Deferred Executions: Digital Transcriptions of Unbuilt Architectural Projects

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The present paper proposes some considerations on methods aimed to the construction and visualization of 3D digital models based on design drawings of unbuilt architectures. In this case, some of the Francesco Cellini's projects were analyzed. The tested procedures considered the most suitable visual language to communicate the different degrees of verisimilitude (from the symbolic to the iconic) in the process, allowing to manage the quantity and quality of information throughout the whole process, from data acquisition to final visualization. Various variables were considered, such as: the type of recipients, the quantity and quality of the starting data and the possible interpretations of the available sources according to the theoretical assumptions considered. The final product is a geometric and information model in which both the steps of interpretation and the final result can be identified. In order to describe the type of realized model and aiming at the establishment of a shared methodology in the field of virtual reconstructions of unbuilt architectures the experimentation of a "Level Of Reconstruction" value (LOR) is proposed, in analogy with the concept of Italian LOD applied to "Building Information Modeling" BIM. LOR is a function of both the level of detail and metric/geometrical accuracy and the level of reliability of the reconstruction itself. The proposed LOR, at this stage of the research, has four levels (A, B, C, D) that are distinguished by graphic codes created on the basis of both real and hypothesized data. The ongoing research has started on drawings by Francesco Cellini but it is expanding the case studies by acquiring other examples, as the unbuilt projects of the ABDR firm in Rome (Italy).

Key words:
Digital Reconstruction, Unbuilt Architecture, Design drawing, Francesco Cellini, Level Of Reconstruction.

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INTRODUCTION

There is a cultural heritage consisting of design drawings of the twentieth century architecture that are represented through traditional tools and techniques. This heritage testifies to a way of thinking and designing that is not yet influenced by the transformations of the digital era. This contribution concerns drawings of unbuilt architecture. They contain an intangible heritage characterized by different knowledge: that of the history of architecture, of the history of construction techniques and technologies, of the development of the theoretical thought of the belonging era, of the designers' individual poetics.

Currently many authorities, public and private institutions keep architectural drawings and make them accessible through digital archives, organized by collections, according to standards of cataloguing and filing adhering to standardized indications, showing original images sometimes at high resolution, sometimes at low resolution. Consider, for the Italian architecture at the Michelucci fund, the Ridolfi collection, the archive of the Accademia di San Luca, the MAXXI[1] archive in Rome and the drawings archive of the IUAV[2] in Venice. Moreover, there are the multiple digital interpretations of architectural projects proposed by numerous exhibitions or conferences in recent years.

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[1] Museo nazionale delle arti del XXI secolo ("national museum of 21st-century arts")
2 Istituto Universitario di Architettura di Venezia ("higher institute of architecture of Venice")

The presented research started on some reflections that took place after an educational experimentation at the Department of Architecture of Roma Tre, in the Course of Representation Techniques, where the students have interpreted and reconstructed in a 3D environment some projects of the architect Francesco Cellini. All the projects were unbuilt except for one. The aim was to make students understand that drawing is a critical tool with numerous valences. An important issue emerged: how to communicate the different levels of reconstruction that can be achieved starting from the archival drawings, considering that the information concerning each project is different in data quantity and quality?

Thus, research began on the digital accessibility of archival collections and on the possible methods for interpreting and returning the available data and information. The case study of Francesco Cellini's drawings of non-built architecture was studied in greater detail. Part of the reflections are contained below and are divided into four sections: (a) the object of the experimentation and its classification in the graphic culture of the design drawing; (b) the definition of the graphic message in digital reconstruction; (c) the interpretative value of the operator and the reference to the restoration theories; (d) the proposal of an LOR level, i.e. “Level Of Reconstruction”, which allows to identify levels of iconicity and to establish graphic codes for the different levels of interpretation. The first three sections indicate the theoretical process developed to support the last one that shows a first proposal for a protocol to visualize the experimentation.

THE OBJECT OF EXPERIMENTATION

Francesco Cellini's (*1944) drawings are the place of experimentation. Cellini graduated in Architecture in Rome in 1969. During the university period, he frequented Alessandro Anselmi, Manfredo Tafuri and Carlo Aymonino. From 1980 to 1982 he worked as an exhibition designer and curator with the Architecture sector of the Venice Biennale, and from 1982 to 1985 with the Visual Arts and Cinema sectors. He is a member of the editorial board of the magazine "Casabella". Among his works it is worth mentioning: Houses for workers at Maccarese, Rome, in collaboration with Alessandro Anselmi (1971); a project for Piazza dei Cinquecento, Rome (1982); a project for the new Faculty of Architecture for the University of Roma Tre at the former abattoir in Testaccio, Rome (1999); a project for new residential tipology, at Bufalotta (Rome) with P. Orsini and G. Raggi (1999); a renovation project for Piazza Augusto Imperatore (under construction) and the exhibitions "The Project of the Roman Group at the XVII Triennale of Milan[3](Rome, 1989). He has been a member of the National Academy of San Luca since 1993 and President for the two-year period 2019-2020. He is a Roman architect, great draftsman, influenced by the Roman school painter (such as Lorenzo Vespignani) and he is a scholar of Mario Ridolfi. The repertoire of drawings of non-constructed projects covers a period from the eighties of the twentieth century to the early years of the twenty-first century. The projects were developed for architectural competitions so they present different degrees of definition. For this reason it was taken into account a fundamental concept: the transmission of the characteristics of a projected architectural work is entrusted to its graphic editing, where it is intended as the communication of the architectural project in all its articulations: from the sketch of the initial idea to the executive drawings for the construction. The entire first phase of the research was dedicated to the analysis of the drawings and to the interpretation of the raw data and information they contained in order to better organize the three-dimensional reconstruction. The designer's poetics and language have also been defined. It was possible to distinguish some categories of drawings composed by different types of graphs (Fig. 1).

[3] Unpublished materials for the exhibition. The imagined cities. A trip to Italy. Nine projects for nine cities. Rome. The political city. The Parliament and the new Ministries", in collaboration with Cornell University College of Architecture, Art and Planning and University La Sapienza of Rome, curated by F. Moschini, R. Einaudi and A. Capuano, at A.A.M. Architettura Arte Moderna

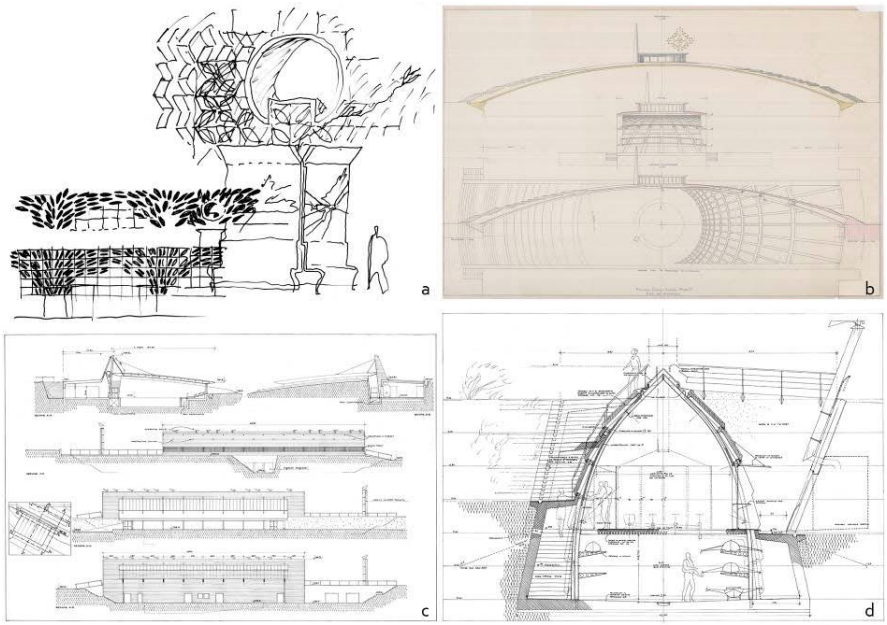


Fig. 1. Drawings by Francesco Cellini: a) preparatory drawing for Piazza dei Cinquecento, Roma (F. Cellini); b) preliminary drawing for Ponte dell'Accademia, Venezia (Università Iuav di Venezia - Archivio Progetti); c) definitive drawing for a pool, Baschi (F. Cellini); d) executive drawing for rowing facility, Baschi (F. Cellini)

The Italian legislation was also used as a reference. An example of systematization follows: (a) graphs aimed at the designer himself for the volumetric/functional/formal setup of the project idea; (b) graphics for the communication of the work conceived by the designer with the aim of transmitting information to the client for the verification of its satisfaction; (c) graphics intended for the Public Administration responsible in order to ascertain the compliance of the project with the current planning regulations and the issue of authorizations and building licenses; (d) graphs intended for the contractor for the construction of the work itself. The first category includes the *preparatory* drawings for the design of the project, the reference drawings, the conceptual sketches and ideograms; the second category includes the *preliminary* drawings that express the feasibility of the intervention in a given context, the presentation of the chosen design solution and the possible alternatives. These drawings establish the potential development of the chosen solution in the success levels of the final and executive design, therefore they visualize the project according to established limits. The quality and quantity of both the contents and graphic drawings depend on the potential development. The following contents, included in this phase, emerged: historical-archaeological, environmental-landscape, topographical, ecological, hydrological, geotechnical. It is important to underline that the elaborates depend on the design choices and the graphic/architectural culture of the designer, therefore the prefigurations through the drawing of the morphological, typological and technological solutions are at the designer discretion. This is why data and information are often not congruent with the logic of those who analyze them and it must also be said that the case study does not present the development of a project according to the different phases of the building process, but each analyzed project belongs to a distinct phase. During the *definitive* design phase, control drawings emerged. Their object of communication consists in narrating the project idea, now dimensioned and architecturally defined into the given environmental context. Here it has to be distinguish two areas of development of the drawings: (a) building authorization drawings; (b) drawings for the technical-economic evaluation of the project needed to set the lines of development for the executive level. The drawings must also express, through appropriate coded symbols, all the information useful for the control of the technical planning regulations. In general, the drawings of the *executive* phase must respect the indications obtained from the previous level and should offer a both parallel and transversal reading for different areas of study such as: architectural, structural, technological/plant engineering. So the drawings available presented the project starting from an overview in plan, elevations, and sections on a scale of 1:100 or 1:50, until the presentation of the construction detail also in a scale of 1:1. The aim was to transmit the project in its constructive specificity and to highlight: (a) the techniques to be adopted for its realization; (b) the operational aspect of the construction phases [Farroni 2009]. The results of the analysis phase are shown in the table where, for each category, the graphic

apparatus is accompanied by documents that specify the characteristics of the contents. In the research this information was considered as non-graphical input (Fig. 2).

GRAPHIC	preparatory	preliminary	definitive	executive
TECHNICAL		X	X	X
EVOCATIVE	←	—	—	→
NON GRAPHIC	←	—	—	→

Fig. 2. Type of information at different stages of the design process.

GRAPHIC MESSAGE DEFINITION IN THE DIGITAL RECONSTRUCTION PROJECT

For the definition of the graphic message in the digital reconstructions of the unbuilt architecture, the theories by A. Moles [1969] and G. Anceschi [1992] have been taken into account. In fact, according to what Moles reports, in the message there are two points of view that correspond to two types of information: (a) semantic point of view; (b) aesthetic point of view. He argues that the nature of the reaction to the message distinguishes the semantic point of view and the aesthetic point of view. In the research it was considered appropriate to equalize the different graphic phases, corresponding to the levels of architectural design process, at the semantic point of view by Moles, while the aesthetic point of view was used to manage the aesthetic value recognizable in some drawings, which are included in the communication of the project. In fact, the semantic point of view is distinguished by a logical character, recognized rules and coded symbols. Moles says that the semantic point of view is a question addressed to the external world in relation to its state and its material evolution, which serves to prepare a decision (such as manuals and military orders that carry a semantic information or prepare actions and their modalities). This is also the case for the organization of the technical drawings of an architectural project: they structure the development of the project idea and control its constructive possibilities. Again, Moles argues that the semantic information has a utilitarian, logical character, an expressible structure, which prepares the action of understanding and the methods of implementation; its rules and symbols are universally accepted by the receivers, constituting a standardized code. The information is translatable and switchable. The information of the architectural drawings is translated according to the scale of the representation and is switched into *specific graphic experiences* until their realization. Otherwise, aesthetic information does not refer to an universal repertoire, but to the repertoire of knowledge that is common to the transmitter and the receiver. In this specific case, this type of information is linked to the aesthetic value of Cellini's drawings, thus being able to use the concept of *evocativeness*. (Fig. 3).

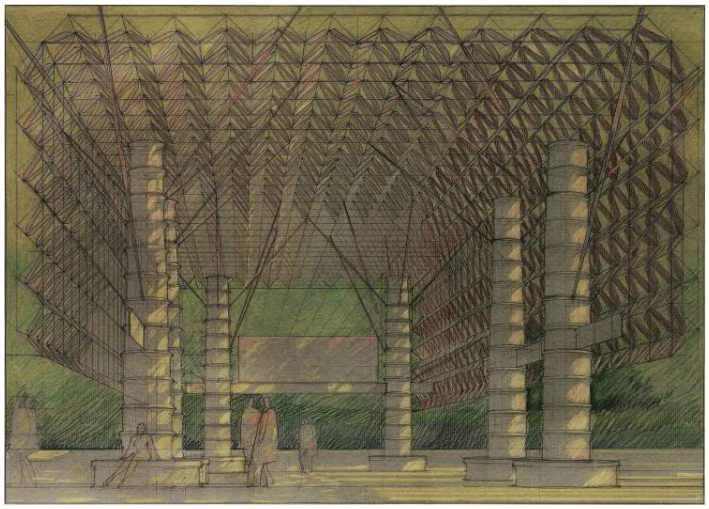


Fig. 3. A perspective drawing by Francesco Cellini characterised by a strong aesthetic value. Project for Piazza dei Cinquecento, Roma (F. Cellini).

As Moles argues, aesthetic information is untranslatable in another language, that is, in another system of logical symbols because this other language does not exist: it is just personal information. It should be emphasized that the aesthetic point of view determines inner states, as shown in the perspective sections drawn by Francesco Cellini. The perspective sections by Cellini are part of the final drawings but are not considered as technical. They present the semantic aspect in the management of the subject, in the relations of balance, of perspective, of the represented objects definition. They also present the aesthetic aspect that is their originality, beyond the phenomenon that Moles considers as redundancy. It is to remember that the latter lets the receiver to recognize the adherence to a style, in the signs and shades, and to constitute a priori knowledge that defines the design style. It also has to be said that the semantic information is addressed to universal aspects and is easily measurable, therefore manageable, while the aesthetic information is random and specific to the receiver and it varies according to the repertoire of knowledge, symbols and a priori structuring. According to Moles theories, in order to support the theory of two coexisting points of view, an external observer is needed. That is, next to the normal source-receiver channel, an auxiliary channel represented by the observer is needed. The observer examines the signals received from the source considering them to be discrete and noise-free, and describes them in a universally intelligible metalanguage [Moles 1969]. In the drawings transcription, the researchers are the observer of Moles' theory.

From the theories by Anceschi reasoning has been made on the object of the representation and on the definition of the visual concept (Fig. 4). It is believed that in virtual reality, the reality is a choice to codify information on both the visual and the interaction levels. In this research, it has been decided to consider only the visual level. D. Marini (a student of Anceschi) speaks of "Degree of Verisimilitude" between the simulated reality and its representation [Marini 2007]. The research faced with a simulated Reality constituted by the real "unbuilt" drawings, a simulated reality that has already been represented. Therefore, the research deals with its representation and with its specific communicative goal. From the theoretical references, it should be noted that the object of representation is the result of a conventional treatment of information. The collection of sources (the drawings) helps to form the visual concept mentioned by Anceschi. The research interpreted the meaning of "visual concept" as the idea (eidos), image, apparition that is created and modified with the acquisition of the sources, the documents that "put before the eyes of the mind" that is complementary to the expression "put before the eyes real and own" (representation). So, an integral vision can be established: a model that can be explored, that is dynamic and practicable, that changes every time new information is acquired. In summary, the important step by Anceschi is that:

> *"The representation and the image consist in a series of operations performed, not on the factuality of reality or even on the actuality of perception but on the always conjectural virtuality of this object/model."*
> [Anceschi 1992]

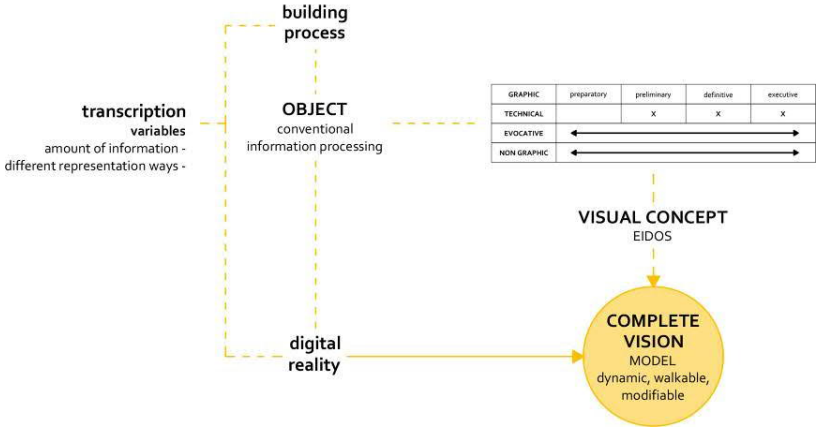


Fig. 4. The idea of Visual Concept in the digital transcription process

THE INTERPRETATIVE VALUE OF THE OPERATOR AND THE REFERENCE TO THEORIES OF RESTORATION

However, the reconstruction process may lead to an object/model that often present incongruent information in its development, some missing parts, some hinted at. In our case, the problem of the "lacunas" emerges, that is, that the design drawings of unbuilt architectures can testify in an incomplete way the work they refer to, thus configuring

themselves as the fragments of an artwork to be restored. The interpretation of the project through the drawing has faced choices and considerations. Useful references in the restoration theory were: (1) the concept of “potential unit” by Cesare Brandi [1963] and (2) the concept of “re-integration” by G. Carbonara [1976] which illustrate the limits and potential of reintegration interventions on pre-existences; (3) Umberto Eco’s theories that show how drawings can be considered as an “open works” or as a field of interpretative possibilities, that allows a series of always variable readings [Eco 1997]; (4) the concept of “deferred execution” by M. Manieri Elia, according to which the project is the only autograph moment of an architectural work, and every architectural works realized (but also unbuilt) are a “deferred execution” of designer’s idea [Manieri Elia 1991]. By transferring these concepts to the drawings of unbuilt architecture, it is possible to consider the drawing interpretation as a sort of digital "laboratory" through which it is possible to analyze drawings details, their graphic and textual notations, to simulate the generative process of the form conceived by the designer.

DISCUSSION: PROPOSAL FOR A LOR LEVEL: LEVEL OF RECONSTRUCTION

It should be emphasized that for the definition of a method for digital reconstructions, the research identified three different levels of the drawings: the archival drawings intended as "zero level", the digital models intended as "transformation level" and the new elaborations intended as "level of completion/reintegration". The use of 3D modelling is chosen as the tool is able to decline the different opportunities offered by the interpretation, allowing their feasibility verification (Fig. 5).

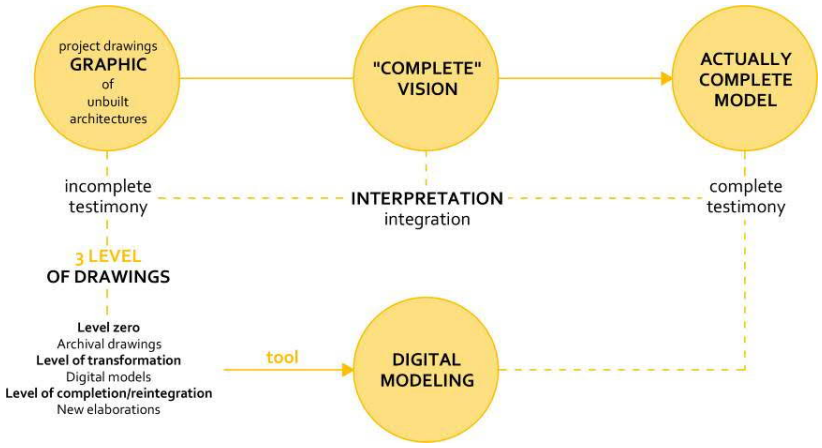
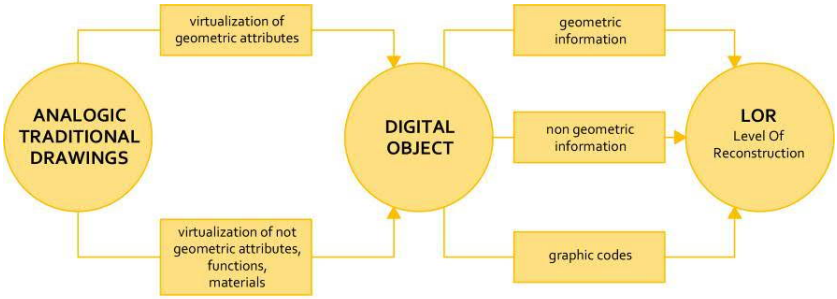


Fig. 5. The role of the interpretation phase into the reconstruction process

The drawings analysis and the considerations made on the interpretations have made clear the need to define a LOR chart, i.e. Level of Reconstruction chart, which would put the visual concept and its integrations into a system. The LOR is defined by geometric and non-geometric information and graphic codes: for both the reconstruction based on data and hypotheses. According to some references on Pavan's “Building Information Modeling” (BIM) theory [Pavan et al. 2017], it is possible to report this scheme that is constituted by: the materials archive drawings (traditional analogical drawings); the virtualization process as the definition of geometric and non-geometric attributes; and the production of a digital object characterized by geometric features/non-geometric information and the definition of a graphic code (Fig. 6).



input	GRAPHIC	preparatory	preliminary	definitive	executive
	TECHNICAL		X	X	X
	EVOCATIVE	◄———	———	———	———►
	NON GRAPHIC	◄———	———	———	———►
Level Of Recontruction (LOR)	LEVEL	A	B	C	D
	GEOMETRY	proportionate volumes	measured volumes	measured volumes	measured volumes
			wall thickness	wall thickness	wall thickness
					wall stratigraphy
					technological detail
	INFORMATION		function of spaces	function of spaces	function of spaces
				materials	materials

Fig. 6. The definition of LOR in relation to the different type of design drawings

Level Of Recontruction (LOR)	LEVEL	A	B	C	D
	GEOMETRY	proportionate volumes	measured volumes	measured volumes	measured volumes
			wall thickness	wall thickness	wall thickness
					wall stratigraphy
					technological detail
	INFORMATION		function of spaces	function of spaces	function of spaces
				materials	materials
	GRAPHIC CODE				
	R. BASED ON DATA				
	R. BASED ON HYPOTHESES				

Fig. 7. LOR levels and their graphic codes

Four LORs are identified: A, B, C, D in ascending order, and the LOR chart is related to the type of drawings (Fig. 7). It should be noted that the table is constructed with the attitude of the philologist that does not exceed the level of design definition proposed by the designer. There is a distinction between the part of the model based on data and that based on hypothesis; the differences are displayed through the definition of the graphic codes. In the definition of the codes visualization, it was taken into account that the reading of the hypotheses is easily recognizable for the territorial scale; while, for the detail at the building scale, the recognizability depends on the distance of the observer as reported by the theoretical assumptions of restoration theories. Below is the specific definition of LOR levels: Level A, in which the model is characterized by proportioned volumes and it is shown with monochrome black/white (Fig. 8); Level B, in which the model is characterized by measured volumes and known wall thicknesses, and it is shown with a gray scale or a single shade (polychrome) – the different shades are assigned to homogeneous groups of elements (Figs. 9-10); Level C, in which, in addition to the information of the previous level, the knowledge of the materials is added and is shown through the colors (correspondence) - assigned according to the materials they refer to (Fig. 11); Level D: in which the model is characterized by measured volumes, known wall thicknesses and defined stratigraphic composition and the presence of technological details. This level is visualized with photorealism - in which in addition to the color of the materials there is also their texture (Fig. 12).

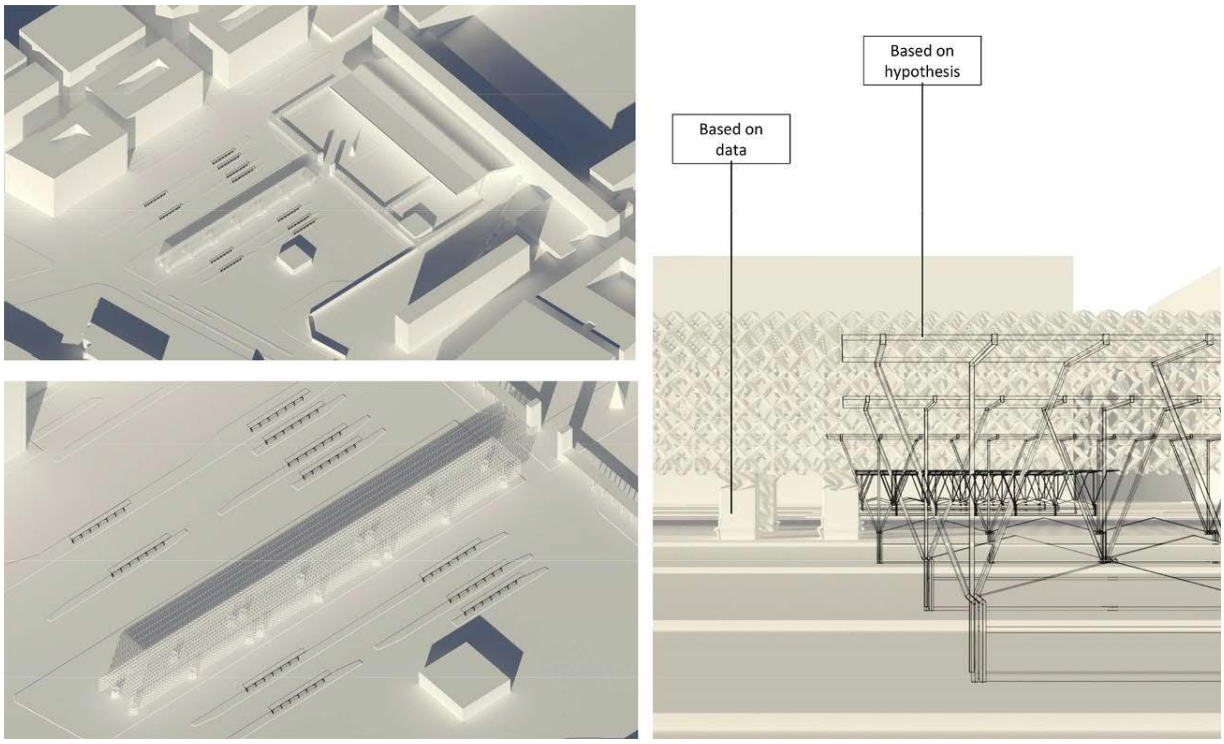


Fig. 8. LOR A: digital transcription of Francesco Cellini project for Piazza dei Cinquecento, Roma

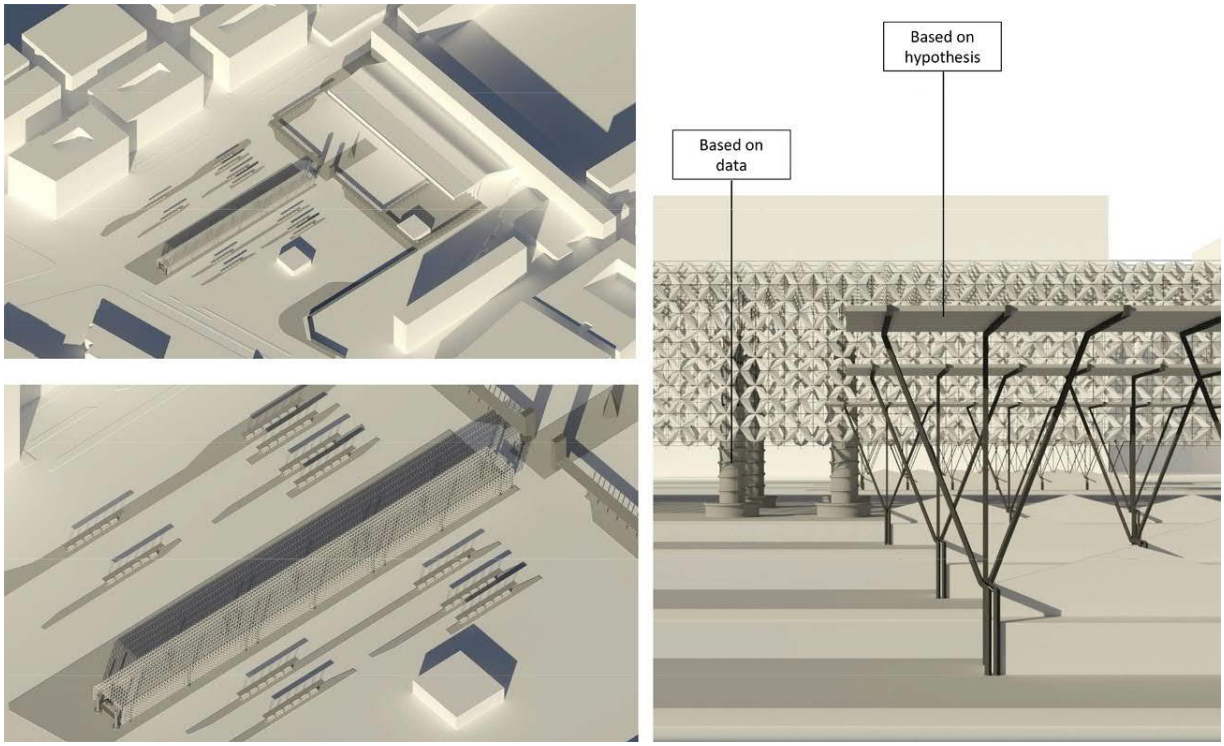


Fig. 9. LOR B: digital transcription of Francesco Cellini project for Piazza dei Cinquecento, Roma

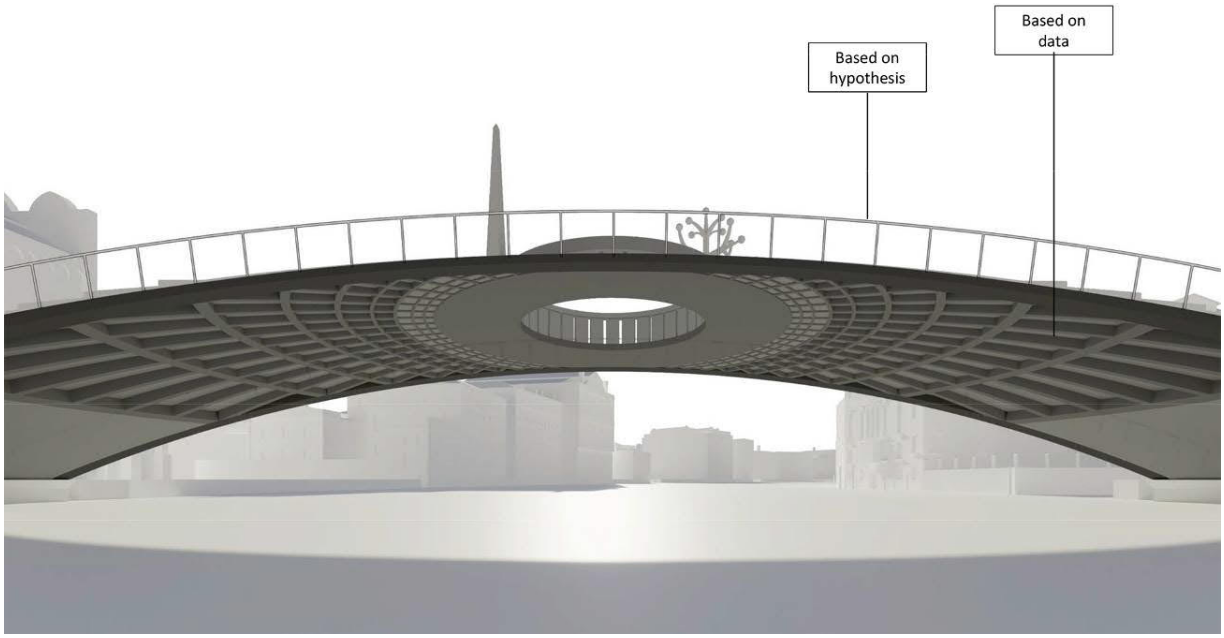


Fig. 10. LOR B: digital transcription of Francesco Cellini project for Ponte dell'Accademia, Venezia

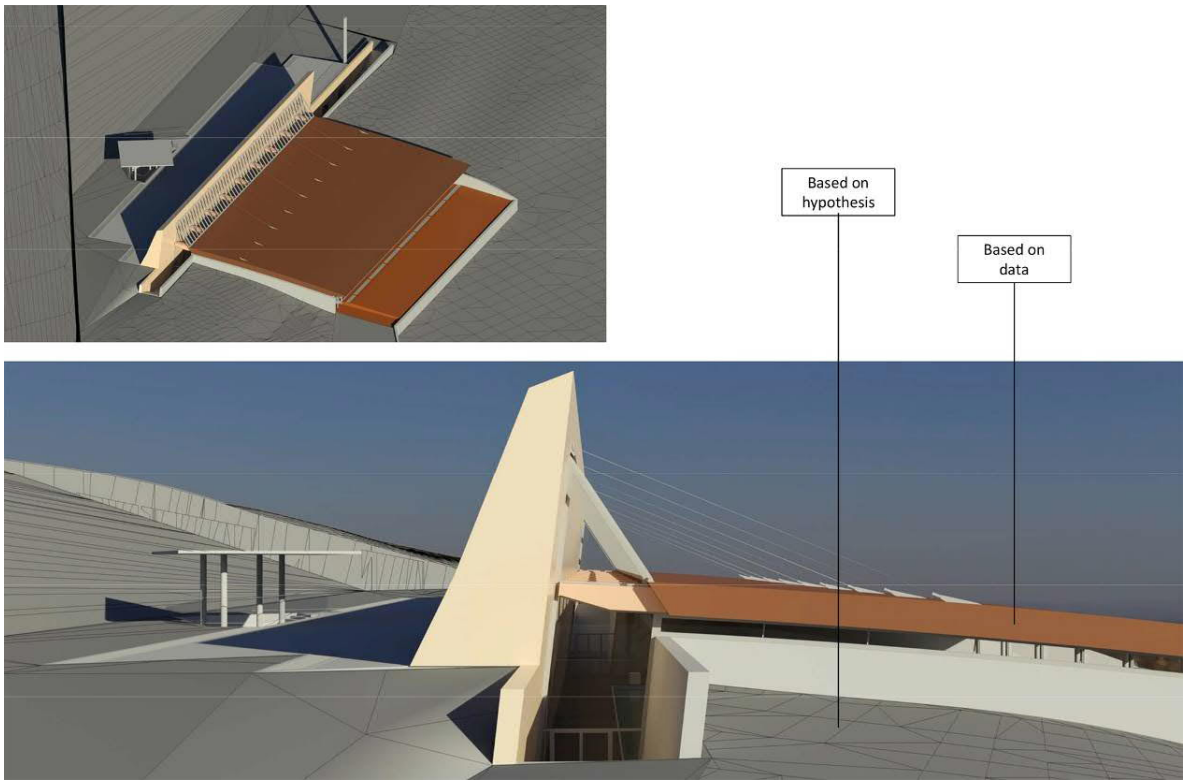


Fig. 11. LOR C: digital transcription of Francesco Cellini project for a pool, Baschi

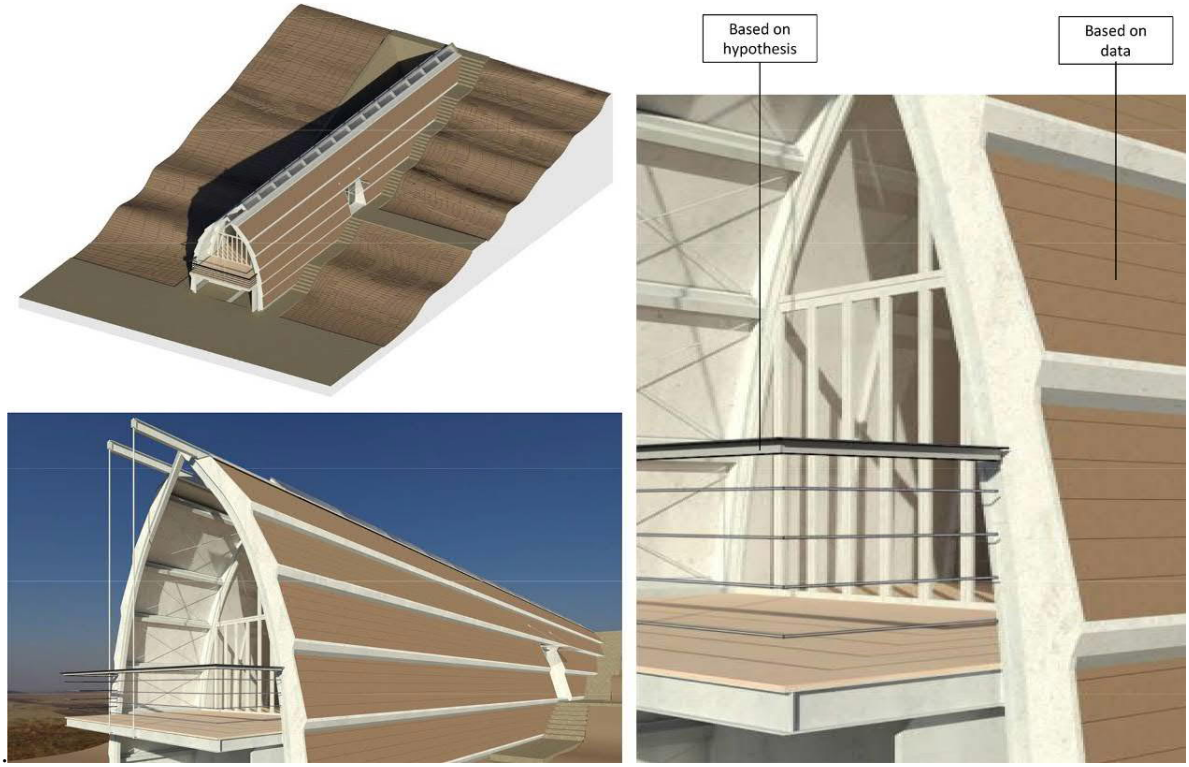


Fig. 12. LOR D: digital transcription of Francesco Cellini project for rowing facility, Baschi

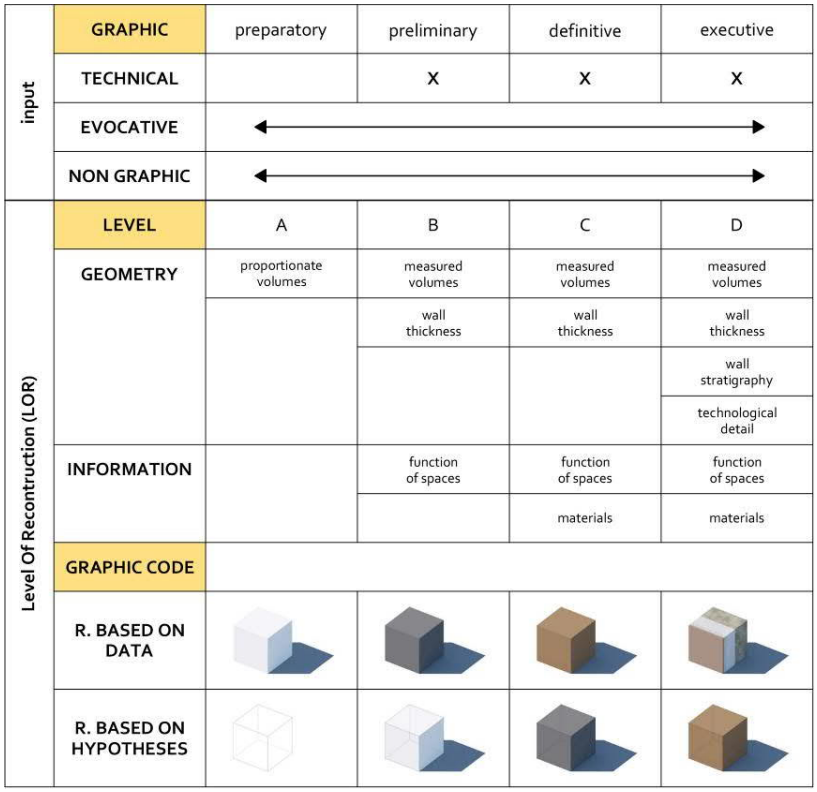


Fig. 13. The chart resumes the whole protocol starting from the archival drawings to the LOR levels definitions

CONCLUSIONS

In conclusion, the proposed chart indicates a protocol for working on a digital transcription process of architectural drawings (Fig. 13) in order to make the 3D modelling process a reliable transcription of the architect's designer intent. The reliability is given by the structure of the model, defined according to the analysis of the original drawings, but also through its visualization where the original and hypothetical data must always be recognizable. In this way it is also possible to check the interpretations both as a choice of technical solutions and as a language. There are many open paths, among these it has been started the semantic structuring of the models [Apollonio 2012] in relation to the belonging LOR. The research also highlighted the need to visualize the graphic style present in non-technical drawings. The definition of the LOR is limited at this moment but effective for the case study. It is intended to widen it according to several cases belonging to different eras: for example by interpreting drawings by renaissance architects where often survey and project coexist in the same drawing. Graphic codes will also have to be expanded as there are many signs that can be detected in analogical drawings that require different reflections in their digital transcription. The authors intend to develop an application capable of concretely managing the modelling through LOR levels.

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