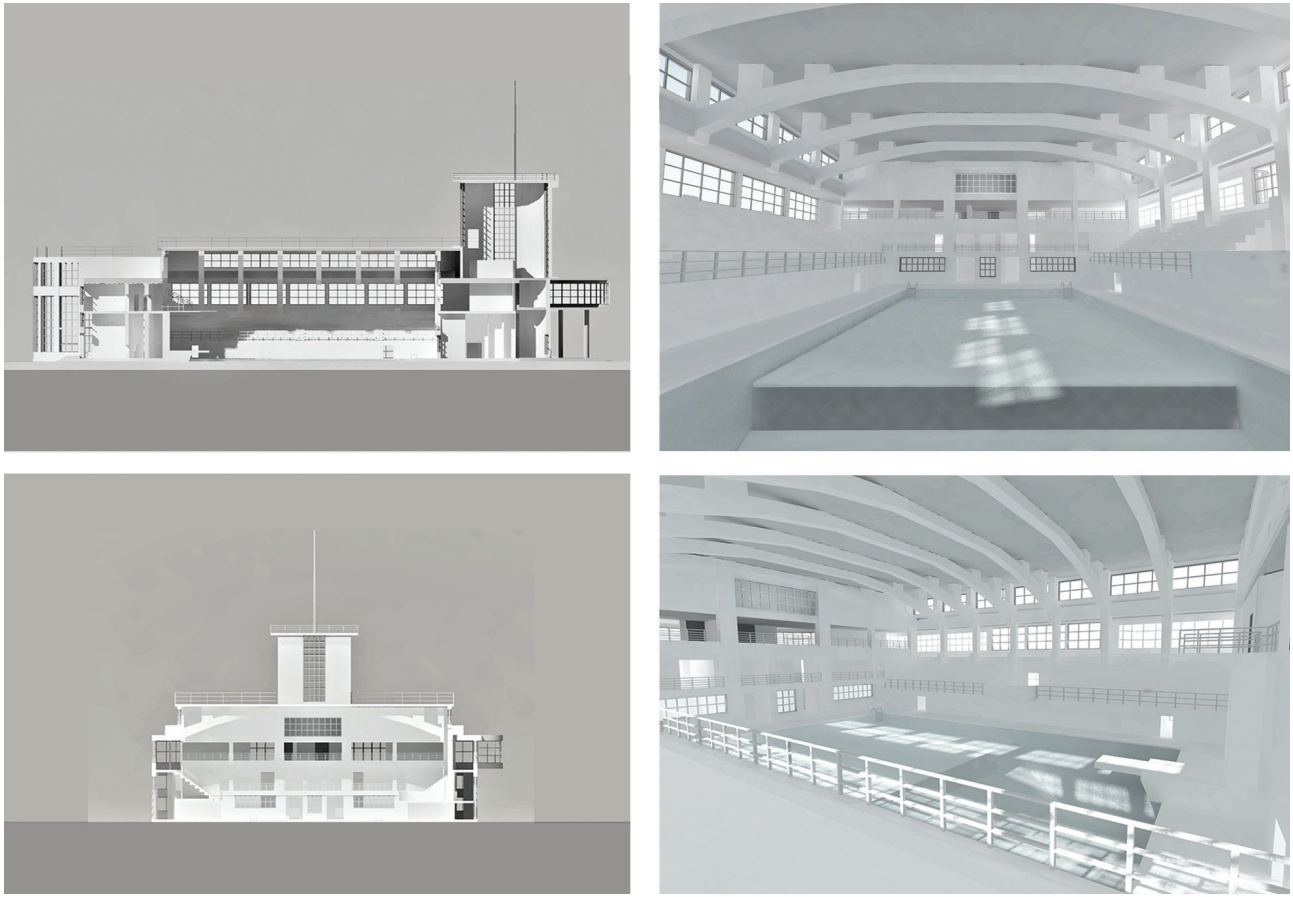
upstream to it, while downstream it extends into the stretch of water in front of it with two large terraces equipped with diving boards and descents to the sea. The plan and the axonometric sketch of the preliminary project (fig. 2) document an initial conception with a much more rigid layout of the regular and necessarily semi-circular volume, in which, on the contrary, the final solution replaces an interesting alternation of full and empty volumes well-articulated around the pre-existing cliff that the plan and the beautiful perspective clearly show. The access to the sports-centre initially conceals the volume and is configured through a staircase leading to the large terrace, revealing the view of Borgo Marinari and the Castle. The buildings are arranged on either side of the staircase and are distinguished by clear geometric characteristics: the ones on the left are compact and homogeneous, used for the association's activities, while those on the right, destined for changing rooms and equipment, are dislocated and differentiated in form. The front elevation shows the nautical reference even more clearly, underlined by the mast, with flagpole and ropes, designed for possible athletic exercises, and by the final section overlooking the sea, which sketched a prow [De Cristofaro 2021].
The strongly horizontal orientation underlined by the striped facing of part of the elevation in which the plastic volume of the diving board boldly jutting out into the water stands out. The perspective bale is more attentive to documenting the relationship with the sea and the landscape than with the upstream context, and therefore favours perception from the sea in which the building's ability to integrate with the cliff is evident, almost as if it were an integral part of it. The expressionist flavour of the representation recalls other objects designed by Frediani which have unfortunately not withstood the test of time. Among them, the beautiful washhouse built in Benevento stands out (of which there are only a few photographs in the archives), whose cantilevered concrete roof with the ribs of the shaped beams in evidence reveal an ability to elaborate the expressive language of reinforced concrete, as is also shown in the section of the indoor swimming pool at Molosiglio and as can best be guessed from the redrawing operations that we have carried out on it, as on the other two episodes mentioned.

Re-drawing: re-attribution of meaning

Investigating architecture through the graphic transcription of the Drawing means first of all tracing the design process,

starting from its condition of 'drawn architecture', as if to demonstrate, to quote Gregotti [Gregotti 2014], how thin the line separating project and drawing is and how much the two terms exchange and overlap, mirroring each other. In this sense, the project drawings of the Frediani archive have been investigated not only in an attempt to provide a critical interpretation of the 'drawing' intended as an action of transcription of the project idea, but also as an opportunity to try to decipher between the folds of the information contained in them –sometimes incomplete, sometimes contradictory– the traces of a project path whose results can be re-proposed through operations of re-drawing and modelling that allow for a fundamental exercise of re-attribution of meaning especially to that "endless territory of the unrealized proposals, of the drawings that remained as such, understood as the ideal landscape of architecture and of the architect" [Purini 1993, p. 347]. Graphic analysis is therefore extraordinarily

Fig. 9. Molosiglio indoor swimming pool: graphic analysis and construction of the digital model. Perspective sections and illustrative interior view (students: C. Franzese, E. Imbembo. Laboratory Representation and modelling of architecture, BSc in Architecture A.Y. 2020/21, prof. A. Cirafici, tutor A. Palmieri).



useful in the interpretation of buildings that were never built, of which –as in the case of some of Frediani's works– only archive documentation remains, for the identification of formal and spatial values. The redrawing of the projects and their digital processing have thus made it possible to see a complete image of buildings that do not exist in reality, whose reading can only be the result of a cognitive and imaginative process. In the case of the interventions on the waterfront, restoring graphic consistency to this imaginary design means coming to terms with an urban landscape, perhaps utopian, but which, if realised, would have given a different meaning to part of the coastal stretch of the centre of Naples. As Pagnano says, "an architecture can reveal much of its meaning if subjected to specific analysis techniques that design can implemented in accordance with its formal, constructive and linguistic characteristics" [Pagnano 2008, p. 7]. Redrawing can highlight a series of issues implicit in archive documentation and which can be the object of consideration through critical operations of representation. The operational value of graphic transcription lies in its ability to make the figurative matrixes of the project and the compositional methodology visible, in a narrative made up of drawings of architecture that was never built, whose memory remains alive thanks to the reconstruction of the image. The graphic re-proposition of Frediani's projects, starting from the materials in the archive, is therefore part of the practice that allows for the critical reading of a work *in absentia* through a transcription that is in no case just a conventional re-proposition of the project drawings, but on the contrary is the result of a selection of signs and elements of a metalinguistic system that in itself configures the features of a critical transcription. Far from pursuing a hyper-realistic approach, the digital representation relies on the strength of line and volume and their ability to synthesise form. At times, as in the case of the indoor swimming pool at Molosiglio, the perspective views have favoured the reconstruction of the volumetric articulation and the solution of the roof in the internal views, which give back a perceptive datum totally absent in the archive documentation, allowing for the view of new internal viewpoints that reveal an articulated space conceived with functional rationality. At times, as in the case of the Rari Nantes Club headquarters, the only work actually built, the sense of the redrawing was to investigate the original intention that drove Frediani in his volumetric research, functional and formal at the same time, guided by the dialogue with the sea, the true protagonist of the space used. The small structure is located below street level, almost fan-shaped, to follow the urban topography and to turn the gaze towards Mt. Vesuvius as well as Castel dell'Ovo. Through the redrawing and construction of three-dimensional models, it is possible to figure out the perspective view, which allows to investigate a compositional choice that conceives the construction as a sort of naval bridge, culminating in a springboard and a raised walkway probably to be used as a mooring for boats. The internal views try to enhance the relationship with the sea and the city, guiding the lines (curved in this case) of the form, which at the top hooks onto the Santa Lucia roundabout to open up towards the coastal landscape, seeking an interpenetration between exterior and interior, facilitated by the reduced depth of the small volume which allows the landscape to be visible from every room. The connection with the sea is profoundly physical,

Fig. 10. Molosiglio indoor swimming pool: digital model construction and external views (students: A. Mugione, A. Russo, E. Viale. Laboratory Representation and modelling of architecture, BSc in Architecture A.Y. 2020/21, prof. A. Cirafici, tutor A. Palmieri).

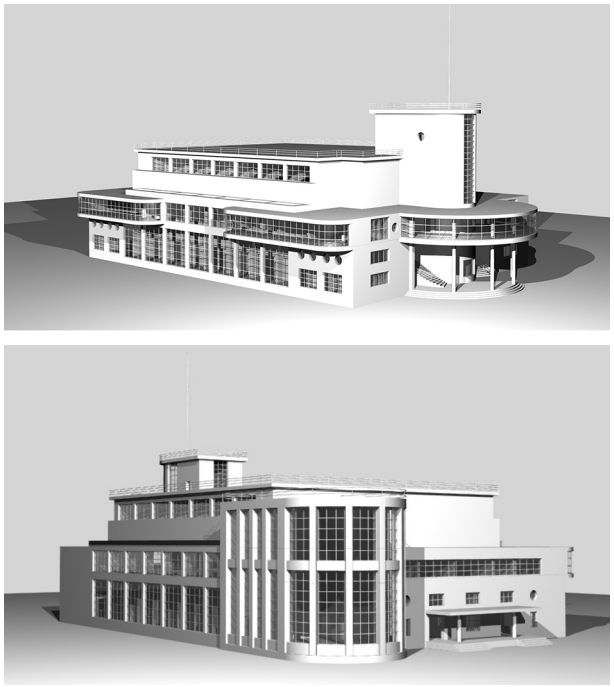
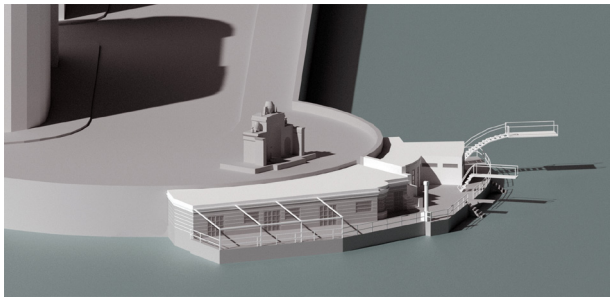


Fig. 11. Rari Nantes Club Headquarters: graphic analysis and critical interpretation. Synthetic table (students: L. Pagano, M. Portella, A. Perfetto, A. Oliva, S. Oligino. Laboratory Representation and modelling of architecture, BSc in Architecture A.Y. 2020/21, prof. A. Cirafici, tutor A. Palmieri).

concrete, and embraces construction and structural issues, resolved with lightness in favour of an architectural image that interpenetrates with the water, to the point of maximum tension in the design of the diving boards, which leave the terrace 'behind' to develop in suspension above sea level. In apparent total contrast is the relationship with the city's buildings: the large representative buildings on the Santa Lucia waterfront are only a backdrop for the Rari Nantes project, which has its dimensions, form and language at odds with the 'classicism' of the buildings at street level.
Finally, the work of analysis through the drawing of the articulated Santa Lucia project has privileged an action of progressive reduction of signs to the point of extreme synthesis, succeeding in reducing the connotative elements of the project to very brief but effective strokes. By re-proposing sections and plans, he has once again emphasised the relationship of the designed space with the city and the landscape, enhancing the monumental and symbolic quality of the design idea and its close relationship with the territory. The succession of plans and volumes is synthetically narrated with an expressive force by the axonometric exploded view in which the entire articulation by successive superimpositions is evident (figs. 7, 8).
In conclusion, we can affirm that in all the cases described, the redrawing operation offered itself as an opportunity to implement a critical and interpretative process of translation of the spatial complexity into a graphic sign, becoming the implementation of that thought, so well expressed by Francesco Maggio, according to which if "the drawing is the 'place' of construction of the form, the redrawing is the analysis of the completed form" [Maggio 2008, p. 39].

Fig. 12. Rari Nantes Club Headquarters: construction of the digital model and external view (students: A. Perfetto, A. Oliva, S. Oligino. Laboratory Representation and modelling of architecture, BSc in Architecture A.Y. 2020/21, prof. A. Cirafici, tutor A. Palmieri).



Credits

Although the approach and contents of the essay are shared by the authors, it should be noted that the first and third paragraphs are by A. Cirafici, while the second and fourth are by A. Palmieri.

Acknowledgements

Special thanks are due to Gianluca Frediani for his generosity in allowing the consultation and publication of materials from the Frediano Frediani private archive.

Notes

[1] On the figure of Frediano Frediani, see the recent volume by Carlo De Cristofaro that for the first time collects the entire work of the architect born in Forte dei Marmi in 1897: De Cristofaro 2020.

[2] The testimony of Frediani's copious work is kept in a rich private archive, curated by his nephew Gianluca Frediani, whom we thank for allowing the consultation and the publication of the graphic and photographic material.

[3] The ambitious project of the skyscraper off the coast of the hamlet of Santa Lucia involved the construction of a peninsula stretching out into the waters of the gulf for over 200 metres long and 50 wide, protected by a system of dams built for more than 600 metres from the shore, in the stretch of sea between the Molo San Vincenzo and Castel dell'Ovo.

[4] The most complete reconstruction of the political and administrative events of Via Marittima is described in the introductory essay by Michele Fatica to the volume: Gerosa, L. (2006). *L'ingegnere "fuori uso", Vent'anni di battaglie urbanistiche di Amadeo Bordiga, Napoli 1946-1966*. Formia: Fondazione Amadeo Bordiga.

[5] This quotation is reported for the first time in V. De Lucia e A. Jannello, *L'urbanistica a Napoli dal dopoguerra ad oggi: note e documenti*, pubblished in *Urbanistica* n. 65, 1976, p. 16. A monograph on Neapolitan urban planning from the Plan of 1939 to that of 1972.

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RUBRICS

Readings/Rereadings

Readings/Rereadings

I luoghi di Dedalo. Elementi teorici dell'architettura by Vittorio Ugo. A Rereading

Luigi Cocchiarella

Rereading a text that has significantly contributed to one's path of reflection, after more than twenty years, can reserve unexpected emotional repercussions. I am referring to the resurfacing of echoes of some thoughts and dreams of the youth, and the prior awareness of a necessary critical review that would inevitably have involved the re-reader, too. And to the memory of the unexpected loss, which occurred in 2005, of a colleague and a teacher, as well as of the Professor with whom the writer was enrolled at the Politecnico di Milano in 1999, coming from the Federico II University in Naples. Of course, I will confine myself to the attempt of fulfilling my mandate by focusing on the "rereading" only.

To respond to a cultural urgency widely felt for a long period during the 1980s, the volume, published in 1991 by partially collecting and systematizing previously elaborated studies, aims to outline a theoretical asset for architecture, based on its own disciplinary statutes, for a discourse "about" architecture that is also a discourse "of" architecture (p. 11). A titanic mission to say the least, which Vittorio Ugo undertakes and develops by weaving and knotting an impressive amount of knowledge, retracing the endless ramifications and intertwining between myth and history, starting from classical Greece –the privileged source, absolutely– and from the Latin world, to extend the investigation to the French culture between the seventeenth and nineteenth centuries, up to the twentieth with Michel Foucault, for him a decisive intellectual profile together with the German philosopher Martin Heidegger, as well as to the German and European culture in general, and the Far Eastern culture, in particular Japanese culture, personally dear to him –as the dedication on the title page proves–, including more remote worlds, and some Italian masters of his time. Almost 180 titles are listed in the bibliography, of which about 30 are by the author, to which the conspicuous series of the detailed citations in the text refers.

The definition of architecture, concise and dense, appears almost immediately, precisely on page 32 in a volume having a total of 215 pages, which is worth quoting:

"The Architecture consists of the 'form' historically conferred and phenomenologically recognized –through the action of building, the use, and the critical reflection– of the modes of existence of the system of relationships:

- nature/culture
- materials/techniques
- space/place
- memory/project

according to 'dwelling'" [my translation].

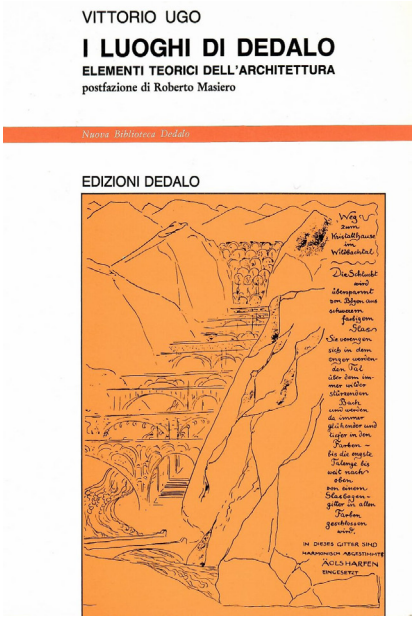

Fig. 1. Cover of the first edition. Original caption: "in copertina: Bruno Taut, Weg zum Kristallhause im Wildbachtal, da Alpine Architektur, Erschienen im Volkwang, Hagen, 1919, Tav. 2.".

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diségno ISSN 2533-2899

From this thematic assumption, the sequence of dissertations and –sometimes enchanting– etymological genealogies starts, designed to re-establish and demonstrate the complex and articulated assertion, to justify it on a historical, theoretical, and critical stage. The argumentative approach proceeds, inexorably, through progressive series of syntheses of oppositional categories, as one can already see from the quotation above. Conceptual knots and categorical juxtapositions, sometimes apparently irreconcilable at first sight, break up and dissolve under the patient and very careful discursive elaborations, supported by a clear language and by the articulated support of formidable referential apparatuses, with frequent parenthetical references even to more minute and recurring details, almost to avoid the risk of even the slightest misunderstanding or omission. As in a theorem, the skein unravels, finally precipitating into synthetic and fulminating definitions, sometimes surprising, often further elaborated in new syntheses, in a tireless process of reduction aimed at recomposing a coherent and unitary theoretical statute for the architecture, at setting a barrier to its disarticulation, at correcting superficial or mystifying disciplinary interpretations. Hence the reference to the responsibility of the author is expressed in the *Premessa* (Introduction), citing Heidegger, who, "if he is happy, as the *auctor*, he provokes an *augere*, a development" (p. 7).

A development that the volume promptly triggers, and which has a lot to do with the theme of this number 10 of the journal *diségno* dedicated to the archives of architecture, since *I Luoghi di Dedalo* is a book precisely aiming at defining an "archaeological field", intended "as a set of modes of existence of the architectural space", of which it is considered necessary to identify appropriate "units of measurement" that allow us to "measure architecture with the architecture itself" (p. 147), considering the latter according to the William Morris key, or, in the entire range of its dimensional extensions, from interiors to the territory. The justification relies on the Foucauldian thought, for which the "archive" identifies "the field of the things said" and "the archaeology is destined to analyze it" (p. 145). With a further theoretical expansion, because the field of the things done, that is, of the things physically built, also belongs to the architectural archive, as even those things are *monumenta* (monuments) that can be processed as *documenta* (documents) in the theoretical synthesis.

Prepared by the first two chapters, the treatment of the third, precisely entitled *Una "Archeologia"* (an archaeology), takes up exactly half of the volume, containing its conclusion. It starts with a recognition and a redefinition of the "elements" qualifying the field of existence of architecture, understood in their intrinsic dual physical and conceptual value, updating them through the detailed recovery of roles and meanings from the depths of tradition, myth, and history, and proposing a detailed taxonomic classification of them, organized by increasing complexity, into "analytical elements" (that is, element as "material", as "component", as "part", as "type", as "nucleus", as "limit", as "fragment") and "synthetic elements" (notably element as "origin" and "principle", and as "syntax"). From these, in particular from their syntactic aggregations, the "archetypal forms", capable in their entirety of "measuring architecture with architecture", would arise.

The archetypes of "architecture" are thus specifically defined, being identified in the "labyrinth" (here is the work of Daedalus! with wide resonances also in the other archetypal forms), in the "hut", and the "bridge", as well as the archetypes of "nature", which are identified in the "forest", in the "garden", and the "clearing", they all considered as the constituents of an "archeology" of architecture, or, of a "strong archaeosystem" corresponding to it, and therefore appropriate for measuring and generating it.

Even briefly, it is worthwhile to review them.

The "labyrinth" (pp. 147-168)

Created by Daedalus upon the order of Minos to lock the Minotaur in a house that is at the same time a prison, the labyrinth is the most intriguing of the archetypes. It takes its name from *λαβύριον*, the intricate system of tunnels of the underground lair of the mole. One cannot visually embrace it at a glance, not even its two extreme configurations, that is, nor when it is "unicursal", containing a single –tortuous– path towards the exit, nor when it is a "pure desert", where one always proceeds –from an ever-ubiquitous center– everywhere to nowhere. Apparently unrelated to architecture, it relates to it in terms of "scheme" instead, and due to its tactile, topological, combinatorial structure, based on a "myopic algorithm", whose "logical" organization one can follow and reconstruct by Ariadne's thread, and through the "rhythm" of its unfolding, one can "measure".

The "hut" (pp. 168-176)

It is the most human archetype, mimicked by Adam himself in the act of sheltering his head from the rain with his hands joined, on his expulsion from the Earthly Paradise. Also known as the "House of Adam in Paradise", it is the best known and most legitimated of the archetypes considered at the origin

of architecture. Going back to Vitruvius, it refers to the *scenographia*, which provides "the image and the idea" to architecture, and through this way, to the ancient Greek word *σκίας*, which, in addition to evoking the shadow, translates the words "pavilion, pergola", understood as the "fundamental reference" to the spatial and functional substance of architecture. The hut, therefore identifies the house, the shelter, also from an optical-projective point of view, as they can be inscribed and recognizable in the field of the visible, and therefore be related to Alberti's compositional notions of *concinnitas* and *mediocritas*, concerning architectural design.

The "bridge" (pp. 176-191)
Although an object of particular and in a certain sense autonomous nature, the archetype of the bridge provides the "syntactic" element to architecture, by the function of connecting, holding together, linking, as in the Italian term ponte and in the Latin word *pons*, from which *Pontifex* (the Pope), derived from the Greek *πόντος*, the sea considered as a "path" connecting Mediterranean populations. However, the Greek culture made little use of the properly said bridge, in the author's opinion, perhaps, also because Greek culture was not very sensitive to the "territorial unification". Yet using the more natural and less "sacrilegious" *γέφυρα*, that is, the embankment that connects two basins, the Greek culture exploited its function as a connector between two lands, for the benefit of a spatial extension which, well beyond its metric dimension, such as Heidegger said, defines a "place". The archetype of the bridge, considered in its physical consistency and as a theoretical device, therefore also concerns the relationships between the artificial and the natural component of architecture. This latter is also measurable, with the three archetypes related to it.

The "forest" (pp. 200-203)
The forest refers to the "original state" of the Earth (*Erde*), in the Heideggerian language, as opposed to the state of the Earth as an inhabited world (*Welt*), to the *φύσις* of the "natural absolutes", such as glaciers, deserts, abysses, mountain ranges, oceans, and so on. It is associated with the idea of the *silva*, or the wild nature, which, like the labyrinth, cannot be grasped in its entirety, except through the abstraction of cartographic reproductions or, at the antipodes, through the direct experience from "inside". The forest, therefore, identifies the "anti-home" par excellence, which can be transformed into a place of living through a process of "domestication" that leads to the creation of the "garden", or through the "localization" of a "clearing", thus entering the field of action of the other two natural archetypes.

The "garden" (pp. 203-205)
Complementary to the forest, referable to pure nature, the archetype of the garden appears as an organized artificial system, even if composed of natural elements, whether it consists of a *κόσμος* prepared "by man", or whether it is considered in the original form of the *Eden* predisposed "for man". Therefore, even without "separating itself from nature", it tends to "identify itself with the dwelling". In this sense, compared to the forest as the anti-house, it rather represents "the totality of the house", the "totality of the dwelling", summarizing its fundamental characteristics in this. In this sense, the garden defines a model that can be extended to the "whole earth", placing itself as a "medium between micro and macro cosmos", also establishing the principle according to which nature can be "ordered, sampled, classified", included in the cultural dimension.

The "clearing" (pp. 205-209)
The archetype of the clearing strongly refers to the concept of place. Whether spontaneously formed, or artificially created, the clearing establishes a "condition for the settlement ", like the foundation of a building or the groove traced in the ground for cultivation. It is the domain of agriculture, unlike the forest, the domain of gathering and hunting, in which it opens up like a *patio*, as in the Borgesian definition, letting the light penetrate it, a characteristic also attested by the words *clairière* (French), clearing (English), *Lichtung* (German). Therefore, the clearing opens up a "void" which, according to Heidegger, defines a "space" (*Raum*), taking on "locality" (*Ortshaft*) in connection with "dwelling" (*Wohnen*). That's why it offers a fundamental "condition of existence" to the settlement, to the *ager* (rural), and the *civitas* (urban). Many examples attributable to the archetype of the clearing, taken both from nature and from built architecture, are referred to in this regard, from the cave, the oasis, the island, and the lake, to the court of the houses, palaces, and castles, as well as the square and the city bounded by its walls, up to the farms and the cultivated fields. All these manifestations share the fact that each of them is "circumscribed and not generically extended", almost sacredly defined as a *τέμενος*, that is, as a "cut-out" identified by a border, by a frontier, which separates it and at the same time connects it with the surrounding parts.

In the last paragraph, titled *Un "campo archeologico"* (an archaeological field), dialectical juxtapositions are also proposed between architectural and

natural archetypes, assuming them in the correspondence labyrinth-hut/forest-garden, as well as in the more problematic relationship bridge/clearing, where, as it is described and argued, the "two classic dimensions of the Apollonian and the Dionysian", the solar and the chthonic, intersect and confront each other in a more direct way (p. 211). Regarding the archetype of the bridge, apparently the least architectural and the most difficult to classify, yet so crucial in the passage from the concept of space to the concept of place according to Heidegger's thought, it is hardly necessary to note that just the bridge appears on the cover of the book, namely the diaphanous crystal bridges of the *Wildbachtal* by Bruno Taut's *Alpine Architektur* –a work that is also significant for other reasons in the present international situation–, as the only exception in a text devoid of images and exclusively concentrated on the discursive quintessence of architecture.

All this makes sense with the human dimension. Returning to the aforementioned definition of architecture, we note that the two quoted terms "form" and "dwell", which "tend to intersect and being unified in the realm of the realized work" (p. 32), possess profound proximity of meaning also at the linguistic level, given that "form" goes back to the classic Greek word *σχῆμα* (from *ἔχω*) and "abitare" goes back to the Latin *habitus* (from *habeo*), that is, both derive from the verb "to have" (in Italian avere), here understood as the indicator of a way of being rather than of mere possession, "like the 'property' that is spoken of about certain materials", in short, "the English *propriety*, rather than *property*" (p. 33). It is the conclusion of a reasoning path, which from the beginning relies on the Heideggerian categories *Bauen* (to build), *Wohnen* (to dwell), and *Denken* (to think), taken as a system of critical notions, without omitting the persistent latent correspondences with the classic Vitruvian categories and their more ancient Greek ancestors, and whose further dialectic syntheses *Bauen*/*Wohnen*, referable to technique (*τέχνη*), and *Wohnen*/*Denken*, referable to life itself (*βίος*), definitely highlight the fundamental value of the "dwelling", and in particular, of the "culture of dwelling" (p. 107).

A demanding and intriguing work, aimed at establishing a theoretical statute, between *κόσμος* e *χάος*, for the benefit of architecture, an "art devoid of Muse" (p. 191), and therefore devoid of any reassuring truthful mythology, of any pre-established Olympic *ἀλήθεια*, however, for this reason so profoundly human, permanently in search of its proper foundation, of its *ἀρχή*, which resounds even in its nominal root. I will not go into the question of "truth" or verity, the pitfalls are well signaled, not only by the author himself but also by Roberto Masiero in the *Postfazione* (afterword) to the volume. Everyone can do it by reading, freely and secularly as the author would have liked, this singular and in many ways exceptional book. An invitation especially addressed to the young generations, with the reasonable certainty that they will find it unforgettable.

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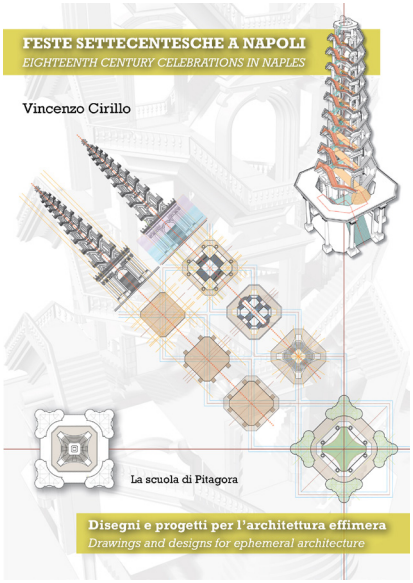
Reviews

Reviews

Vincenzo Cirillo

Feste settecentesche a Napoli. Disegni e progetti per l'architettura effimera

La scuola di Pitagora Editrice
Napoli 2021
324 pp.
ISBN 978-88-6542-836-8



The use of ephemeral architecture for celebrations and religious events, the first examples of which appear in the 15th century in and around Rome, reached its peak during the Baroque period, spreading to different areas of the Italian peninsula. Artists, set designers and architects invited to create triumphal arches, portals, carousels, and scenography had the opportunity to experiment and study design solutions that they would apply in their artistic and architectural works.
The book by Vincenzo Cirillo, which focuses on the ephemeral Neapolitan architecture of the 18th century, is excels in the exploration and deepening the Neapolitan experience by suggesting new approaches to the historical and cultural study of the city of Naples.
The volume presents the results of research conducted by the author starting from 2017 at the University of Campania 'Luigi Vanvitelli'. It is divided into chapters and contains an appendix that collects the sources used for the analysis as well as the elaboration of virtual models, transcriptions of printed texts from the era and the reproduction of numerous graphic plates related to them. The latter allows for the appreciation of the compositional and graphic expertise that scenographers and architects dedicated towards the design of ephemeral structures.
In the first chapter, the author introduces the topic of his research. In the subsequent chapters, he develops an in-depth analysis of the ephemeral structures designed and built to honor the reigning Bourbon family on four festive events celebrated between 1738 and 1791. Thanks to the careful study of the sources, the author proposes some digital models developed through accurate analysis of the geometric and compositional architectural forms.
The first ephemeral apparatus introduced by Cirillo is the one set up during the celebrations for the marriage of Charles of Bourbon to Maria Amelia of Saxony (1738). The work, created by the architect scenographer Ferdinando Sanfelice, and defined as an *invenzione capricciosa* by his contemporaries, takes the form of an urban theatre, a large *Fiera* bordered by an enclosure within which one finds pavilions, kiosks, fountains, and obelisks. As pointed out by the author, the work aimed to arouse feelings of 'astonishment and wonder' in visitors. Ferdinando Sanfelice meticulously took care of every detail and, in particular, the artificial lighting: using crystal chandeliers and mirrors, which allowed the light generated by the torches to create surprising lighting effects. In the virtual reconstructions, the author tries to evoke the emotions felt by the visitors of the time. Cirillo does not limit himself to only proposing renderings of perspective views but also offers a point of view of this ephemeral architecture in the urban context of the city of Naples. Starting from identifying the area occupied by the Fair

in historical cartography, he proposes its probable location. The reconstructed model is inserted into two iconic representations of the Neapolitan city: the pseudo-axonometry of the city seen from the sea in the engraving by Alessandro Baratta (1627) and the perspective view of the Castle area in the painting by Antonio Joli (1757). These representations allow the reader to understand the relationship that these works, although temporary, established with the urban fabric, resuming its axiality and volumetric relationships.
The second ephemeral apparatus described in the volume, also the work of Sanfelice, is the one created for the birth of the eldest daughter of Charles III of Bourbon (1740). It is a large *Torre*, about 53 meters high, surrounded by four fountains and placed in the center of a large hemicycle connected with the facade of the Royal palace. The tower was characterized by its pyramidal shape and was divided into ten levels that offered spectacular observation points over the city. In this chapter, the author investigates the geometric matrices of the project based on the description of the *Relazione sulla festa* and two drawings, a perspective view and an elevation, preserved in the Library of *Storia Patria* and the Cabinet of Drawings and Prints of the Museum of San Martino in Naples. Thanks to the data reported on the *Tavola del prospetto della gran Torre Piramidale*, a digital model is produced, and from this, a fascinating perspective view from above which, through the dematerialization of the external envelope, allows to highlight the complex system of vertical and horizontal connections of the tower. As in the previous chapter, the author proposes some renderings of perspective views; in this case, the choice of points of view appears less satisfactory. It results in an overly aberrated vision of the Tower in relation to the context. In addition, for this ephemeral apparatus, the author carries out the appreciable operation of insertion in historical representations of the city, in particular in a painting by Gaspar Van Wittel from the early 1700s.
After a brief *excursus* dedicated to the numerous ephemeral apparatuses created for the birth of the first son of Charles III of Bourbon (1747), the following chapter is dedicated to the spectacular *Macchina da fuoco d'artifizio* set up near Largo Castello. The author proposes a redesign in double orthogonal projection of plate XV of the *Narrazione delle solenni Reali Feste*, used as a reference for the construction of a digital model and the creation of two graphic elaborations. In the first, the *Macchina da fuoco* is reproduced inside the painting mentioned above by Antonio Joli, while in the second the model is placed in a digital reconstruction of 18th century Naples, during of celebrations and under colorful fireworks.
In the last section of the book, the author reviews the structures made in Naples, along the Toledo road, for the return to Naples from Vienna of the sovereigns Ferdinand IV and Maria Carolina of Austria (1791): from the city gate to the Largo di Palazzo, up to the Royal Palace, in front of which the *Tempio della Fortuna Reduce* was set up. Here, the reconstructions of Cirillo show a different graphic language, interrupting a continuity that had characterized the previous chapters. In this case, the reconstructions take on a new value since they are used for an experimental application, essential but appreciable, of visualization in augmented reality. Cirillo identifies the potential of this technology as a tool for the knowledge and dissemination of the ephemeral apparatuses of Naples, which over the centuries, even if for very short periods, have been an integral part of the urban context of the city.
The volume concludes with a study of the new forms of representation linked to intermittent events, such as video mapping installations and drone light shows. These offer to the author the opportunity to underline the similarities with the ephemeral apparatuses of the 18th century described in the volume and draw the attention of readers to their importance and to the contribution that such experiences, in a new and comprehensive perspective such as the one presented in the volume, can offer as a source of inspiration for digital visualization applications.

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Reviews

Domenico Pastore

Dalla superficie al volume. Una lettura grafica dei Solidi di Cesare Leonardi

Libria
Melfi 2021
292 pp.
ISBN 88-6764-256-1

The study settled by Domenico Pastore in his book *Dalla superficie al volume. Una lettura grafica dei Solidi di Cesare Leonardi*, was conducted with the aim of promoting the knowledge of one of the key figures of Italian design: Cesare Leonardi. At the beginning of the 1980s, Leonardi focused on recycling and recovery operations of multilayer wood panels, used for the formwork of reinforced concrete structures, as a material for the construction of a variety of objects for domestic use. Leonardi anticipates –as Pastore observes in the introduction– some current themes of contemporary research based on the reuse of materials and on an artisan/authorial approach to reflection on the design project, also in terms of feasibility. In line with these issues, Leonardi's ability is therefore highlighted in terms of a unique artistic research on the elaboration of the object-form using drawing as reported in the extensive and exhaustive design documentation. The outline of the book –organized in paragraphs and graphic elaborations– has an organization that comprises two parts: the first represents on the one hand a cross-section of Leonardi's biographical events and summarizes his main research in the field of design. These were mainly centered on the expressive and structural possibilities of wood. In the second part, the investigation of his projects is analyzed, using not only the available bibliographic and iconographic material, but also elaborations and revisions.

The outcome of this research and reworking activity can take the form of a very in-depth academic/disciplinary investigation into the configurative genesis and creation of design objects on the Italian scene. This research is therefore a starting point for further and even more detailed elaborations that may, one day, guide the possible –and favored by many– reading of design from a generative point of view.

This study also makes use of a detailed and precise graphic analysis of the solids elaborated by Cesare Leonardi from 1983 to 1993. These complex objects were then modeled both digitally and through the creation of prototypes made with the use of laser cutting machines, during the teaching activities of the Design lessons, inside the three-year degree course in Industrial Design of the Polytechnic of Bari. These activities, carried out in the academic year 2019-2020, involved two architect tutors: Francesca Sisci and Luca Bifone. Furthermore, these elaborations were then the subject of an exhibition, entitled *METAMORPHOSIS –from surface to solid– redrawing Cesare Leonardi's solids*. This exhibition, held in February 2020 in the Brunelleschi and Philibert Delorme Gallery of the ICAR Department of the aforementioned Polytechnic, aims the knowledge, outside the disciplinary boundaries, of a fundamental and influential personality of the twentieth century design. On the other hand, from the study presented by Pastore, the

personality of a designer with creative abilities emerges that the careful analysis of his works confirms as an emblematic exponent of the Italian and international scene. The work, therefore, is part of the study of the geometric-structural genesis of design objects also in transformative terms, understanding the Leonardi's ability to handle surfaces as dynamic configurations ready to be generated. In particular, from the adopted documentation and from the re-elaborations proposed by the author, it is possible to reach a complete understanding –albeit complicated due to the articulated and complex shapes that are found among the drawings– of the structural nature of the objects, also making the understanding of the objects completely adequate, with construction details (cuts, joints, assemblies). The book clearly highlights the process of implementing complex geometries that go beyond an elementary conception of design. In this sense, the study of surfaces plays a decisive role not only in the field of graphic representation[1]: "*non essendo realizzabile alcuna proiezione –mongiana, prospettica o assonometrica– di una qualsiasi forma dello spazio, senza che se ne conoscano la genesi geometrica e le proprietà configurative*" [Sgrosso 1996, p. 63]. In fact, the close link between the knowledge of surfaces, in their geometric essentiality, and the understanding, communication, representation of design objects, leads us to observe how this knowledge is also capable to stimulate the invention of innovative and original shapes, acting as a creative support for the entire design process. Therefore, from the study proposed by Pastore, new aspects of those same surfaces can be seen, whose only metric properties have long been considered, according to a reductive and simplistic evaluation. Surfaces thus assume a configurative role not only for architecture –existing or *in fieri*– but also for the design, connoting itself, at the same time, as the geometric structure of the shapes– entitled "solids" by Leonardi.

For these reasons, the research conducted by Domenico Pastore is structured as a rational taxonomy. Far from being a formal scientific systematization of design and sharing of the idea of design that is determined by multiple factors, not only by evidence visualization of surfaces, this taxonomy allows us to reflect on the following feature: the importance of the assimilation, by the designer who approaches it, of those concepts that make the shapes of the design itself not only recognizable, but also imaginable and projectable. Moreover, as anticipated, this investigation does not want to be limited to the simple identification and representation of these shapes everywhere present and essential to our civil life, but rather investigates their intimate geometric nature and the impact on implementation aspects. In fact, from the proposed extensive graphic apparatus, the importance of the study of the metric aspect is also evident. The metric aspect, in fact, establishes the material limits of the realization and therefore allows and controls the sizing of the configurations and their structural definition, without however exhausting their values or meanings, which can be deduced from the study of surfaces and mutual intersections.

Andrea Giordano

Notes

[1] «Nella rappresentazione, tramite la comune riduzione al contesto grafico e ai suoi codici logicamente e storicamente istituiti, può dispiegarsi ed esprimersi per intero il rapporto tra le dimensioni umane e quelle fisiche della materia, che nel progetto assume forma e commensurabilità con la mediazione dell'elaborazione geometrica e numerica» [Ugo 1994, p. 188].

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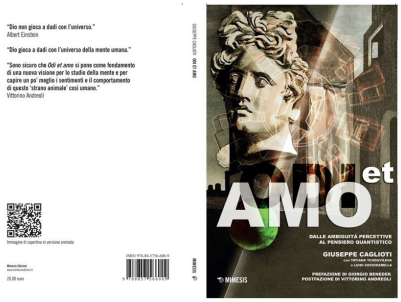
Reviews

Giuseppe Caglioti
con Tatiana Tchouvileva
e Luigi Cocchiarella

ODI et AMO
Dalle ambiguità percettive al pensiero quantistico.
Mimesis
Milano 2020
244 pp.
ISBN 9788857566009



It is not so unusual to leaf through a book before reading it, without even being sure to do it later. The accomplished act that summarizes this operation, traditionally considered an instinctive and common belief to many, is often depicted in the iconic paintings concerning the Annunciation of the Madonna. The Annunciation to the Virgin Mary is, in fact, one of the most represented themes in the history of art, and the three characters (Angel, Virgin, and the dove) involved in their meanings and signifiers, always interact within an architectural scene, in which the only accessory present is (almost always) a book. The pose of Our Lady towards this object is, in most cases, that of a pause or a rest, and here the doubt arises: if surprised by the event, she is interrupting the reading, or she is simply leafing through that book.
A different attitude one normally has, instead, when intentionally, by necessity, or upon request, as in this case, the book must be read, and reflections, and perhaps written notes, are indispensable for the review.
I am normally interested, by elective affinity due to my main profession (the draftsman and designer), to almost immediately look at the figures in a book, whether they are graphic or photographic representations. This is a common habit for many people, and even more for the draftsman, I believe. But at this point, I allow myself to appoint the author of this essay as a 'draftsman' as well, having since the beginning noted the quality of the choice in the plenty of images with which Professor Giuseppe Caglioti was able to graphically give an exhaustive comment, even on the most technical aspects, thus offering not only words by writing but also images by drawing to explain the quantum thought. The main image of every book from which one must be immediately captured is of course the cover image. It is not just and only for commercial purposes, rather, it is a sort of visual attractor towards which the reader must be induced. Referring to the Homeric memory, a sort of siren song. Sometimes my predisposition not to use diminutives, as in this case, would lead to bring the word back to its root: therefore, the word 'cover' should be replaced by the word 'deck', that is, the deck covering the boat! Regarded as the part of the boat constituting its closing element, or rather the cover, thus transforming the book by a metaphor, into a ship capable of taking us to sail endless seas. The seas of science, sometimes threatening and stormy, or, the reassuring and more serene ones, like the seas of fantasy. In the case of the essay *ODI et AMO*, the image of the cover, or, if you prefer, the 'deck' with the fading effect of the title on the figures, is like a sort of eco-graphic, which almost immediately sends you to the back of the cover (of the deck). If the animation upon QRCode, with its technological strength, manages to dynamically involve the curiosity to read

the book, however warning about the scientific attention that the text requires, when turning to the second page, everything returns to reassure the state of soul, encouraging the reading of the main title *ODI et AMO*, which stands out on the graphic space of the page, as if it was an acronym, a sort of logo with latent symmetry, fixed at the endpoints by the letter 'O' that opens and closes the main title.
The perception of the classic literary quote from Catullus is attractive in its Gestalt ensemble and suddenly appears in the *horror vacui* of the blank page, as a symbol; transforming itself from writing into a symbol. Its metamorphic 'appearance' has the evocative effectiveness of the *Delorean Motor Company (DMC)* logo-writing, where the acronym gains strength from the perfect symmetry of its three letters, wherein the initial letter D, the vertical auction has been deliberately eliminated to present it as palindrome to the final letter C, to the perception of our eyes. The elegant, synthetic, and above all, symmetrical brand that baptized one of the most iconic supercars of the 70s of the twentieth century, the *Delorean*, transformed into a 'time machine' for the movie *Back to the Future*, is an example of one of the most sustainable symmetries between brand and writing. In the main title of the volume *ODI et AMO*, we can find this concept, namely that of a writing-logo, almost an antiphon, and an opening introducing its subtitle *Dalle ambiguità percettive al pensiero quantistico*, meaning perceptual ambiguities and quantum thought.
The paratext is structured in eight chapters, with captivating and incisive titles and subtitles, of which the first enters, as in a guttural commentary the stoic sports journalist Nicolò Carosio would define: "a straight leg". The *Ubiquità dell'Ambiguità*, meaning the ubiquity of ambiguity, that is, the title of the first chapter, becomes the oxymoron with which not only "thinking as with a quantum mind", but also seeing drawings and images surrounding the text… quantistically. If being able to see is a prerequisite for being able to draw, it can be safely asserted that this essay on Physics has the right parameters to be also welcomed in the disciplinary field of Drawing. The scientific writings of the Professor of Physics are represented by the graphic skills of Luigi Cocchiarella, who, with the itinerant drawings appearing either in the pages of the text, or in the suggestive graphic plates collected at the end, was able to give a structured iconicity to the complex concepts of quantum physics science.
The aesthetic sensitivity of Tatiana Tchouvileva manages to emerge among the interdisciplinary skills and becomes a cohesive contribution, between the purely scientific aspect described in words, and the equally scientific, but analogically more traceable one, shown by drawings and images. The whole and the union of the whole *corpus* reveal and encourage the reading, precisely because of the shrewd transversality of the concepts. Not surprisingly, and it is often rare, complicated principles are dissected by calling humor/irony into question, and here it will be good to remind what Achille Castiglioni himself wrote, in a sort of decalogue (*L'Espresso* No. 147, 5 April 1992), as a suggestion for scientific creativity: "begin to train yourself on irony and self-criticism".
If Betty Edwards had accustomed us to "seeing with the right side of the brain", the text with the graphic appendix including the plates allows us to RE-see with both the cerebral hemispheres. *Edgar Rubin's Vase* and the multiple perceptual options for the *Necker's cube* in the simultaneous digital interpretations, find the apex of a perceptual synthesis in the extraordinary and even disturbing three-dimensional views of the ammonia molecule. In the text, the author shrewdly "caresses" the *Schrödinger's Cat* and argues, as well as describes the bas-relief of the parade of pink flamingos on the *mastaba of Saqqara*, elevating the zoomorphic metaphors to the status of simplified versions of complex quantum concepts. Furthermore, the concepts of symmetry and how it can find its compositional and perceptive rigor in chaos and vice versa, seem to find a sharing point in Ludovico Quaroni's compositional concept of "balanced asymmetry". Quantum thinking… symmetrically to perceptive ambiguities, allows our eye to work, and in its saccadic movements, as for the photographer Berengo Gardin, the eye becomes a profession.
Not disavowing that of a book I curiously see the images first, in this first survey, I add that I immediately read the last word as well. Therefore, if God does not play dice with the universe, I believe that it cannot be considered a coincidence that professor Caglioti concluded the essay with the word *cuore* (heart).

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Reviews

Felice Romano

Nouvelle Méthode di Jean-Jacques Lequeu. Ridisegno, analisi grafica e rilettura critica

FrancoAngeli
Milano 2021
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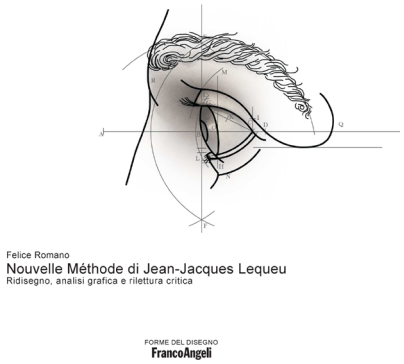

When I received for the first time the assignment of teaching Architectural Representation Techniques in 1996, I made a small handout with my course notes: for the cover I chose precisely Table 4 of Jean-Jacques Lequeu's *Architecture Civile*.
"*On voit sur ce dessin des instrumens à l'usage de celui qui dessine ou trait, qui ombre; enfin qui fini et termine une représentation géométrale où perspective sur du papier, avec le soin et la propreté du bon dessinateur*" ("we see on this drawing tools for the use of those who draw or reproduce, those who shade; finally, those who refine and finish a geometric or perspective presentation on paper, with the care and neatness of a good draughtsman").
So I agreed to review Felice Romano's book with extreme interest, which brought me back, with nostalgic joy, to the time when, more than five lustra ago, I used to show my intrigued students the singular, sometimes bizarre, pictures from Jean-Jacques Lequeu's Treaty.
"Lequeu's drawings, whatever the object of representation, are endowed with such a fascination as to intrigue and enthrall the observer, holding him captive in a whirlpool of cross-references and dense accumulations of meaning, ready to vanish and mutate into something else", as Edoardo Dotto writes in the preface of the volume on page 9.
Lequeu, a singular figure, undoubtedly an artist, as the possessor of what the Greeks called the 'technĕ', mastery, the decidedly all-hand art of knowing how to make an artifact.
"*Très habile dessinateur*", very skilled draughtsman, "*dessinateur infatigable*", indefatigable draughtsman, these are the defining adjectives for Lequeu we often find in the past literature that has dealt with him. Most of his drawings done in pencil, pen, Lavis-colored ink and watercolor show us unequivocally his high and unquestioned graphic skills. Through the relevant illustrative set of his book, Felice Romano presents and reveals Lequeu to us as a draftsman obsessed with perfection, a solitary, isolated artist, basically misunderstood by his contemporaries, who would build little and nothing, even never selling any of his extraordinary drawings.
Jean-Jacques Lequeu, in the biographical notes that Romano presents to us, appears as one of the many architects disappointed by the society that surrounded him (a concept that is always very relevant), by the outcomes of the Revolution, the actions of Bonaparte and the Restoration, who takes refuge either out of necessity or vocation in fantastic and dreamlike drawing, in profound observation of human beings, or who ventures into reasoning expressing utopia, skepticism, irony, scientific interest and technical experimentalism. "Lequeu's architectures exist only in the seemingly limited region of the paper sheet […] they have been classified as revolutionary, dreamlike or visionary […] a game of mirrors" [Romano 2021, p. 58].

In his book Felice Romano shows us, with explicit examples, how Lequeu, whose brilliant talent mostly eluded his contemporaries, became a forerunner and, at times, inspirer of artistic currents and authors that would follow, even long after his death.
References to Ruennese's drawings can be found, latent or manifest, in the anguish of the Symbolists, in the dreamlike atmospheres of the Surrealists, such as Salvador Dalí, in René Magritte's men in bowler hats, or in Giorgio de Chirico's silent architecture, Marcel Duchamp's actions, Eduardo Paolozzi's sculptures or Igor Mitoraj's chalky fragments.
Felice Romano leads us in exploring the corpus of Lequeu's drawings he collected under the title of *Architecture Civile*. A work that can be considered as his diary and, probably, his spiritual testament, between whose pages, hidden among the strokes of pen and charcoal, his tormented personality emerges: amid utopian buildings, vegetation as lush grotesque figures as disturbing that seems likely to submerge the constructions, a microcosm not only technical, but also philosophical develops.
Although inspired by Étienne-Louis Boullée and Claude-Nicolas Ledoux, Lequeu went further. Indeed, one can think of *Architecture Civile* although inspired by Étienne-Louis Boullée and Claude-Nicolas Ledoux, Lequeu went further: in fact, one can think of it as a collection of thoughts translated into images aimed at creating, through architecture, the ideal environment where the drives and terrors of humanity can be expressed in a controlled manner, through reasoning. Ideally, indeed utopically, Lequeu pursues the reconciliation of De Sade, Voltaire and the Directory, that is, a new society where republican orthodoxy gives way to individual freedom.
In unfolding his thought, Lequeu obviously does not neglect the human figure, which is after all his real subject of analysis, and in this light architecture becomes an ancillary discipline, useful to the extent that it succeeds in creating environments that best accommodate the needs and aspirations of the individual. He studies the emerging science of physiognomy with amused interest, but not without a certain biting satire and without denying pornography either; numerous are his self-portraits somewhere between the real and the caricature.
Romano also attempts to summarize, as much as possible and in a general way, the polymorphism of the issues contained in the *Nouvelle Méthode*, with the intention of being able to skim the different facets. The emphasis on aspects related to the origins of drawing, anthropometric questions, as well as the approach to the debate on physiognomy, brings new useful elements of framing Lequeu's character within his own era.
Felice Romano, tracing the directions traced by the Ruennese, arrives at delineating the geometric construction of a face, in a series of ideal, golden ratios, obtaining at the end of the process an accomplished physiognomy, which, however, no longer has anything human about it. The geometrically perfect result, however, is depersonalized, a face that brings to mind the humanized features of Rotwang's robot: the android Maria of Metropolis.
Lequeu's drawings even to this day mesmerize, fascinate, provoke, unsettle, a veritable trap for the eyes; the numerous enigmas that crowd his plates, for the most part still unsolved, will still constitute mere 'entertainment' for several generations of drawing scholars.

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Events

Events

REAACH-ID 2021 Symposium Research and Reflections on the Use of Digital Technologies for Representation

Michela Ceracchi

The symposium REAACH-ID (*Representation for Enhancement and management through Augmented reality and Artificial intelligence: Cultural Heritage and Innovative Design*), was held in webinar mode also in its second edition. The virtual events, imposed by the pandemic, have now amply demonstrated the possibility of creating a place for dialogue that overcomes spatial distances.
The relationship between representation, digital technologies, cultural heritage, and innovative design was the focus on which the debate is centered characterizes the encounters organized by Andrea Giordano of the University of Padua, Michele Russo of Sapienza University of Rome, and Roberta Spallone of the Polytechnic University of Turin. These meetings are conceived as the fertile ground for reflections not only on the results achieved or the technical aspects of the research carried out but also on the most profound significance. It was precisely on the relationship between representation and technology that was the focus of the intervention by the president of the UID (*Unione Italiana per il Disegno*), Francesca Fatta, who, beginning with Anaxagoras' and Aristotle's philosophical definition of "man", emphasizes how both the Drawing and technology are creations of human intellect and, at the same time, instruments at the service of this selfsame intellect. She further underscored how their use applied to cultural heritage may contribute in innovative manners to the understanding, appreciation, and sustainable enhancement of this heritage. With this scope, the studies exhibited show how on the one hand Artificial Intelligence (AI) allows the use of an enormous quantity of raw data, customarily gathered but unused, to speed up and expand the possibility of obtaining information, and, on the other hand, how Virtual Reality (VR) and Augmented Reality (AR) allow the discipline of Drawing to exponentially enhance the ability to represent and communicate reality and the imaginary, permitting new and more articulated means of promoting the use of cultural heritage and an innovative approach to design.
Pilar Chías Navarro, coordinator of the research team *Patrimonio arquitectónico y arquitectura sostenible* of the Department of Architecture of the University of Alcalá, Spain, has highlighted how AR, AI, HBIM, and Information and Communication Technology (ITC) are useful and necessary instruments to reach a greater objective: universal access to culture. Tackling these issues within the context of European programs of research and innovation must, therefore, become a cornerstone of the activities of researchers concerned with culture and cultural heritage.
Reflection on the use of digital technologies, posed by the first keynote speaker, Roberto D'Autilia, professor at the Department of Mathematics and Physics of the Roma Tre University, opened up the symposium. In his communication, he underlined how some problems may only be solved by natural intelligence but even how Artificial Intelligence, by handling the so-called big data, can offer fundamental assistance in the interdisciplinary studies concerning cultural heritage.
Artificial Intelligence and the opportunities offered by the digital world to create a parallel reality, either virtual or augmented, amplify the practical potentials of the disciplines of Drawing, allow for a methodological and operational update, and open the disciplinary boundaries by implementing a real transdisciplinarity in different fields. From such a premise, the contributions participating in the symposium and selected by the Scientific Committee can be considered expressions of a unified discourse in which the syntagms themselves are differently combined according to the specific application. And it is precisely from the

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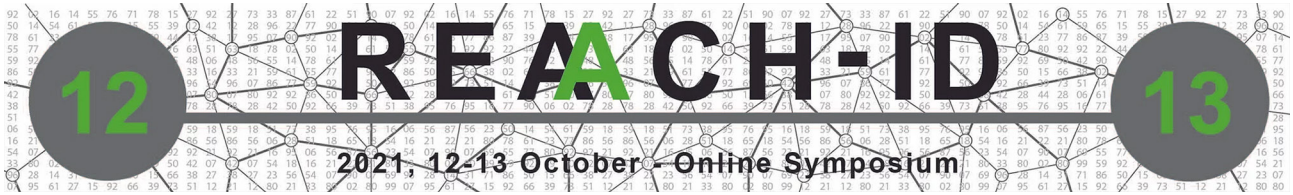

Fig. 1. Logo of the second edition of the symposium.

juxtaposition of these fragments that some key concepts emerge: transdisciplinarity, experimentation, methodological updating, usefulness, accessibility, inclusivity, interoperability, collaborative workflow, social effects, perceptual aspects, and emotional involvement. The talks by the keynote speakers mark the thematic chapters of this discourse, within which the presented researches may be grouped.

The ICT *Heracles* platform for the maintenance, conservation, and restoration of cultural heritage proposed by Giuseppina Padeletti and Patrizia Grifoni –CNR researchers at the ISMN (*Istituto per lo Studio dei Materiali Nanostrutturati*) and the IRPPS (*Istituto di Ricerche sulla Popolazione e le Politiche Sociali*) respectively– aims at providing a concrete solution to the growing need of new instruments for the management and enhancement of the cultural heritage, increasing its resilience.

The digital world permits the creation of informational models to gather the overwhelming amount of data produced in the multi-disciplinary studies aimed at knowledge, maintenance, conservation, and restoration of cultural assets. Precisely in the context of the HBIM, the talks have shown how AR can become a concrete instrument for the analysis and management of the cultural heritage, allowing to update information *in situ* regarding physical consistency of the assets, adding information obtained from the real world to the digital model and favoring interoperability by the continuous and direct exchange of information among involved individuals.

The potential of digital has been experimented in many other applied fields, spanning from the digital reconstruction of objects or sites that have never been realized or no longer exist, exploitation of non-accessible assets, digital implementation of ancient treatises to recover and comprehend them, experiences in expanding the knowledge of museum pieces, projects for virtual museums to make inaccessible collections available or bring lost collections back to life.

The presented researches aim at building a formative experience that is not a mere simulation of reality, paying specific attention to the construction of the project of interactive fruition requiring the collaboration of different skills.

A food for thought emerged from the interventions concerns precisely the involvement obtainable from the different modes of fruition. Virtual experience, in fact, cannot replicate the emotional response that arises from a real experience but permits interaction with the digital twin of the object, an interaction generally precluded with the actual object. Those solutions proposing virtual usage alongside the fruition of reality without aiming at replacing it offer the opportunity of enrichment. Conversely, when experiencing the real is not possible, the effort of the researchers is concentrated on making the virtual experience as realistic as possible, implementing interaction with the virtual model and optimizing the perception of virtual space.

In some of the proposals presented, the use of technology is motivated by the aim of rendering culture usable, accessible, and inclusive: the digital fabrication and some specific applications of AR and VR allow people with physical and cognitive disabilities to undergo experiences, by giving substance to the concept of the "design for all" in the view towards a society based on equality.

By extending the areas of application, Camilla Pezzica –Lecturer in Digital Methods in Architecture and Urbanism at the Welsh School of Architecture, Cardiff University– has introduced the topic of the interdisciplinary connection between representation, planning practice, AI and the opportunity afforded by the technological advancement in the management and enhancement of the urban and the territorial environment. Several contributions have emphasized how the capability to represent extends to the capability to analyze, understand, manage, and valorize the object being represented.

The representation of a territory or an urban structure is a multidisciplinary and multidimensional endeavor. It is in the management of relations among the different pieces of information that AI can intervene, which, according to computer vision, can be trained to reproduce processes and functions of the human visual apparatus, simulating the ability to read the typical signs of the discipline of Drawing, thus becoming an essential instrument to analyze, monitor, and manage the city and the territory via the interpretation of the signs that constitute them.
The possibility of creating virtual experiences that are, at the same time, tied to the physical consistency of urban instances, by geolocalization or tracing of a physical target, allows the creation of instruments for participatory planning and management of the urban space, just as projects to valorize the city and the territory through immersive narratives into the past and thematic museum itineraries via AR and VR experiences.
It is interesting to note how many of the experiences presented at the symposium were born in a teaching environment, demonstrating the prolific exchange that should always be present between research and teaching. The demands imposed by the pandemic highlighted the need to update the educational and training practices just as the modes of fruition of the cultural heritage. There is, furthermore, another interesting consequence of the research inherent to these topics: the possibility to involve younger students in the emerging research, thanks to their familiarity with the digital vocabulary of their generation.
The talks by Francesca Matrone –research fellow at Department of Environment, Land and Infrastructure Engineering of the Polytechnic University of Turin– and by Violette Abergel –researcher at the research unit *Modèles et simulations pour l'Architecture et le Patrimoine*, of the *Centre national de la recherche scientifique* (CNRS) and French Ministry of Culture– demonstrated the necessity and possibility of implementing a methodological update of the discipline.
Since the birth of digital technology, the field of representation has questioned itself, acquiring new instruments and integrating the digital model among the models it utilizes. Planning, design, conservation, and all the disciplines related to the disciplinary scientific sector of Drawing have been overturned by the possibility of creating a digital twin of reality that may be analyzed and simulated in ways otherwise impossible with analogic technologies. The continuous development in the field of digital technologies brings this potential to considerable levels.
Today AI permits the automatization of processes related to the representation, from the semantic segmentation of the numerical models derived from the 3D survey to the dynamic recognition of certain objects thanks to the training on the dataset created via photogrammetric models.
Also, the possibility of creating augmented and virtual models of reality has significant repercussions in many fields related to the discipline. Exhibited were experiments in representation techniques on a holographic table, virtual simulators to teach topographic surveys, interactive experiences in which AR becomes a true teaching tool, ending with studies on the interaction between the physical, inform-

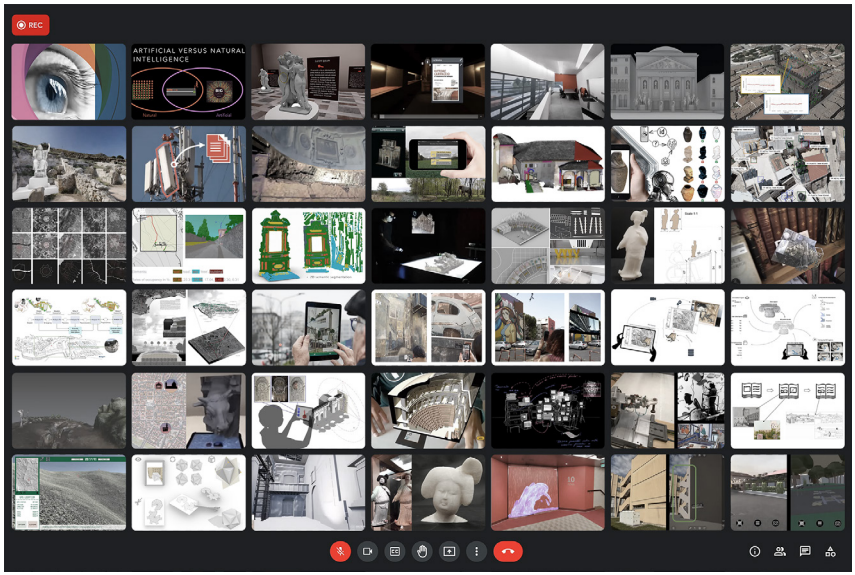

Fig. 2. Virtual mosaic of the studies proposed in the symposium (author's elaboration).

ative, and digital models, in which the aim is to turn the physical representation into a narrating artifact to which AR contents can be connected in a continuous interchange between reality and the virtual.
The artistic installation *Divina!*, presented by the Laboratory *Astro* of the Department of Civil and Industrial Engineering of the University of Pisa in collaboration with *Foll.ia Lab* and *AcaS3D* utilizes AI to enable communication between technologies belonging to different eras. The results obtained demonstrate the rapid obsolescence of technological language that must be faced within these kinds of studies.
The outcome of these researches has therefore revealed the role of digital technologies in the renewal of the discipline, but they also highlighted how appropriate it is to constantly question on the ethical implications arising from the use of these new instruments.
The symposium has assumed the form of a self-sustained dialogue on ever-new reflections and questions, itself becoming a shared process of research. The contributions are elements of a far larger mosaic, influencing each other and aggregating continuously, varying the whole structure. A mosaic in the making, therefore, which will unfold in the next edition of the symposium, already planned for 2022, assuredly enriched by the results of the researches still being carried out and those that will take shape from the reflections born from the 2021 meeting.

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Events

III Research Evaluation Seminar in SSD ICAR/17-Disegno. Disciplinary Strategies and Policies

Edoardo Dotto

On 12 May in the Aula Magna of the Faculty of Architecture in Valle Giulia, the *III Research Evaluation Seminar in SSD ICAR/17-Disegno. Disciplinary strategies and policies* was held, organized by the Commission on Scientific Production and Evaluation jointly with the Innovation Commission of the UID.
The seminar aimed to lay the foundations for a thematic comparison based on concrete data that could take into account the contents of the calls for RTD-a, the PhDs financed by the PNRR and the main lines of research emerging from the publications of the *Disegno* sector, collecting the requests arising from the debate around the new declaration, shared and approved by the members after a joint effort that engaged the Association between November 2020 and May 2021. Furthermore, the seminar intended to share an initial analysis of the PRIN results, starting from the data available for 2020, using the data collected through a questionnaire submitted to the UID associates, in order to identify the prevailing interdisciplinary issues and evaluate the results obtained.
In the introductory speech, Rossella Salerno, Coordinator of the Research and Evaluation Commission, showed how the seminar was solidly linked to the two that preceded it. In the *I Seminar on Research Evaluation in the ICAR/17 SSD*, of May 9, 2019, the main focus was on improving the quality of the evaluation and the enhancement of the most appropriate strategies to enhance the quality of scientific products in the area. From this first appointment it became clear to what extent the evaluation policies influence the choice of research areas and how these different aspects must be taken into consideration jointly, through flexible and effective tools. A tangible outcome of this first Seminar was the decision to draw up the *Evaluator's Vademecum* approved in February 2020 after a shared path that engaged the Commission and the CTS for months.
During the *II Research Evaluation Seminar in the ICAR / 17 SSD* of 4 March 2020, the evaluation exercise of the 2015-2019 VQR was taken into consideration, analyzing the call in a precise manner, in order to disseminate detailed information on the typologies of research products as well as the methods of conferment and judgment. On the same occasion, the *Evaluator's Vademecum* was presented with the aim of promoting the dissemination of a culture of refereeing that was as aware and shared as possible. In addition, the role of the third mission in evaluating departmental structures was considered.
At the end of her introductory speech, Rossella Salerno, making explicit reference to six of the MUR thematic areas of specific interest for our disciplinary area, took stock of the various questions to which the seminar tries to answer that –taking into account the opportunities that open up for young people– concern the responses that our area is able to offer to the urgencies of the PNRR, the new relationships with organizations and companies and the multifaceted European field of research.
The complexity of the current moment, however, is evident by some open questions that constitute the background of our field of action, such as the '*Riforma dei Saperi*', the updating of the SSDs and the debate on the criteria for adapting the Degree Classes.
The first thematic speech was that of the group formed by Antonella di Luggo, Edoardo Dotto, Laura Farroni, Matteo Flavio Mancini, Ornella Zerlenga who –starting from the consideration that recent investment actions show thematic constraints aimed at specific areas of *Innovation* and *Green*– have tried to identify the directions towards which the research interests of the discipline are moving, building a strategy for identifying the topics of interest to our SSD, through an analysis of scien-

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tific products aimed at sharing common languages and references.
To achieve these objectives, the recently funded RTD-a PON projects were analyzed and, above all, the classification of the research topics through the detection of key words relating to the research products. In this first phase of analysis those of the five-year period 2017-2021 were examined, taking into consideration the essays hosted in four of the most popular scientific journals in our SSD and the monographic publications. It was necessary to propose a new organization of the keywords into four thematic groups, adding to the traditional areas of Drawing, Surveying and Geometry also that of Visual/Multimedia Design. The organized list of keywords proposed is also the result of the elaboration of previous lists, now updated by resolving ambiguities and repetitions and integrated with new items that identify emerging research lines. The list of keywords of specific interest for our area proves to be a very useful tool for monitoring the development of our research areas and will be supported with the construction of a reference glossary available to scholars.
The slides projected at the Seminar with the detailed graphics –together with all the slides shown during the other speeches– are available on the UID website that can be referred to for an in-depth consultation.
The following speech was by Marcello Balzani of the Innovation Commission, who took into consideration the React EU *Green* and *Innovation* calls and the investment potential in industrial research for the ICAR/17 sector. These calls are part of a response strategy to the crisis generated by the recent pandemic that uses huge resources designed to be used by 2023, also in order to contribute to the settlement of the differences between North and South and to build a connection plan between the cycles of programming 2014-2020 and 2021-2027. The speech showed the results of an internal survey in the area aimed at recognizing the areas in which research and innovation paths are concentrated, the various types of partnership and above all the variety of thematic responses that seem to be distributed, albeit with different percentages, including that of Digitization, Visualization, Social Innovation for Cultural Heritage, that of Technologies for the conservation of built, historical and artistic heritage, that of Cities, Territory, Landscape and Environment. Furthermore, he showed how, in specific areas, it is necessary to make the timing of research coincide with those of the needs linked to industrial production, which requires particular reactivity.
The third speech by Alessandro Luigini, Roberta Spallone and Graziano Valenti analyzed the participation of our sector at PRIN 2020, for which he proposed an analysis of the results, and at PRIN 2022. Furthermore, it took into consideration both the ERC subsectors that the proposals as well as the number of enrolled in the register of REPRISE assessors refer, in order to make available the tools to build an overall strategy that can lead to the improvement of our performances. Also in this case, the data on which to operate –as well as from the research in the ministerial databases– were extracted from the responses to a questionnaire disseminated among the shareholders. Very detailed elaborations were shown, supported by clear and captivating graphics, which took into consideration in an analytical way the involvement of the various ERC sectors. In analyzing the unsatisfactory results in our sector, among other things, it was shown that the highest concentration of winners is attributable to an extremely limited number of proposing SSDs.
In her closing speech at the Seminar, UID President Francesca Fatta underlined the fertility of this choral work and indicated some critical aspects identifying the type of challenges that await our sector. She also noted how there is a direct continuity between the aspects dealt with so far in the three seminars on Research and Evaluation and how they clearly outline a series of issues to be addressed in the future.
At the end of the work, it became clear how the work of the Commissions was able to provide new reading tools to organize conscious research strategies within our SSD and how it is essential to continue in the collecting and processing of new data, in order to structure a repertoire that allows us to plan the paths that will guide the future of the area. This year, more than other times, the Seminar was based on the critical processing of precise data, 'surveyed' –we could say– with care and patience and transformed in a balanced way into project ideas, into conscious openings, according to an intellectual attitude which, in hindsight, deeply characterizes the operating methods referable to our discipline.

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Events

Representing Time. Architecture, Geometry and Astronomy International Study Day

Marco Fasolo

The International Study Day entitled *Representing Time. Architecture, Geometry and Astronomy* was held on March 23, 2022, at the palazzo Spada in Rome, Italy.
Organized by Laura Farroni (Department of Architecture, Roma Tre University), Manuela Incerti (Department of Architecture, University of Ferrara) and Alessandra Pagliano (Department of Architecture, University of Naples 'Federico II'), the meeting was aimed at bringing together a wide range of knowledge dealing with the theme of the relationships between astronomy, geometry and architecture.
The interesting debate was developed in two sessions: the morning session, addressed to astronomers, and the afternoon session, addressed to scholars of Drawing. Although for organizational reasons, the speakers were divided into two distinct groups, it was possible to observe how the peculiarities of the competencies of the former could merge into the latter and vice versa, in a continuous osmosis where the semi-permeable membrane increasingly loses its characteristic of being a tenuous boundary and the two souls converge towards a single direction, that of knowledge.
The conventional institutional greetings were extended: those of the host, the Council of State represented by Councilor Solveig Cogliani, as well as those of Pasquale Basilicata, Director General of the Roma Tre University, Adolfo Baratta representing the Department of Architecture of the Roma Tre University and Francesca Fatta, President of the *Unione Italiana per il Disegno*, all of whom agreed on the importance of these cultural exchanges. What's more, pervading throughout was the common desire to continue these meetings by promoting, even in the future, activities focused on scientific research applied to the vast cultural heritage present in the prestigious palace.
Wanting to identify a common thread in the topics covered by the speakers, this can be found precisely in the protagonist of the title: *Time*, lived and represented in the various eras, from archaeological to ancient, medieval, and Renaissance, only to end with the contemporary era by passing, of course, through the Baroque. In short, a journey through time with Time.
Therefore, the speeches that followed showed particular attention to this common theme starting from the history of time, to the concept of space and time and the relationship between Astronomy and Art and between Astronomy and Architecture, as Fabrizio Bònoli (University of Bologna, Director of the *Giornale di Astronomia*, SAI) clearly outlined in his speech.
Another theme dealt with throughout the day was related to instruments. Elio Antonello (President of the Italian Society of Archaeoastronomy SIA, INAF) focused on the observation of the sky performed by ancient cultures without today's telescopes and instruments. He emphasized how this activity also had a practical purpose: to define a calendar in order to develop agriculture and the agricultural culture at a time when writing did not yet exist nor, consequently, written calendars.
Again, dealing with the union of the history of Time and its instruments, Mario Arnaldi (former Editor-in-Chief of the journal *Gnomonica Italiana*) began by criticizing the current abandonment of studies on the chronometry of ancient cultures. He then dwelt on the *Geometrie intuitive della percezione oraria* (Intuitive geometries of time perception) underlying the creation of the very first sundials. An international contribution was brought to us by Angélique Ferrand (ATER History of Medieval Art, University of Nantes), who in her study *Penser le temps dans l'espace: les signes du Zodiaque et les Occupations des mois rythmant l'architecture ecclésiale (XI^{e}-XIII^{e} siècles)* posed the problem of the relationship between the Zodiac and architectural space.
The morning's talks were closed by Nicoletta Lanciano (Sapienza University of Rome), who reflected on how, alongside works of architecture, in the evolution of scientific-astronomical thought there are works born in the sphere of teaching and didactic research. Paolo Giulierini (Director

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Fig. 1. Flyer of the event

of MANN–National Archaeological Museum of Naples) focused his intervention on the Alexander Mosaic. In recent years, this museum has attempted to convey the message that the ancient world was not only composed of artists, but also strongly centered on technology. To support this conviction, he illustrated the work in which it is possible to recognize a testimony of the union between art and science.

The event, attended not only by those present but also by some 80 online participants, resumed work, still in the fascinating Hall of Pompey so magnificently frescoed by Michele Colonna and Agostino Mitelli, after having had the opportunity to enjoy the direct vision, in the adjacent gallery, of the famous catoptric-gnomonic astrolabe designed by Emmanuel Maignan, explained to the visitors by Giulia Tarei, a PhD student at Sapienza University.

Cristina Càndito (University of Genoa) opened the afternoon session with a speech that reviewed her studies on gnomonics as evidence of the fertile field of inquiry that such research can offer to scholars of Drawing. Returning to the theme of the instruments of gnomonics, Filippo Camerota (Scientific Director of the Museo Galileo, Florence) presented to the participants, with effective and clear digital images, personal reconstructions of instruments found in the pages of several 16th-century treatises.

Two interesting speeches dealt with gnomonics and astronomy incorporated into architectural projects. The first by Alessio Bortot, dedicated to Maignan's gnomonic marvels in the project for Borromini's villa Pamphilj, illustrated, with effective digital images, the project of the villa, which was conceived by its authors as a great machine for observing astronomical phenomena. The second speech, presented by Agostino De Rosa with a leap in time of five hundred years, brought the auditorium to experience, thanks to his intervention, the experiential project conceived and already partially realized by James Turrell at Roden Crater. The project features complex astronomical alignments to be set in the hypogeum of an extinct volcano with the obvious attempt to correlate terrestrial space with celestial space.

A significant review of studies on palazzo Spada was presented by Laura Farroni and Matteo Flavio Mancini (Roma Tre University); a research activity that posed as a foundational basis the temporal and spatial dimension of the figurative episodes present in the palace.

The speeches of this very interesting day were concluded by Alessandra Pagliano, who aimed not only to retrace the history of sundials but, above all, to raise a cry of alarm about the severe state of degradation in which some of these instruments are currently found, calling for restoration work carried out with awareness and knowledge of their identity. In her contribution, Manuela Incerti underlined the importance of interdisciplinarity in these studies. She presented the evolution of the field of research both in Italy and abroad, recalling the many initiatives of academies, scientific societies, institutions, universities, and distinguished scholars who have dedicated themselves to these studies.

At the end of the day, a reflection on how to continue these studies could not be missing, and the answer was offered precisely by the three organizers of the Study Day, who announced the launch of the series *Architettura Geometria Astronomia*, Edizioni libreriauniversitaria.it., which sees them in the role of Editors. The Series is intended as a place for ongoing reflection, where the exchange of knowledge on the topics addressed in today's event can continue.

Ornella Zerlenga concluded the Study Day by highlighting the enthusiasm and expertise of the speakers who had addressed very complex issues, in a rich multiplicity of studies. Finally, she extended sincere congratulations to the curators for the excellent organization of this seminar filled with so many rich insights and reflections.

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Events

ANNA SGROSSO through Memory and Future

Barbara Messina

On April 22nd, 2022, in the magnificent location of palazzo Gravina, the historic headquarters of the University of Naples 'Federico II', it was held a memorial day of Anna Sgrosso, a leading figure for the Neapolitan school of Architecture and a national reference point for the scientific-disciplinary sector of Representation of Architecture.
The meeting was attended by several students and pupils, many of whom are currently professors, who had the pleasure of getting to know Anna Sgrosso by meeting her as a guide in their academic careers.
The event was introduced by Alessandra Pagliano (Department of Architecture of Naples), who pointed out the dual spirit, artistic and mathematical, of Anna Sgrosso and the key role she played in the dialogue between tradition and innovation. She was indeed able to combine scientific rigor with extraordinary creativity. Her unique way of drawing architecture, depriving it of materiality and leaving only the geometric structure visible, allowed her to invent new codes that prefigured 3d digital graphics and provided a valuable and still relevant scientific contribution to the Science of Representation.
She then retraced some personal episodes, which linked her to Anna Sgrosso, and underlined her great human and professional qualities, her kindness and humility in guiding generations of students, thus creating emotional connections over time, were highlighted.
The opening speech was followed by greetings from Michelangelo Russo, Director of the Department of Architecture. He highlighted Anna Sgrosso's critical thinking, technical qualities, and ability to conceive a solid methodology, which was the basis of architectural design. A methodology based on the graphic interpretation of space and characterized by the ability to observe, interpret, disassemble and reassemble architecture. Finally, he highlighted her originality in creating a cultured and sophisticated form of knowledge also through *ante litteram* collaborative workshop experiences, with which to make students develop transversal skills.
Institutional representatives and faculty members from 'Federico II' spoke afterward. Massimiliano Campi dwelt on Anna Sgrosso's teaching technique on understanding the "transparent quality" of architecture and thinking about the way it is composed, rather than the way it appears; Antonella Di Luggo remembered her enthusiasm in guiding students, with whom she always gently and rigorously dialogued to get the best out of them; Riccardo Florio, proposed a comparison with the "*membrature solide e tuttavia gentili*" that Leon Battista Alberti speaks of in one of his writings [Alberti 1960], describing her as "a tiny and gracile person but capable of releasing powerful energy"; Lia Papa referred to her ability to sense in advance the importance of weaving a cultural and scientific dialogue with other disciplines, first and foremost the History of Architecture and Restoration, and to her sense of belonging to the scientific community of Drawing; Mariella Dell'Aquila, her first student, highlighted the determination with which she was able to coordinate the PhD course in '*Rilievo e Rappresentazione dell'Architettura e dell'Ambiente*' at the University of Naples 'Federico II' and the decision to reinstate the subject 'Fundamentals and Application of Descriptive Geometry' –for an optional period– among the basic and mandatory disciplines, as it is fundamental for the training of future architects; finally, Leonardo Di Mauro, President of the Order of Architects of Naples and co-relator with her in several master degrees theses, remembered her as one of the first professionals registered in the Order (since January 1951, the number 228), and referred to her as a refined and cultured colleague, capable of bringing out the historical aspects of the images thanks to a rigorous re-

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Fig. 1. Flyer of the event.

search methodology based on drawing and graphic interpretation.

The subsequent session of interventions, coordinated by Gianluigi De Martino (Department of Architecture, Naples), had an initial contribution from Francesca Fatta, president of the *Unione Italiana per il Disegno*, who recalled Anna Sgrosso's key role within the UID, starting with her participation in the first national meeting of university professors in Drawing. The meeting had been organized in 1979 in Santa Margherita Ligure by Gaspare De Fiore to discuss what would be the contents of the declaratory of the scientific-disciplinary field, and on that occasion, Anna Sgrosso firmly brought her position: "Representation is not limited to the measurement of reality but shows the aptitude to interpret complex qualities and aspects", obviously through a mainly geometric type of understanding. Words that denote an awareness derived, as Francesca Fatta observed, from her teaching experience in the field of mathematical disciplines for Architecture, from which also flowed the firm conviction that architecture is a synthesis of humanities and "hard" sciences. Her deep dedication and the importance of her cultural and scientific contribution to the field of Representation of Architecture led her to the highest awards given by the UID: the Certificate of Magister in 2005 and the Golden Plaque in 2017 [Cundari 2008]. Finally, there was no lack of personal memories of Anna Sgrosso as professor of the 1st cycle of the PhD program in '*Rilievo* e *Rappresentazione del Costruito*', which was nationally organized in four locations. Anna Sgrosso was noted for her dry but crystalline character, direct and without metaphors, linear –like her figure– and the clarity to tell complex things with simplicity.

In the following intervention, Agostino De Rosa (Dipartimento di Culture del Progetto, Università IUAV di Venezia) related, with sincere emotional participation, the great sensitivity of a "woman with an ancient soul" who always stood out for her democratic approach to culture and knowledge. A woman with broad interests –mathematics, art, music, literature– that then flowed into her writings, all of which, as well pointed out, are marked by a limpid form of expression: the same that emerges in her drawings and her poetic world in general. During his speech, he paid particular attention to a specific aspect of Anna Sgrosso's research, namely the study of the history of the Science of Representation, which she approaches well in advance of the national and international background. In 1969 she published a small volume [Sgrosso 1969] dedicated to that topic, relating –through the eyes of someone who looks from the inside and deeply knows this discipline– the evolutionary process of representation. Agostino De Rosa highlighted her particular interest in Piero della Francesca, in whose drawings she sought much more than the critics identified. These contained the "configurational character" so dear to her, that is, the law by which lines and surfaces are added. This work then led to the publication of the three volumes published by UTET on the history of representation, written by three hands with Agostino De Rosa and Andrea Giordano [De Rosa, Sgrosso, Giordano 2001], whose long 'gestation' strengthened and made even deeper the bond of pure and mutual affection, as well as that of scientific interests.

The intervention was followed by Giuseppe D'Acunto (Dipartimento di Culture del Progetto, Università IUAV di Venezia) who, combining personal recollections with a more properly historical record, reconnected in the time framework the milestones of her career, starting from the year in which she enrolled in the Faculty of Architecture (1944) –among the first female students– brilliantly completing her studies in 1950 and disrupting, with an innate elegance, the then-common idea that this career was not suitable for a woman. Her academic life was then retraced, from her beginnings alongside Mario Giovanardi, Rodolfo Permutti, and Maria Miglio (the latter of whom she considered "extraordinary people both, though in different ways"), to her teaching assignments as an assistant (since 1961) and professor (since 1969) in disciplines such as Projective Geometry, Mathematical Analysis, Surveying and, of course, Descriptive Geometry,

which she taught until her retirement. Also recalled were the many institutional roles she held, including that of Coordinator of the Doctoral Program at the University 'Federico II', as well as –for two mandates– Director of the 'Dipartimento di Configurazione e Attuazione dell'Architettura' at the same university. Roles that, as highlighted in the speech, were never interpreted as an exercise of power but carried out with a real spirit of service.
The session was closed by Andrea Giordano (Department of Civil, Environmental and Architectural Engineering, University of Padua) who spoke about Anna Sgrosso and geometry. An inseparable union lived in the certainty that this science was "among all the most suitable to act as a link between art and mathematics". The speech brought out the broad meaning associated with the concept of geometry, which, as she liked to repeat, did not refer only to measurement, but contains within itself much more than that. It is in the drawing of the reality that surrounds us, since geometry, the one that configures space and surfaces, allows a true knowledge of it –a knowledge that must necessarily imply 'structure' and constructive aspects– and, consequently, allows its correct representation. She also loved, as mentioned, to introduce her students and pupils to concepts such as the point, the line, and the projective plane, which forme the basis for real solutions to complex problems in the representation of architecture. The report also focused on her relationship with digital representation to which, with the foresight of one who knows how to look beyond, Anna Sgrosso had always shown herself to be in favor, cautioning, however, against an exaggerated use of such a tool since, as she said, computer science without knowledge of Projective and Descriptive Geometry becomes only a mechanical matter.

Fig. 2. The designation of the classroom 'Anna Sgrosso'.

After a brief greeting by some of her alumni– who commemorated Anna Sgrosso as a professor, thesis advisor, PhD tutor, with inevitable and tender personal memories– Dora Francese (Department of Architecture, Naples), her daughter and student, closed the session of speeches, speaking about her as a mother, life teacher, and university teacher. The short but intense talk focused on lesser-known private moments and cultural and professional interests of her life, but fundamental to defining the richness of a person many have known only as a passionate teacher and researcher of Geometry. For example, Dora Francese recounted that her first academic choice had fallen on studies in Chemistry; then, at the wishes of her father, who recognized her strong aptitude for drawing, she had opted for the Faculty of Architecture, after a long talk with the then Dean Marcello Canino. Moreover were illustrated, also with original drawings, her talents as a project designer –attentive to executive details, to materials but also to clients, with whom she always related politely– and her deep passions for fashion (her dress sketches are splendid) and design. The talk concluded with a remembrance of Anna Sgrosso seen no longer through the eyes of a daughter but of a university student, who discovered in her a new person, willing to transmit all her knowledge with great passion.
The event concluded with the dedication to Anna Sgrosso of one of the most prestigious classrooms in the Gravina palace, currently the site of

lessons for the master's degree in 'Design for the Built Environment'. A proper tribute to a multifaceted researcher, with a kind, sensitive, helpful, polite character; a rigorous woman with an innate elegance and an old-fashioned grace but stubbornly obstinate in the pursuit of her intentions; a professor aware of her own and others' merits, capable as few were of teaching, engaging and enthusing her students and pupils with whom she shared her knowledge. In the certainty that transmitting some of her knowledge would have meant continuing to live on in them.

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Events

Connecting. Drawing for Weaving Relationships

Rossella Salerno

The days of the 42nd International Conference of Teachers of the Disciplines of Representation held in Reggio Calabria from the 16th to the 18th of September 2021, marked the return of the association's in-presence activities. It is not with a 'notarial' emphasis that we speak of them, but rather in recalling their special character: they were the first, in fact, after the pandemic hiatus, which allowed us to rediscover an opportunity to exchange ideas, to elaborate projects for the future, but also to allow individual and collective narratives that were interwoven with the intense days planned in the work program, packed with events and scientific communications.

The theme of the conference, *Connecting. Drawing for Weaving Relationships*, already conceived in 2018 and proposed to the CTS of UID for 2020, turned out to be as topical as ever, also in view of the exceptional emergency situation; while the theme was primarily intended to focus attention on the dialogue between disciplines, knowledge and cultures which animate 'our Drawing', it also represented the inevitable context of the contemporary situation, increasingly characterized by the dialectic between *Global World* and *Local Worlds* [Geertz 1999].

The four topics proposed for the 2020 edition, extensively documented by Issue No. 8 of *diségno*, allow the 'mythological' echo of the beautiful Calabrian region to emerge: *Prometheus*, *Metis*, *Mnemosyne*, *Hermes*. These were joined by a fifth, *Distances, Languages, Technologies*, which made it possible to establish continuity on the more general themes of drawing and connection, which remained at the center of the extraordinary edition of the 42nd UID Conference.

Lectures introducing the topics were given by Massimo Giovannini *Connettere. Un disegno per annodare e tessere* (Connecting. Drawing for Weaving Relationships); Gaetano Giunta, *Prometeo: la Teoria e la Tecnica* (Prometheus: Theory and Technique); Orazio Carpenzano, *Meti: la Mutazione della Forma* (Metis: the Mutation of Form); Nicola Aricò, *Mnemosine: la Costruzione della Memoria* (Mnemosyne: the Construction of Memory); Alessandra Chemollo, *Hermes: il Racconto dei Luoghi e delle Cose* (Hermes: the Story of Places and Things); undoubtedly heterogeneous personalities who tackled the thematic challenges by expanding the more usual viewpoints of architecture and landscape, to explore the relationship between technologies, sciences, society and ethics, and venture into the terrains of history and photography.

The days of the well-attended conference –in fact, a record number of registrants was reached– can be reconstructed through a synthesis of the themes addressed by the contributions that were considered the most significant and, therefore, awarded as *Best Papers*.

We present them here in the same order given to the topics, starting with *Prometheus*, for which three papers were selected: Marcello Balzani and Fabiana Raco –*Object towards Human Body. The Space of Human Body between the Surveying and Representation Processes*– for which the spatial and object design configurations connected to the survey of the human body represent, in architecture as well as in product design, an area of growing experimentation: ergonomics, proxemics, user- and customer-centered design techniques. Cecilia Bolognesi and Fausta Fiorillo –*Survey and Modelling for a Theoretical Reconstruction*– presented an experiment in three-dimensional modeling for an interesting cognitive and reconstructive application in the field of Cultural Heritage. Enrico Cicalò–*Connections between Knowledge. Disciplinarity, Interdisciplinarity and Transdisciplinarity of Graphic Sciences*–addressed the need to give identity and visibility to the Graphic Sciences, which today are difficult to place within the international classifications of the scientific research domains, through a transdisciplinary

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Fig. 1. Flyer of the event.

path aimed at redesigning the identity of the Graphic Sciences in the confrontation with possible and fertile connections with other knowledge.
The broad context of *Metis*, centering on questions of form, saw the emergence of two groups, the one consisting of Marianna Calia, Antonio Conte, Roberto Pedone, Margherita Tricarico –*Twine Forms to Re-stich Memories of an Ancient Plan in Basilicata*– and the other consisting of Gian Marco Girgenti, Claudia Tarantino –*Connections and stratifications of the Urban Shape. The Traces of the Roman Amphitheaters in Their Metamorphoses*– ; the first presented a research starting from the knowledge of the territories and fragile heritages in the Lucanian area, and which aimed to re-configure a possible transformation for re-inhabiting the abandoned ancient city center of Craco, hypothesizing new opportunities for cultural, touristic and economic enhancement; the second group, instead, presented the investigation work carried out on Palermo, wanting to verify –through the survey and redrawing of the urban fabric– the compatibility of the most recent hypotheses of location of the buildings for spectacles in the *Panormus* of the Roman age.
Two papers were also selected for the theme of memory, inspired by *Mnemosyne*: Sara Antinozzi, Diego Ronchi, Salvatore Barba –*Macro and micro photogrammetry for the virtualization of the Orphic Foil (V-IV B.C.) of the National Museum of Vibo Valentia*– investigating the implementations offered not only by the technological evolution of acquisition tools, but also by the challenges posed to surveyors and more generally to the theory of measurement, dwelling in particular on the codification and formalization of survey practices for small objects. Fabiana Carbonari, Emanuela Chiavoni, Giulia Pettoello, Francesca Porfiri, María Belén Trivi –*Project and Memory. Drawings and Relationships for the Museum of Natural Sciences in La Plata*– proposed a research activity dedicated to disseminating the extensive cultural and scientific heritage of the Museum of Natural Sciences in order to consolidate its memory; using different types of graphic documents that show the links between ways of seeing and representing the building and its rich museum heritage.
For *Hermes*, it was Edoardo Dotto's contribution that proved most convincing: *Weaving. The Building Blocks of the Digital Image between Art, Science and Craftsmanship*; a reflection that uses drawing as a tool to grasp the analogies between images of a different nature that can make it clear how the most modern low-res media show a direct connection with visual structures developed through manufacturing practice.
Finally, the topic devoted to the relationship between *Drawing, Languages, Distances, Technologies* was developed in a very articulate manner, allowing a number of different competencies and subjects to emerge among which five texts were selected for their originality: Mara Capone and Emanuela Lanzara –*Web-based Interactive Cognitive Artifacts: Edutainment for Cultural Heritage*– showed in-progress research aimed at the development of interactive web-based cognitive artifacts, usable in situ and/or remotely, to transfer cultural content and stimulate participatory enjoyment of heritage using 'pseudo-play-

ful' modes (gamification). Roberta Spallone, Fabrizio Lamberti, Marco Guglielminotti Trivel, Francesca Ronco, Serena Tamantini –*AR and VR for Heritage Communication and Fruition at the Museo d'Arte Orientale di Torino*– illustrated an application of augmented and virtual reality technologies for communication and fruition, whose activity involved a multidisciplinary team covering the knowledge of representation, information processing systems, art history, archaeology, and museography.
Massimiliano Ciammaichella –*Drawing of the Dance. Notation and Performative Space Control*– investigated the theories and methods of graphic transposition of notation, to understand the design principles, highlighting how all the case studies analyzed originated from the study of the body and its kinematics. To conclude, Domenico Pastore –*From Surface to Solid. A Close Reading about Cesare Leonardi's Project Solids*– addressed the project Solids, which in the early 1980s pursued the intention of obtaining, from panels previously used for reinforced concrete formworks, a variety of household furniture, using the entire surface of the modular panels and without employing additional material.
The wide range of topics covered by these contributions gives evidence of an area of studies capable of looking forward without forgetting tradition, and able to compete with other disciplinary contexts through an array of increasingly updated competencies.
The specificity and dynamism of the sector were reflected in the interesting series of programmed papers that saw the confrontation between 'our history' and the future: *Mario Docci, Una storia di rilievi 1979-2021* (Mario Docci. A History of Surveys 1979-2021) by Pilar Chìas and Gaetano Ginex; Franco Cervellini, who retraced, through Drawing, the extension of the former Faculty of Architecture; Daniele Castrizio, *Ipotesi sui Bronzi di Riace, connessioni tra storia e mito* (Hypothesis on the Riace Bronzes, Connections between History and Myth); Livio De Luca, *Un ecosistema digitale per l'analisi e la memorizzazione multidimensionale del restauro di Notre-Dame de Paris* (A Digital Ecosystem for the Analysis and Multidimensional Memorization of the Restoration of N*otre-Dame de Paris*).

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Events

Workshop 3D Modeling & BIM. Information and 3D Modeling for the Cultural Heritage

Michele Valentino

Given the continuing emergency due to the Covid-19 pandemic, the *Workshop 3D Modeling & BIM* was held on 7 April 2022 for the third consecutive time on a telematics platform; this limitation, however, allowed for a more significant number of participants. The seventh edition subtitled *Information and 3D Modeling for the Cultural Heritage,* in addition to maintaining its role as a privileged observatory on the use of Building Information Modeling (BIM) in architectural design, also explored the fields of investigation of surveying and visualization tools for the dissemination of the architectural built heritage and, more generally, of built heritage.

The day opened by Tommaso Empler, Director of the Workshop, who, after a brief introduction, left the stage for the institutional greetings to Carlo Bianchini, Pro-Rector of Architectural Heritage and Director of the Department of History, Design and Restoration of Architecture of Sapienza Università di Roma.

The works were opened by keynote speaker Michele Calvano from the Institute of Heritage Sciences of the National Research Council, with a speech entitled *Il Visual Programming Language per l'indagine e l'arricchimento dei modelli 3D* (Visual Programming Language to investigate and enrich 3D models). The speaker illustrated the approach of the *Built Heritage Innovation Lab* for the documentation, conservation, and management of historic buildings with a focus on the simulation of their building systems and the recognition and semantic enrichment of 3D objects within HBIM models.

Postponed for technical reasons, the greetings of Francesca Fatta, President of the Unione Italiana per il Disegno, became an opportunity for debate with the keynote speaker on the prospects of BIM, which from an experimental technology has evolved into a tool entirely attributable to the traditional contents of the scientific-disciplinary field of Drawing.

The six speeches of the session highlighted the variety of activities related to the documentation and management of the built heritage and historical buildings in which our country is prosperous. With the presence of research laboratories from different Italian universities, the first session showed the versatility of application cases in the field of information modelling for the built heritage. In the first speech, Fabio Bianconi, Marco Filippucci and Giulia Pelliccia (Università degli Studi di Perugia) illustrated some research concerning the experiments developed on the value of digital modelling for the programming of the response of materials printed through additive procedures. Following this, Flavia Camagni (Sapienza Università di Roma) and Sofia Menconero (Roma Tre University) presented the results of a didactic experience that, starting from the image-based 3D survey, leads to the digital representation and 3D printing, to then move on to the communication phase that includes the augmented and virtual reality visualization of the surveyed objects. Greta Attademo (University of Naples Federico II) then presented the experimentation of a new Cultural Game for the Marino Marini Museum in Florence, revealing how the conscious use of drawing can contribute to the innovative narration of museum cultural contents. Giuseppe Amoruso and Giorgio Buratti (Politecnico di Milano) similarly showed how some *Game Engine* applications applied to the digital reconstruction of artefacts and architecture can be helpful for the enhancement of cultural heritage. Then, Anna Lisa Pecora (University of Naples Federico II), starting from the case study of the Ascension Chapel in Carditello, presented some guidelines on the autism-friendly representation of virtual space. At the end of

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Fig. 1. Poster of the event.

the session, the group coordinated by Massimiliano Lo Turco (Politecnico di Torino), which also involves some members of the Fondazione Museo delle Antichità Egizie in Turin, illustrated the development of an HBIM to re-functionalize the Egyptian Museum, starting from its modelling and representation capable of recording change.
The end of the morning session was also the occasion to present volume 9 of the journal *Dn. Building Information Modeling, Data & Semantics*, which once again questions the innovative solutions for the HBIM sector and the objectives towards which future experiments should be directed.
The afternoon session, coordinated by Graziano Mario Valenti, saw the presentation of some contributions showing the application of 3D and Information Modeling in contexts ranging from the scale of the architectural object to that of the territory.
Massimiliano Benga and Maria Antonia Russo (Arsarc Studio) illustrated the procedures for the creation of the BIM information model of the MAXXI Museum in Rome, which also required the implementation of the model for the maintenance of the plant systems and some building components. In their report, Emanuele Carlo Bussi, Matteo Del Giudice and Anna Osello (Politecnico di Torino) highlighted the need to adapt traditional procedural standards to those introduced by technological innovation, enhancing the role of information modelling capable of connecting graphic and alphanumeric contents in a single BIM model. Following this, Michele Valentino, Amedeo Ganciu and Andrea Sias (University of Sassari) showed the first phases of research that foresees the construction of a Digital Twin of the island of Asinara to obtain a man-

agement tool for the Park area. Carlo Bianchini, Marika Griffo and Luca James Senatore (Sapienza Università di Roma) presented some methodological arguments that in the model see the direct integration of the duality between the characters of ideality and those related to the object in its actual configuration. Oscar Roman (University of Trento) and Kelly Pagan, Carlo Zanchetta, Elvis Cescatti and Maria Rosa Valluzzi (University of Padua) presented two case studies in areas at high seismic risk. Suppose in the first intervention, HBIM aims to examine some preservation and digital management techniques of historical buildings in the second one. In that case, the study is directed toward documenting historical evolution and damage to obtain a model in an 'open' and implementable format. Similarly, but with different aims, Alessandra Tata, Luisa Capannolo, Stefano Brusaporci and Pierluigi De Berardinis (University of L'Aquila) illustrated the role of the BIM methodology for the construction of a digital identity card of the buildings capable of documenting the state of conservation of the modelled buildings.
In the last part of the session, some works developed by the students of the *Master HBIM* of Sapienza Università di Roma were illustrated. They showed some experiences related to the procedures of Visual Programming Language linked to the HBIM methodology for the analysis, documentation, and management of restoration interventions of some case studies developed within the educational path.
From the variety of experiences presented during the Workshop emerged the overcoming of the pure procedural approach in the construction of the information model and greater attention to the documentary one that necessarily passes from the semantic structure of the document that the virtual model constitutes and that becomes an opportunity for a profound interpretation of reality, overcoming even the simple geometric measurement. Once again, the opportunity for comparison made possible by the *3D Modeling & BIM Workshop* was an opportunity to compare experiences that open up new prospects for the interoperability of these documentary repertoires.

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