

ANALYTICAL DRAWINGS OF ARCHITECTURAL BUILT HERITAGE

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Introduction on the material and cultural values of built heritage

The following paper provides reflections on the importance of analytical drawings in the process of understanding the architectural built heritage together with relevant aspects to analyse, theories and tools to produce them. Beyond every analytical drawing there is an interpretative process linked to the application of concepts and theories, hence it is not a simple graphic document which requires mainly technical skills. The main aim is to undertake an analysis through the use of one or more drawings representing the graphic translation of an analytical thought.

The architectural built heritage is one of the most important research fields for the quantity, quality and diversity of buildings and artifacts it contains. The importance of this heritage, the current global economic recession, the need of reducing resource consumption (not only non-renewable energies, but also the excessive sampling of the renewable ones), along with the importance of preserving the cultural roots for the future generations, confirm and strengthen the importance of this research field. This field includes both famous monuments and vernacular architecture, hence there is a considerable variety of buildings pertaining to all cultures worldwide. In many cities the marketplace made of recovery and maintenance interventions of the built environment has overtaken that of newly constructed buildings. Many urban areas worldwide have also a remarkable number of industrial heritage worth to be regenerated for various purposes including tourism. Therefore, thanks to these reflections, it is possible to distinguish two main values in the architectural built environment: a first value as a cultural resource and a second one as a material resource. In order to preserve, reuse, evaluate and promote in an appropriate way this resource, it is necessary to comprehend, document and disseminate it properly. In some circumstances, the architectural built heritage has been studied superficially, both from the cultural and material point of view.

The negligence of those who study and work on this heritage is often translated into a wrong or incomplete interpretation and analysis leading to inefficient actions of valorization, promotion, safeguard, maintenance, refurbishment or reuse. These aspects, together with other difficulties, have negative consequences from the economic, functional and cultural point of view. These difficulties can be connected to material characteristics (difficulties arising from the characteristics of the site; other difficulties

result from the characteristics of the artifact or from extraordinary situations, such as an earthquake) or methodological and cultural approaches.

The production of analytical drawings can represent a method to improve, deepen and communicate information and meanings on the architectural built heritage.

The role of analytical drawings

Each building is a complex system of tangible and intangible characteristics that could hardly be understood and analyzed in an efficient way and just with the traditional graphic drawings (plan, elevation and section). The role of the analytical drawings is to analyze, document and communicate only a few aspects of the building. Thanks to these graphic drawings it is possible to split the characteristics of a building to better study and represent them individually or in sub-groups. Consequently, attention is paid to one or more aspects, isolated from the whole building and analyzed through one or more graphic works. In this way it is possible to better comprehend the buildings and highlight hidden aspects with a single overview. In fact, an overall view of the building can limit, or make more difficult (and sometimes impossible), the analysis of a particular characteristic. Some unnecessary elements could obstruct the study of some features. The analysis process could lead to a detailed understanding process that becomes a critical analysis open to new intuitions and interpretations. The role of these analytical drawings in architecture can be compared, to some extent, to the one of the “Anatomical sketches” created by Leonardo Da Vinci. Thanks to his drawings, it has been possible to have new documents and information on the human anatomy and to share them with a wider audience of scholars and enthusiasts. Analytical drawings are scientific drawings, where objective information and subjective interpretations coexist. During the study phase of a building belonging to the built heritage, it is often necessary to use a creative approach to overcome the lack of information.

Analytical drawings can be used in different situations, such as:

- in the analysis of an existing building through new point of views to discover new aspects, hence to improve and widen its knowledge;
- in restoration, renovation, regeneration, recovery and maintenance actions;
- in the identification of particular qualities that should be safeguarded and valorized, such as in reuse projects of existing buildings, namely in the modification of their destination use with respect to their characteristics;
- in comparative studies, when two or more buildings belonging to one or more cultural contexts are compared, to better understand similarities and differences;
- to spread information difficult to understand through texts or other communication methods.

It is always possible to find out new characteristics or qualities through the definition of new theoretical approaches and tools that allow new and innovative interpretations/critical readings of existing buildings. Moreover, each era brings new tools and new methods to study the built heritage.

Historical buildings are continuously studied since the ancient times, but there is not a complete and definitive study of any building, even for what concerns the most famous monuments such as the Coliseum, the Gothic Cathedrals, etc. All buildings, mainly the ones belonging to the built heritage, are subject to new interpretations, because it is always possible to find out new aspects that can be analyzed with in-depth studies. Remarkable pieces of architecture are like the literature classics: they always have something new to say¹. Moreover, holistic, multidisciplinary and trans-disciplinary approaches always lead to new and innovative research path on the existing buildings. A different theoretical approach in the study of a building can lead to different interpretations and analytical drawings because it could be possible to take into consideration different elements (never taken into consideration) or to read elements already studied in new ways (new or different meanings and/or functionalities could be attributed to them). The analytical drawings could be also used to study unbuilt, lost or damaged buildings.

Analyzing the features of architectural built heritage

Every building pertaining to the architectural built heritage has specific tangible and intangible characteristics resulting from different aspects, influencing one another and in different ways during the course of history: cultural, social, political, economical, religious, etc. When a building belonging to the built heritage is studied, not only are the functional aspects considered as the anatomical sketches by Leonardo Da Vinci, but also as intangible aspects like the emotional, poetical, sensorial ones. The first passage for the preparation of the analitical drawings is theoretical and it consists of the identification of the characteristics to be studied.

Features of the architectural built heritage

The number and variety of tangible and intangible characteristics to be analysed is very wide. Every buiding can be analysed throughout different point of views but some features are particularly important in most situations. The first characteristic that has to be analyzed is the morphological one, the others add new depth layers on different tangible and intangible aspects.

- *Morphological*: The first contact with an artifact is visual. If we are not able to understand, represent and document its general morphology, we will never be able to break it down and analyze its single elements, or to understand the structures that regulate it;
- *Constructive*: The concept of constructive peculiarities indicates the constructive system of an artifact, referring to the number and type of technical elements and the materials that compose it, to which requirements it corresponds and how they are connected/assembled;
- *Evolutionary*: The analysis of these peculiarities focuses on the temporal variable which has been considered in two different ways, both combined by the

¹ Calvino, Italo. *Why Read the Classics*. London, United Kingdom: Penguin. 2013.

progression of the actions. At first, it has been considered the transformations which have interested an artifact or a settlement during the centuries or years, and they have influenced the actual configuration; afterwards, the various realization phases of an artifact, characterized by the assembling or a progressive construction of technical elements have been considered;

- *Perceptual*: The perceptive phenomena, which are intangible as lights, shadows and colors, characterize an artifact of a settlement as well as the tangible features, because the whole of these phenomena contributes in making a unique and unrepeatable built environment, characterizing its atmosphere.
- *Functional*: The spatial arrangement inside the same room and between different spatial units, both horizontally and vertically. This aspect directly affects the movement in those spaces; the arrangement and sequence of spaces are key elements that contribute in the experience of a place.

A recent research by the author which took place at the Mackintosh School of Architecture (in the Glasgow School of Art), in collaboration with Prof. Tom Maver, has presented a different theoretical and methodological approach to read buildings, focusing on their *narrative* characteristics². A narrative architecture is an architecture that, like a book, communicates a story through its tangible and intangible features. A story implies impressions, reflexions, sensorial and cultural emotions presented during a path through one or more spaces. These characteristics are then communicated during the direct experience of a building. This approach includes part of the characteristics previously expressed, even if they are analyzed throughout a different theoretical framework. All the selected features are important to improve the comprehension, management and valorization of the architectural built heritage. Of course other characteristics can be analyzed in addition to the ones described in this paper. Once selected the characteristics to be analyzed, which define the content of the analytical drawing, it is necessary to choose the graphic representation to be used. The relation between content and representation is the same occurring between message and language. Hence, the set of theoretical principles used to analyze some aspects of the buildings is graphically translated into the drawing.

Types and methods of analytical drawings

Drawing to produce analytical drawings means to study, analyze, discover, represent and communicate. The selection of the technique to be adopted is mainly influenced by the final objective of the graphic works that have to be produced, namely by the information that have to be communicated (shape of the building, construction techniques, perceptual phenomena, etc.). Analytical drawings can be produced in scale or out of scale and with various abstraction levels. The details that have to be added or omitted depend on the final objective and by particular communication choices

² Di Mascio, Danilo. "Investigating a narrative architecture: Mackintosh's Glasgow School of Art", in: Thompson, Emine Mine (ed.), *Fusion*. Newcastle upon Tyne, UK: ECAADE 2014, pp. 653-663.

The main graphic representations to be adopted are two-dimensional and three-dimensional:

- *Orthographic projections*: These graphic works are two-dimensional representation of the building, realizing projecting lines on a chosen plan. These drawings form the traditional graphic works to document the survey of a building: plans, sections and elevations. Each of those drawings become an analytical drawing when some aspects are highlighted, such as spaces, bear structure, openings, paths, etc. For example, the same plan can present different information each time it is studied.
- *Three-dimensional images*: The category of three-dimensional images includes both perspective views (both from the first person point of view and other locations) and parallel views (Axonometric and isometric). Three-dimensional images succeed in communicating information that would be too difficult, if not impossible, to convey with plan, section and elevation drawings because of the complexity of some details or buildings. The axonometric/isometric images for example can be very effective in communicating constructive details.

Both representational techniques can be creatively used in different ways and there are some elements that can contribute in highlighting some aspects of the analysis: colours, thickness and types of lines, hatchings, textures and lighting techniques (types of lighting, etc.) in the three-dimensional representations.

Traditional and digital tools

Different tools and representation models can be used to produce the previously mentioned graphic representations, starting from freehand sketches to digital three-dimensional models³. In recent years we have seen a diffusion of digital reconstructions in the study of the architectural heritage: not only the digital reconstruction allows a better comprehension of the building during the process itself, but also it allows the preparation of a wide range of graphic works, from rendered views to other graphic representations. Hand made sketches made during on site inspections or while studying projects on books can be considered as analytical drawings⁴, and, at the same time, they constitute an important documentation to prepare more complete and precise drawings, including 3D digital models. Sketches are always useful to study those characteristics that cannot be observed immediately. Different references can be used in the creation of analytical drawings:

- Representational and analytical sketches;
- Existing drawing, both historical and produced during surveys;
- New surveys;
- Photographic surveys;
- Physical models;
- Laser scanning data (point clouds).

³ Farrelly, Lorraine. *Representational techniques*. Lausanne, Switzerland: AVA Publishing. 2008; Yee, Rendow. *Architectural Drawing. A visual Compendium of Types and Methods*. Hoboken, New Jersey, United States: John Wiley & Sons. 2013.

⁴ Unwin, Simon. *Analyzing Architecture*. Abingdon, Oxon: United Kingdom: Routledge. 2009.

The following paragraph will describe some analytical drawings, produced during previous research projects, in order to understand, document and communicate some of the previously described characteristics.

Analytical drawings and features of the historical built environment

Every tangible and intangible characteristic of the built environment can be studied through different analytical drawings, both two-dimensional and three-dimensional. The following examples describe the analytical drawings produced during some researches on different case studies pertaining to different scales and cultural contexts: Italy, Scotland and Morocco. These examples show only few possible solutions. All drawings were produced after a digital reconstruction of the buildings but using some of the references previously mentioned.

Morphological

The following table shows a classification of some of the main volumes of the Glasgow School of Art, designed by C.R. Mackintosh in Glasgow, Scotland. This table aims at showing and comparing the dimensions and shapes of the different spaces. The dotted lines of the hidden sides are needed to communicate the overall shape of the spaces. Different colours were chosen to highlight the nature of the spaces: green for special rooms, red for connection spaces, etc. A proper level of abstraction has been defined to make the visual comparison more straightforward, hence the shape of the rooms has been reduced to a few essential lines (Fig. 1).

Constructive

The UNI Norms of the Italian Normative and specifically the ones related to the technological break-down (functional classification of components) are used as classification scheme for the preparation of the analytical drawings to study and document the constructive characteristics of a building. The selection of the criteria to classify and analyse the elements of a building is a critical factor that requires particular care because most of the buildings pertaining to the built heritage cannot be easily classified using a standard knowledge management system.

Various analytical drawings have been used for every technological subsystem in the study of the Turchinio's Trabocco⁵, mainly to understand the relations among the different parts. For instance, a rendered exploded axometric drawing with the textures (providing information on materials) has been prepared for the fishing platform, together with a series of two-dimensional drawings describing the different elevations and the constructive layers of the fishing platform. The two-dimensional drawings with fine lines allow to read in a clear and efficient way the different components of the structure (Fig. 2).

⁵ Di Mascio, Danilo, "Digital Reconstruction and Analysis of Turchinio's Trabocco: A method of digital reconstruction of a complex structure as a way to improve our knowledge of a cultural heritage artifact", in: Abdelhameed, Wael; N. Hamza and A. Bennadji (eds.), *Digitizing Architecture: Formalization and Content*. Manama, Kingdom of Bahrain: ASCAAD. 2009, pp. 177-189.

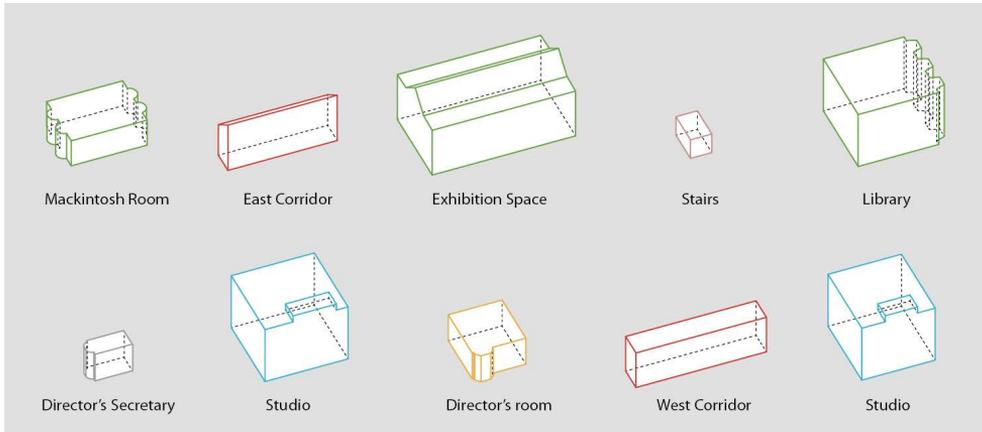


Fig. 1. A scheme where are classified some of the volumes of the spaces of the Glasgow School of Art designed by C.R. Mackintosh
 Source: personal archive of the author.

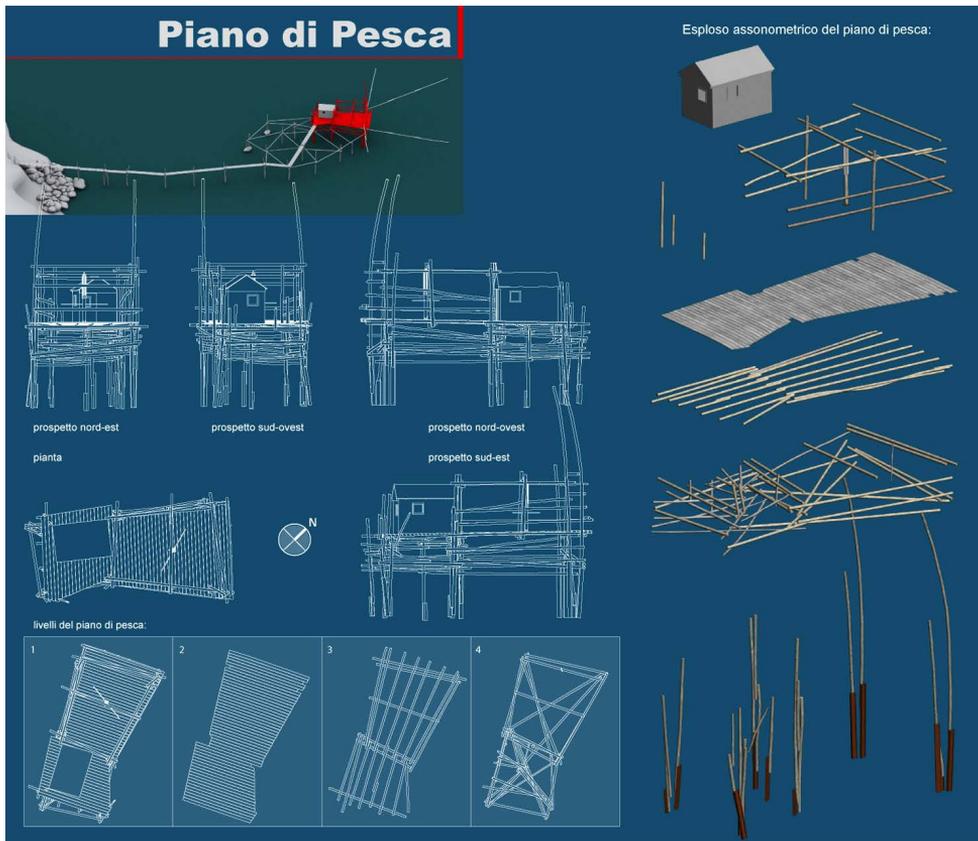


Fig. 2. Analytical drawings of the fishing platform of the Turchino's Trabocco
 Source: personal archive of the author.

Perceptual

To analyze the perceptive characteristics (lights, shadows, atmosphere) of the Castelnuovo fortified centre⁶, a series of rendered images have been produced, in particular lighting and shadows of the internal paths: prospective views in first person and from above. A black wireframe grid underlines the division of the different horizontal and vertical dwelling units and it helps to comprehend the scale of the settlement. The choice of neutral colours – white for the horizontal surface and light grey for the volumes of the buildings, and of the lighting (sunlight and global illumination) - has allowed to clearly highlight lights, shadows and the atmosphere of the inner roads of the fortified centre (Fig. 3).



Fig. 3. Study of the lights and shadows in the inner paths using different perspective views

Source: personal archive of the author.

Evolutionary

The evolutionary features of the trabocco and of a raw-earth house in Figui (Marocco) have been analysed through a sequence of rendered axonometric views where each single frame describes a construction phase. Theories and techniques from the filmmaking world were used as reference to produce these analytical drawings⁷. The images show also the constructive characteristics of the raw-earth house. Textures have been applied only when it was necessary to communicate the materials (Fig. 4).

⁶ Di Mascio, Danilo. “Preserving memories with digital media: a methodology for the reconstruction of Castelnuovo Village”, in: Dave, Bharat; Li Andrew I. - Kang and Hyoung-June Park. *New Frontiers*. Hong Kong, China: CAADRIA. 2010, p. 83-92

⁷ Di Mascio, Danilo. “Digital mediated techniques for the knowledge of the evolutionary peculiarities of the built environment: Three case studies”, in: Yu-Cheng, Lin and Shih-Chung Jessy Kang. Taipei, Taiwan: CONVR2012, pp. 37-46.

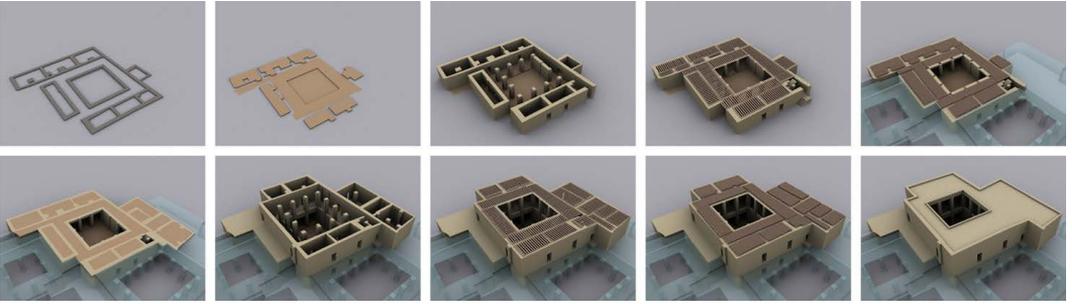


Fig. 4. Frames documenting the building sequence of the raw-earth house
 Source: personal archive of the author.

Discussions

For each artifact/building or settlement the information related to their most relevant features with various analytical drawings have been interpreted and represented in various analytical drawings using various graphic representations. These case studies have also permitted the use of tools provided by technology and to define and experiment new methodologies. In this way, each case study has represented a research within the research, because it caused difficulties that required specific solutions in order to be solved. The same feature analyzed in two different case studies presented different problems and solutions, for this reason it is necessary an open approach to experimentation.

Conclusions and future developments

In this paper the importance of analytical drawings in the process of understanding, maintaining and evaluating our architectural built heritage has been described. Without a proper analysis of our built heritage there is always the risk of damaging or even losing it. These drawings are useful to improve and deepen the understanding the aesthetical, technical, functional, poetical and cultural values of the building. This piece of writing highlights and describes relevant aspects, namely concepts, methods and tools, that are significant for the creation of analytical drawings. Some concepts and key features of the built heritage are proposed. The examples of some case study show the flexibility of these graphic works to study and convey information about objects pertaining to different scales. Thanks to the advance of technology, both two and three-dimensional images can be produced using CAD and modelling software, in order to increase the variety of analytical drawings that can be developed. The support of digital technologies and the formulation of new, supporting, theoretical background can open new research paths and bring the comprehension of the heritage to a new upper level. The usefulness of traditional techniques is recognized (such as freehand sketches), together with techniques coming from other disciplines (cinema).

These graphic works can be useful in increasing the sensibility of people towards these architecture and make them aware about the importance and safeguarding of the architectural built heritage for present and future generations.

Future research paths include a further development of theoretical approaches to analyse the architectural built heritage joined with different representational techniques through other case studies both aimed at investigating new ways of studying building through analytical drawings. The author is currently working on transferring and developing theories and concepts elaborated for the Narrative Architecture to a new theoretical approach to read the city, called: Narrative Urban Environment. It is planned to apply this new theoretical approach to the analysis of the historical heart of Newcastle upon Tyne.