



McDONALD INSTITUTE CONVERSATIONS

# Authenticity and cultural heritage in the age of 3D digital reproductions

Edited by Paola Di Giuseppantonio Di Franco,  
Fabrizio Galeazzi and Valentina Vassallo



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Fabrizio Galeazzi and Valentina Vassallo

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# CONTENTS

Contributors	vii
Figures	ix
Foreword	xi
<i>Introduction: Why authenticity still matters today</i>	1
PAOLA DI GIUSEPPANTONIO DI FRANCO, FABRIZIO GALEAZZI AND VALENTINA VASSALLO	
Defining authenticity	1
Materiality vs constructivism	2
Object biographies	3
Authority and power	3
Experience and performance	4
Structure of the book	5
<b>Part 1 Histories</b>	11
<i>Chapter 1 Cast aside or cast in a new light? The Maudslay replica Maya casts at the Museum of Archaeology and Anthropology, Cambridge</i>	13
JODY JOY AND MARK ELLIOTT	
The Maudslay casts	14
Changing meanings	22
Contemporary role of replicas	22
Conclusions	23
<i>Chapter 2 Authenticity and realism: virtual vs physical restoration</i>	25
LOLA VICO LOPEZ	
Concepts and terminology	25
Principles and norms used in physical restoration and their relevance to the virtual environment	27
Towards a method for virtual restoration	29
Case studies	30
Concluding remarks	32
<b>Part 2 Definitions</b>	35
<i>Chapter 3 Digital Authenticity and the London Charter</i>	37
SORIN HERMON AND FRANCO NICCOLUCCI	
The London Charter – preamble and current situation	38
The London Charter principles	39
Summary and conclusions	44
<i>Chapter 4 Digital heritage objects, authorship, ownership and engagement</i>	49
STUART JEFFREY	
Authorship and ownership	49
Transience	53
Future recording	54
Conclusion	54
<b>Part 3 Practices</b>	57
<i>Chapter 5 Evaluating authenticity: the authenticity of 3D models in archaeological field documentation</i>	59
PETER JENSEN	
Observation and interpretation in archaeology	60
Conceptualized authenticity in archaeological documentation	64
Conclusion	72

<i>Chapter 6</i>	Virtual authority and the expanding role of 3D digital artefacts	75
	KEVIN GARSTKI	
	Photography and its similarities to 3D scanning	75
	Case study 1	77
	Case study 2	78
	Discussion	79
<i>Chapter 7</i>	Volatile images: authenticity and representation and multi-vocality in digital archaeology	83
	GARETH BEALE	
	Mediating authenticity	83
	Case study 1: Basing House zine printing	85
	Case study 2: Microlith	88
	Case study 3: Re-reading the British Memorial	90
	Conclusion	92
<b>Part 4</b>	<b>Uses</b>	95
<i>Chapter 8</i>	Ektypa and 3D models of Ektypa: the reality(ies) of a digital object	97
	ELENI BOZIA	
	Thoughts on authenticity	98
	Digital epigraphy: a new version of epigraphy or a new-found authenticity	100
	Copy vs. original: how a copy verifies the original	102
	Conclusion	108
<i>Chapter 9</i>	Theorizing authenticity – practising reality: the 3D replica of the Kazaphani boat	111
	NICOLA AMICO, P. RONZINO, V. VASSALLO, N. MILTIADOUS, S. HERMON AND F. NICCOLUCCI	
	The 3D replica of the Kazaphani boat. A case study of a fragile archaeological artefact	112
	Visitor's experience: 'A wonderful deception!'	118
	Conclusions	120
<i>Chapter 10</i>	Pitoti Prometheus, virtual reality 360: Valcamonica rock art between naturalism and alienation	123
	FREDERICK BAKER	
	Digital vs virtual	123
	Naturalism – recording rock art	125
	Naturalism and authenticity – the fourth dimension, time	127
	Alienation	128
	Arts-based research	129
	Conclusion	132
Index		135

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## Figures

1.1	<i>Stela E from Quirigua; old MAA, Little St Mary's Lane, Cambridge, 1885.</i>	15
1.2	<i>The Maudslay Hall, MAA, c. 1970, showing the Winchester Cathedral choir screen and the Maudslay casts including Zoomorph P</i>	16
1.3	<i>Casts, Maudslay Gallery, either side of the Haida totem pole.</i>	16
1.4	<i>Zoomorph B from Quirigua; entrance corridor to the Babington Gallery.</i>	18
1.5	<i>Dismantling the cast of Zoomorph P for transport to London. Summer 1979.</i>	19
1.6	<i>Dismantling the cast of Zoomorph P for transport to London. Summer 1979.</i>	19
1.7	<i>New display, Andrew's Gallery of World Archaeology; cast of Stela E from Quirigua.</i>	20
1.8	<i>Casts from lintel 16 of House F at Yaxchilan, Mexico; now on the wall of the Clarke Gallery.</i>	21
2.1	<i>Outline detail of the method of analysis for hypothesis elements in architectural 3D restoration.</i>	29
2.2	<i>Triclinium after the restoration work, 1937; drawing by Cacchiattelli-Cleter 1865.</i>	30
2.3	<i>MidasGen, stresses sig. Z-Z, X-X; structural analysis; virtual restoration.</i>	31
3.1	<i>The church of the Christ Antiphonitis, Kyrenia, from outside.</i>	39
3.2	<i>Some of the repatriated frescoes.</i>	40
3.3	<i>Documenting the fresco fragments.</i>	41
3.4	<i>3D point cloud of the interior.</i>	41
3.5	<i>Last judgement (northern wall). 36 fragments virtually re-located (72 per cent of the scene).</i>	42
3.6	<i>Tree of Jesse (southern wall). 32 fragments virtually re-located (77 per cent of the scene).</i>	42
3.7	<i>Last Judgement. Preserved in-situ frescoes in red, areas with missing frescoes in green.</i>	43
5.1	<i>Skelhøj. Rectification, mosaicking and vectorization of turf structures in a Bronze Age barrow.</i>	62
5.2	<i>Composite of 3D Structure from Motion documentation of human bones, alongside geological section in Alken Enge.</i>	63
5.3	<i>The Jelling Complex. Levels of uncertainty indicated by varying transparency.</i>	65
5.4	<i>The Jelling Complex. Excavated areas shown in white.</i>	66
5.5	<i>Plan drawings of postholes show the architectural similarities between viking age buildings.</i>	67
5.6	<i>Photos of the reconstructed houses at Trelleborg and Fyrkat.</i>	68
5.7	<i>Archaeo online database.</i>	69
5.8	<i>3D model of the planned physical palisade reconstruction and exhibition wall backdrop.</i>	70
5.9	<i>DR News online depicting the Borgring visualization.</i>	71
6.1	<i>Three digital 3D models of a Herakles head from Athienou-Malloura.</i>	78
6.2	<i>3D model of a Roman lamp reproduction, photogrammetry.</i>	79
6.3	<i>The initial 3D model of a Roman lamp reproduction; the altered 3D model using Adobe Photoshop.</i>	79
7.1	<i>GCI rendering of a room interior from Basing House; one of the digital image types to be included in the zines.</i>	85
7.2	<i>The zines.</i>	86
7.3	<i>Centrefold layout of prints and drawings by Peter Driver and students displayed in Volume 4 of the Basing House pamphlets.</i>	87
7.4	<i>Games and things to find on site.</i>	88
7.5	<i>The microlith.</i>	89
7.6	<i>RTI of an incised stone captured during a Re-Reading the British Memorial church survey.</i>	90
7.7	<i>Normal map; one of several imaging modes available easily to the viewer of an RTI file.</i>	91
8.1	<i>Scriptorium monk at work.</i>	98
8.2	<i>Court of Casts in the Victoria and Albert Museum.</i>	99
8.3	<i>Illustration of the Digital Epigraphy Toolbox's 3D digitization process.</i>	102
8.4	<i>Illustration of the analysis of lettering techniques.</i>	102
8.5	<i>1907 Cornell expedition making an ektypon at Quru Bel, Arslan Tash.</i>	103
8.6	<i>Ektypa of the Res Gestae of the emperor Augustus.</i>	103
8.7	<i>Ektypa of the Res Gestae of the emperor Augustus.</i>	104
8.8	<i>Photograph of the Res Gestae inscribed on the Monumentum Ancyranum, Ankara, Turkey, 1883.</i>	105
8.9	<i>Res Gestae of the emperor Augustus: 3D model of the Ektypa.</i>	106
8.10	<i>Visualization of the 3D ektypon with the original ektypon surface.</i>	107
9.1	<i>From the real artefact to the 3D physical replica.</i>	112

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9.2	<i>The 3D scanning of the Kazaphani model boat.</i>	113
9.3	<i>Creation of the 3D digital model.</i>	114
9.4	<i>The replica of the Kazaphani model boat in two pieces.</i>	115
9.5	<i>The completed assembly of the two pieces.</i>	115
9.6	<i>Engraving the marks of the joints from previous conservation.</i>	116
9.7	<i>Application of the binder agent.</i>	116
9.8	<i>The colouring of the replica.</i>	117
9.9	<i>Details of the 3D replica.</i>	118
9.10	<i>The 3D replica exhibited at the Smithsonian behind glass.</i>	119
10.1	<i>Prometheus on Seradina 12a. Still from 'Pitoti Prometheus' Dir. Baker 2016.</i>	124
10.2	<i>Sunset on Seradina 12a with ploughing scene.</i>	126
10.3	<i>Baker Illus 3 'The Hunt' Dir. Kren 2012.</i>	129
10.4	<i>'The Gladiators' Animation Production still for 'Pitoti Prometheus' Dir. Baker 2016</i>	131
10.5	<i>Baker Illus 4 The Plough. Animated preproduction still from 'Pitoto Prometheus' Dir. Baker 2016.</i>	131

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## Chapter 2

# Authenticity and realism: virtual vs physical restoration

Lola Vico Lopez

Computer assisted design and imagery can achieve a very high level of realistic representation, depicting space, forms and colours in a manner that simulates and emphasizes the visual experience. This realistic representation may however not be authentic, nor a genuine reproduction of the artwork.

Technological development in the area of computer assisted design and animation, e.g. 3D digital modeling, has been much faster than theoretical development. Principles and criteria for evaluating historical analyses and hypotheses underpinning projects have been developed after virtual environments where used in archaeology. Although the London Charter (Beacham et al. 2006; Denard 2012) and the Seville Principles (2011) highlighted the principles of scientific visualization and the need for a formalization of reconstructive processes, these documents provide general guidelines but no prescriptive rules or standards to guide the practitioner.<sup>1</sup>

In contrast, architectural restoration is a well-established scientific field, with numerous practical applications. Since virtual restoration shares the notions of authenticity and scientific transparency with physical restoration, one can attempt to establish a theoretical framework for virtual restoration, based on the codes and standards developed for physical restoration.

The goal of this paper is to demonstrate how virtual restorations can borrow and adopt the theoretical framework of architectural restoration. A prerequisite in regards to this is to take a critical look at the contraposition between virtual and physical restorations. This will be framed and contextualized in the context of the Restoration Charters, whose articles can be applied to virtual restorations. In this paper, we will review and discuss the terminology and concepts that can be extrapolated to the virtual area, propose method for virtual restoration and illustrate these concepts and methods through practical case studies.

### Concepts and terminology

In this section, we review key concepts of physical restoration and their relevance to the field of computer assisted design and imagery.

#### *Authenticity*

Umberto Eco (1968) used to say that restoration and philology share the same impulse: one conserves ancient literary texts and the other concerns ancient architecture, both in order to continue enjoying them. Every time a restoration is performed it partially changes the meaning of the building. Wondering whether the result is authentic could seem irrelevant, as authenticity works for mobile and transportable object, which is not the case of a building. In his treaty on general semiotics, Eco states that 'the taste for authenticity is an ideological product of a commercial society: privileging the original one is like privileging the first copy of a numbered edition of a book instead of the second: suitable for antiquarian booksellers but not for literary critics'.

The conservatism prevailing in architectural restoration theory nowadays has caused a relative non-interventionism among architects. A number of monuments are thus left abandoned and suffer from their physical environment. A fetishist conception of archaeological ruins is still frequent, which, as noted prof. Paolo Marconi (1993), comes from the 'fin du siècle' decadent romanticism. The overvaluation of the 'value of antiquity' that comes from the ancient heritage and Renaissance theme '*memento morti*' or '*et in arcadia ego*', generates a taste for the decadent aspect of archaeological ruins, prevailing on the restored monument. For example, there is still an excessive romantic valuation of moss-covered atriiums and falling holes that was the specialty of Piranesi in the eighteenth century. This artist added an aura of mystery to the monuments with the presence of invasive vegetation such as mosses,

lichens and climbing plants covering the building, but in practice this romantic perception should be evaluated against the good conservation of monuments.

From the 1820's the reproduction of artworks or architecture became unpopular in Italy, considered as fakes (thus not authentic). Antiquarians were the only able to certify the authenticity of works of art. Their assessment was based, and is still based, on the autography of objects and on *morellians* details that are useful in the field of painting, but much less when assessing architectural sculpture and architecture. It can be argued that an excessive value is given by antiquarians to the notion of authenticity, as a means of raising the *antiquity value* of the objects. Considering the latter, Riegl declared that is the best recognizable and recognized value appreciated by the uneducated masses confronted with historical heritage (Riegl 1987).

Authenticity has two interpretations: on the one hand it is the measure of the genuineness of an object in its physical dimension, and on the other hand it is the correctness of its use compared to original conditions (Hajnóczy 1995). Authenticity may thus be considered either from the theoretical or practical aspect. At the Nara Conference in 1994, different visions on authenticity were discussed, stating that the term authenticity has different meanings, changing from one country to another. However, The Nara Document on Authenticity (UNESCO 1994) did not receive widespread acceptance, and old restrictions reappeared in the Charter of Krakow (2000) six years later, recommending to avoid 'the reconstruction of whole parts of the building'.

If the multiple dimensions of authenticity are acknowledged, then one should not safeguard the physical appearance only, but also building techniques, original function, archaeological findings, and environs (Von Droste & Bertilsson 1995). This variety of views about authenticity results in different approaches to conservation. Some decide to preserve the original, even when it is incomplete, while others prefer to have a complete image of the original shape (even with the use of new material). And, for other groups yet, it is the location that is most important. A framework developed to address authenticity should take this diversity into consideration (Galla 1995).

From a theoretical perspective, it is advisable to clarify the meaning of authenticity that is best suited to the cultural heritage being examined before every restoration. This may be relative to various sources such as design and form, usage and function, traditions and techniques, location and settings, materials and substance, etc. The use of these sources permits the elaboration of the specific artistic, historic, social,

and scientific dimensions of the cultural heritage (UNESCO 1994).

From a practical point of view, interventions on architectural heritage involve a complex catalogue of decisions, which must be studied and will have different approaches depending on the type of 'authenticity' that is sought, without excluding the complete reconstruction.

Architecture function and significance are connected and form the 'architectonic authenticity' that should prevail over 'material authenticity'. For example, a vault fulfilling its function as originally designed, even if rebuilt with new bricks, masonry and voussoirs is more authentic in terms of architecture, than a vault where the original construction materials have been preserved but cannot fulfil its function because materials have lost their mechanical capacity. In this regard, genuine values of architecture (form, space, structural system, materials, textures, etc.) that have been accredited by scientific research as originals, deserve to be preserved (or recovered, if lost), and transmitted to future generations.

*Restauro* is defined by Cesare Brandi as any intervention aimed at making a product of human activity more effective; as opposed to *preservation* which is *preventive restoration* (Brandi 1977). To use Brandi's own words, '[...] an activity dealing with extending the life of a work of art and restoring its appearance [...] any operation that aims at putting back into effective order a product of human activity'.

The philological debate on *Virtual Restoration* began in 1994, when Gianfranco Fiaccadori (Moschini 2001), professor of philology, suggested the use of these two terms together to name the methodology that consisted in applying digital techniques in the field of restoration. With new data acquisition technologies and 3D digital models, there is no structural alteration of the cultural heritage object. Furthermore, given the power of computer assisted data acquisition, management and analysis, the documentation (González Moreno-Navarro 2000) of the artwork can be augmented (e.g. 3D digitalization of the entire artwork or building) and various sources and types of information can be simultaneously accessed, analysed and integrated in the conservation process.

According to Brandi (1977), the practitioner must act on the aesthetic appearance of the cultural asset, while documenting it from its historical dimension. In this sense, we shall use an instrument that does not alter the physical structure of the object, and so as to preserve their authenticity; which is one of the key issues in physical restoration.

Virtual restoration is generally not supported by the methods and restrictions that are applied to



physical restoration work, since there is no physical (material) intervention. The process however involves a number of hypotheses and interpretations which affect the authenticity of the result. In this regard, principles of the Charter of Restoration shall be considered, not because they preserve the heritage in its materiality, but because they preserve its meaning. The term immaterial applied to architecture advocates an architecture that fuses the immaterial and the material, and considers its consequences, challenging preconceptions about architecture, its practice, purpose, matter and use (Hill 2006).

Let's also remember here that as a result of the absence of physical interventions, virtual restoration does not provide any form of protection against the degradation caused by the physical environment.

*Virtual reconstruction* involves using a virtual model to visually recover a building or tangible object made at a given moment in the past. The process relies on physical evidence available, rigorous comparative inferences and other studies carried out by archaeologists and other experts in relation to archaeological and historical science (Seville Principles 2011). While virtual restoration considers the appearance, purpose and use of the original object, virtual reconstruction limits itself to a visual product, proposing a hypothesis of the physical appearance of the original object.

*Anastylosis* is an architectural term for a reconstruction technique whereby a damaged building or monument is restored using the original architectural elements to the greatest degree possible while new parts are made visible through the use of distinct material. With digital anastylosis, concepts linked to the meaning, usage and memory of the architecture heritage will be recovered, and they will appear in the Restoration Charter of 1987 (ICOMOS 1987a). Digital anastylosis allows the reconstruction of architecture only if based on evidence (in situ or documentary), validated typological parallels, or on established constructive and functional knowledge.

*Virtual conservation* can be applied to knowledge about purpose and use, as well to the representation of the object, but not to the object itself.

The term conservation is defined as follows in the Washington Charter for the conservation of historic towns and urban areas (ICOMOS 1987b): 'to conserve is the supreme preservation principle. Together with stabilization and safeguarding measures, conservation work that protects the fabric of a monument and prevents its further loss should therefore have absolute priority over all other measures. [...] All those measures that serve the preservation of the fabric of a monument are to be counted as conservation work. Conservation includes consolidation of the historic fabric of a

monument, and in general all measures preventing further decay and preserving the historic fabric'.

The last concept we review here is *ripristino*, best exemplified by Viollet-le-Duc, who stated in his Dictionary of French architecture from the eleventh to the sixteenth centuries that: 'to restore a building, is not to maintain, repair or rebuild, it is to re-establish it in a complete state that may have never have existed'. About its application to virtual technology, García Cuetos (2009) proposed that 'computer assisted creation, misnamed virtual reality, aims at being real and may thus be seen as a *ripristino* since some consider it as endowed with the emotional charge of the original monument itself.'

### Principles and norms used in physical restoration and their relevance to the virtual environment

#### *The Italian Restoration Charter of 1972*

The theory and history of physical restoration, which started with experiments on the ancient monuments in Italy at the beginning of the eighteenth century, can provide a theoretical framework for virtual restoration.

The Italian Restoration Charter of 1972 by Brandi (1977) is the first document that describes the concept of reconstruction in the field of cultural heritage, building on the concepts of anastylosis and restoration. Articles 6 and 7 are of particular relevance here:

Article 6 prohibits any completion of unfinished work in style, analogical, in simplified form, or even if there are graphic or plastic documentation illustrating the intended form of the completed work. It stipulates that it will be forbidden to remove or demolish from the artwork traces left by its passage through time, unless these features are of limited scope and incongruous or disfiguring in relation to the historical values of the artwork, or if they are completions in style that counterfeit the nature of the work.

Article 7 allows anastylosis, only when carefully documented and completed by reconstructing missing sections with techniques clearly discernible to the naked eye such as using lighter or neutral materials, setting them at a different level from the original parts, or leaving in sight the original support, however never reconstructing *ex novo* missing figurative sections and inserting important features that will alter the figurative nature of the work.

According to these articles, the Charter accepted only partial anastylosis, not admitting any other type of possible reconstruction. A large number of interventions were excluded by Brandi given his conceptual consideration of the artwork. The theory proposed by Brandi was largely replaced by the 1987 Charter (ICOMOS 1987a) but his initial position had strongly marked the history

of Italian restoration and has also had a strong influence in Europe. The origin of this development in Italy is to be seen in the effects of numerous earthquakes during the 70s, leading to the need to document and maintain traditional buildings (Jiménez 1997).

Articles 2, 8 and 9 of Brandi's Restoration Charter (1977) also provide relevant elements for digital restoration of architecture.

Article 2. 'In addition to items listed in Art. 1 [architectural monuments, painting and sculpture even if in fragments, palaeolithic artifacts, figurative expressions of the popular cultures and contemporary art], the present guidelines will apply to the following categories of objects to assure their preservation and restoration: building complexes of monumental, historical, or environmental interest, in particular historical urban areas; art collections; historic furnishings and interior decors preserved in their traditional arrangement; gardens and parks of particular importance'.

Article 8. 'Any work done on the artwork [...] must be executed in such way and with such techniques and materials that will not obstruct or prevent preservation or restoration work in the future. Moreover, every intervention on the artwork must be preceded by a written report that documents the artwork and explains the motivations for the work to be done'.

Article 9. 'The use of new procedures and materials for restoration, instead of those currently used or permitted, will have to be authorized by the Ministry of Education, with the explicit consensus of Istituto Centrale del Restauro. This institution's role will be to actively advise the same Ministry and to discourage the use of antiquated, damaging or untested materials and procedures, to suggest new ones, and to determine the need of outside resources in terms equipment and specialists not available within their organizations'.

Brandi restoration theory relies on the recognition of art in its physical substance and its dual aesthetic and historical dimension. The image of the artwork itself is immaterial, as reveals itself in every observer, each time it is perceived. An artist produced the artwork in a creative process that ended with its completion. From the recognition of this duality (matter and content) in which the content is the result of a completed process, stems Brandi's first principle that only the matter of an artwork may be restored. Restoration must aim at re-establishing the potential unity of the artwork, as long as this is possible without producing an artistic or historical faux and without erasing the passage of time. This is immediately relevant to virtual restoration. The reproduction of the initial shape of the monument through digital technologies or physical intervention shall not leave room for misunderstanding about modifications over time.

An important aspect to consider in the rules of restoration is the reversibility of the actions performed (article 8). In this regard, the digital model has a great advantage over traditional physical restoration interventions as this tool is not invasive and can serve to visualize and analyse various options prior to the physical intervention.

#### *Applying architectural knowledge to virtual restoration*

Drawing from the above, we propose seven principles for the recognition of architectural authenticity in 3D digital models.

- i. Digital models, just like real architecture, depend on the environment and culture in which they take place. The insertion of virtual restorations of ancient heritage within current context implies an anachronism that can obstruct the perception of represented reality. In this regard, it is essential to contextualize the architecture in order to simulate an appropriate environment.
- ii. Architecture is not only form but also expression; there is a dialectical relationship with its substance. The expression through digital models eases the disclosure of certain elements, since 3D spatial modeling avoids issues relating to two-dimensional coding systems.
- iii. Architecture does not exist without structure: it is part of its nature and it is expressed through its laws. As in the case of buildings, when an architectural virtual model is prepared, explaining and documenting the structural performance of the building is essential.
- iv. History is not only the language of architecture, it also carries its substance, therefore architecture will not be historicist, but historical. Digital models allow us to integrate historical information and new data, easing access, analysis and understanding.
- v. Function drives the organic arrangement of the buildings, but can sometimes be partially disconnected from architecture. The virtual model allows us to explore interactively and in real-time the architectural space, including the access to different information levels. This helps understanding the building and allows us to integrate various levels of information.
- vi. The stylistic unity represents a system of decoupled behaviour from the different architectural parts, and it is organized by contrast, denying linguistic monotony. Virtual models enable the representation of different parts of the building or heritage site and at different historical moments.

vii. Symmetry represents the harmonious relationship between the parts of a building also with respect to the whole artwork. The symmetry is therefore not a simple repetition or rotation, but the tautological use of structural components, represented autonomously and as a whole.

### Towards a method for virtual restoration

In light of the foregoing elements that is, on the one hand the concepts of the Restoration Charters, and on the other hand the knowledge of the science of architectural design construction, Vico (2012) proposed a method for virtual restoration of architecture. The method builds on the physical architectural restoration to bring scientific rigor into the process of digital modelization.

The initial step is to describe the life of a building, from its original construction to its modification caused by use, change of styles or past conservation interventions, as a process of historical loss, consolidation and superposition of old and new elements. All these elements will inform and guide any new proposal. The method proposed by Vico (2012) follows the structural equilibrium and constructive rules, in addition to the philological method, studying every architectural element from a dimensional and static approach as we deal with architecture which was built in the past.

Figure 2.1 displays the operating diagram of phase 3 of this method. This phase corresponds to a detailed level of visualization in which 2D hypotheses are made. Every element will be calculated individually but also in the general context.

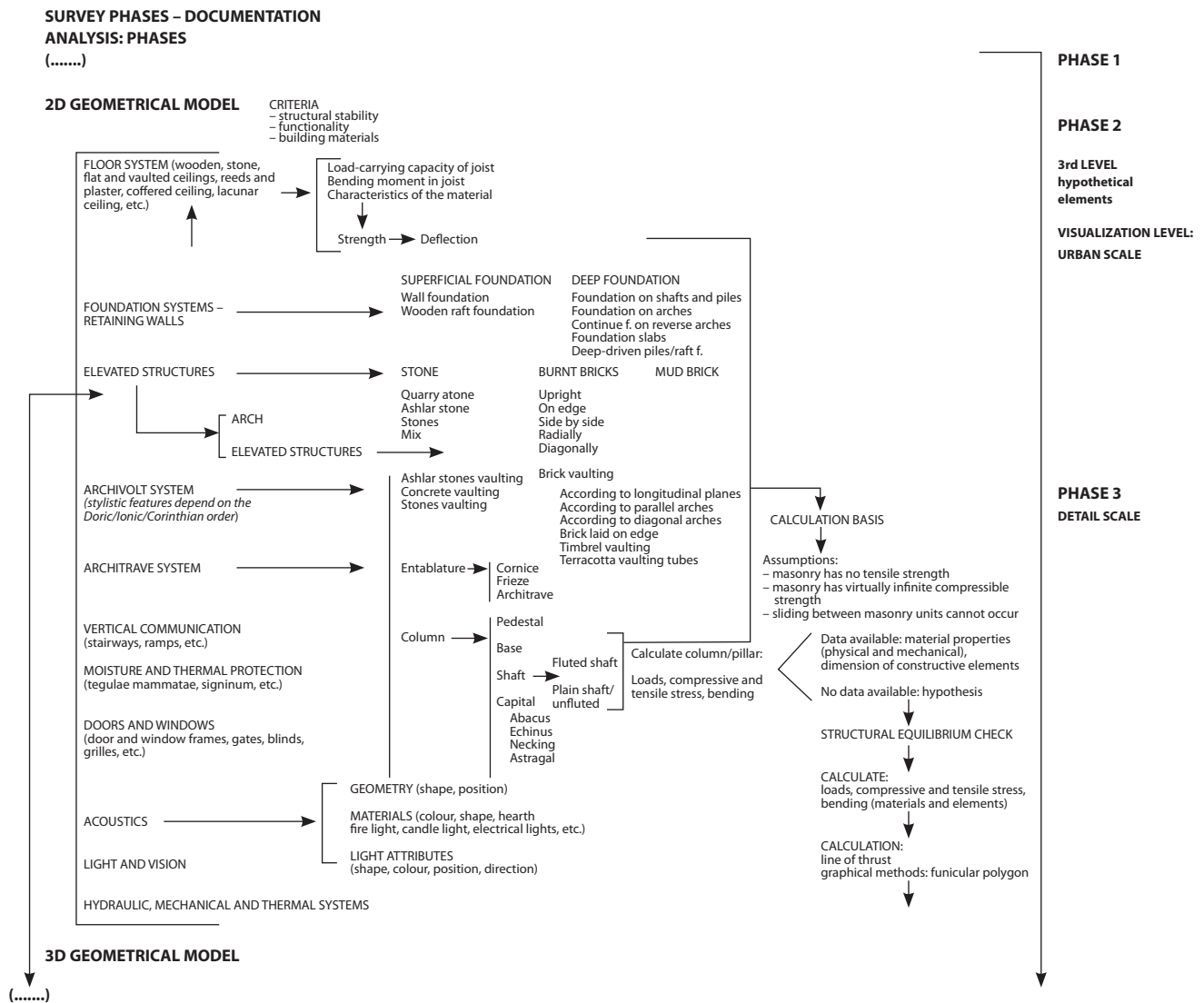


Figure 2.1. Outline detail of the method of analysis for hypothesis elements in architectural 3D restoration (Vico 2012).



The method proposed by Vico (2012) also provides guidance for the management and display of the information used in the virtual restoration process, and the related uncertainty. This addresses an important need in view of the discrepancies between the different techniques proposed for acknowledging and documenting uncertainty in restorations: in some cases, the validation of the 3D model is achieved through the assessment of consistency with documentary sources (Borra 2004); other modelers use stratigraphic approach (Demetrescu 2015); while in other cases yet, documentary sources are gathered according to *levels and classes* (Viscogliosi et al. 2006) or according to *typologies* (Dell'Unto et al. 2013). Basically, the decision is left to the choice of the modeler, and generally ignores architectural criteria.

### Case studies

In this section, we propose two case studies that illustrate the notions of authenticity in virtual and physical restoration. The first one also illustrates how the application of the method introduced above can effectively improve the authenticity of the proposed restoration.

#### *Villa of Livia*

In this example of the subterranean triclinium of the Villa of Livia in Prima Porta, we analyse a room built in the first century BC and rebuilt in 1937. This room was discovered in 1863 (Fig. 2.2), and was described by Sulze (1932). According to Messineo (Calci & Messineo 1984), the original dome which covered the triclinium collapsed with the earthquake of seventeenth century BC and the room was filled with debris. A new room was built posteriorly, on top of the ancient triclinium.



The reconstruction of 1937 covered the space with a barrel vault, with windows for light and ventilation. It was made without due consideration for the geometry of the room, or for the natural terrain. Furthermore, this restoration involved the loss of archaeological remains that were not documented.

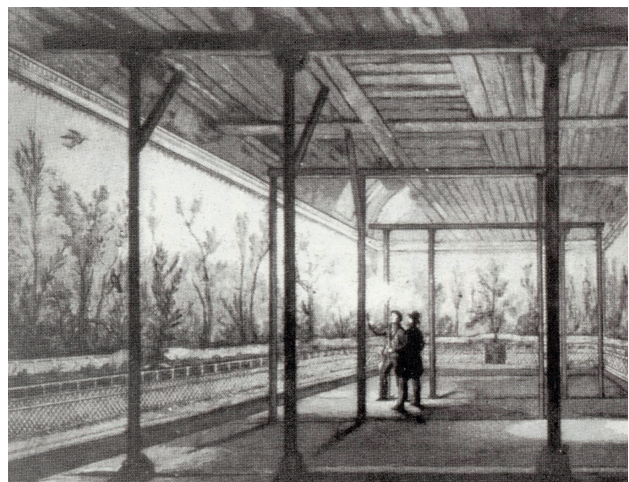
In the virtual restoration based on the method described above, Vico (2012) opted for a lowered vault to cover the hypogeum triclinium, following the description of Sulze (1932) that is coherent from a typological and structural point of view. Furthermore, the proposal was based on an analysis of the structural elements that led to the collapse of the structure during the earthquake. By lowering the vault to 3.58 m. height as described by Sulze (1932), the horizontal component of the thrust increases and the vertical component of the thrust transmitted decreases, which is compatible with the way the structure collapsed.

This restoration hypothesis also relies on assumptions, but these are based on constructive logic which was not the case for the 1937 reconstruction. For example, the material used for making the vault is known to resist between 30 and 70 kg per cm<sup>2</sup>, by comparison with other *opus caementicium* vaults contemporary in the same area.

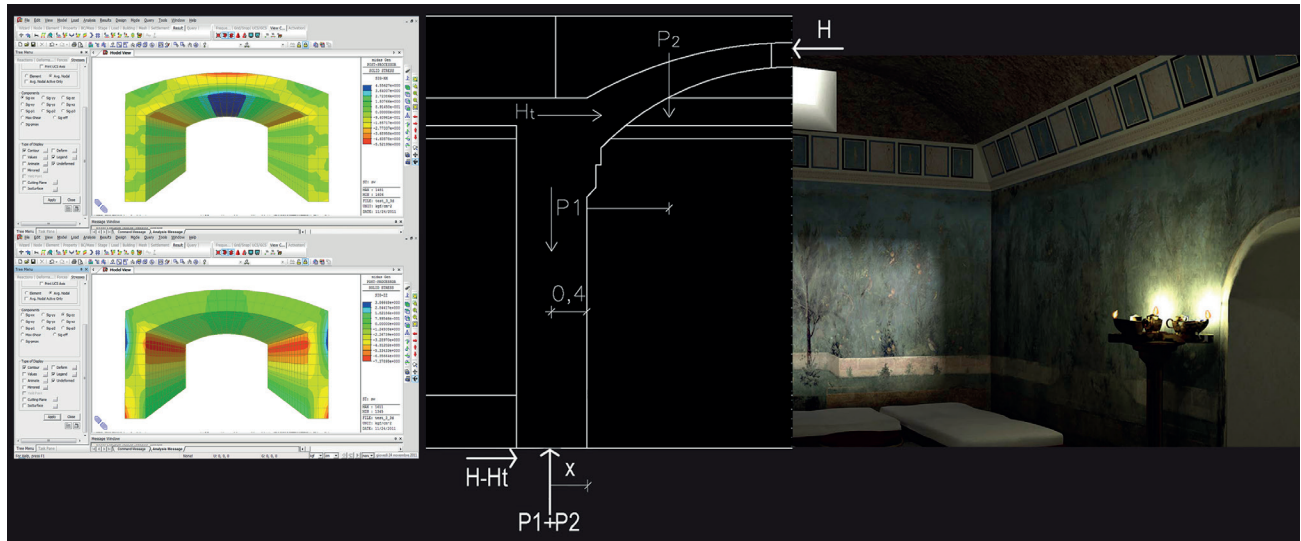
It is suggested that the proposed restoration hypothesis is compatible with existing data, documentary sources available, terrain levels and architecture equilibrium (Fig. 2.3, centre, left), and thus more authentic than the 1937 physical restoration.

#### *The House of the Silver Wedding*

The House of the Silver Wedding is another example of how a lack of architectonic criteria is perceivable in real and virtual restoration. This Pompeian house



**Figure 2.2.** Left: Triclinium after the restoration work, 1937. Right: Drawing by Cacchiatelli-Cleter 1865.



**Figure 2.3.** Left side: MidasGen, stresses sig. Z-Z, X-X. Centre: structural analysis. Right: virtual restoration.

was built around 300 BC and renovated in the early first century AD. Its architecture style is classical and it bears fine decoration. For example, the atrium has four tall Corinthian columns supporting the roof, and an ornamented exedra.

The house was subject to restorations in the 30's and 60's using iron and reinforced concrete. They transformed original roofs, lintels and wooden floors using new and highly perishable material and structures, since the iron, also in reinforced concrete, does not last more than 30 to 50 years at the most. Using wood, as in the original building would also have been

preferable in view of lower maintenance requirements and better durability in case of earthquake, due to its light weight and elasticity.

In Figure 2.4, the left picture shows the Corinthian atrium after the first restoration of lintels with concrete but respectful of the original wooden architecture features, such as cymatium and gutter. The central image shows the Corinthian atrium after the restoration in reinforced concrete of the 60s, without any consideration for the original features of the wooden architecture, possibly guided by a conservative approach. In these two restorations, formal aspect



**Figure 2.4.** Corinthian atrium of villa delle Nozze d'Argento, Pompeii. Left: restoration of the 30s. Centre: restoration of the 60s. Right: virtual restoration by C. Fabius.



has been altered, as well as the building performance, and its language.

In comparison, the virtual restoration proposed by Caius Fabius (Fig. 4, right) is not authentic in terms of architecture: for example, the impluvium, ground levels, and the columns, bases and capitals are different from original.

Both case studies illustrate the many common elements between virtual and physical restoration. With the virtual restoration we can illustrate the process of developing a hypothesis (fig.3), but also create a historical fake altering the sense of architecture, even if virtual reality does not alter the physical structure.

### Concluding remarks

The support of modern technologies allows the general public to have access to information and virtual restorations, which can reach high levels of realism in the representation of artwork. This is a valuable asset in communicating and valuing ancient architecture among the non-specialist.

Virtual restoration however is still a discipline under development in the area of archaeological research, and there is a strong contrast between the impression of realism that virtual models confer and the many uncertainties and hypothesis associated with their production.

As early as 1924, Adolf Loos warned against the tendency to create new architectural ‘esperantism’, saying that an architect is a builder who has learnt Latin. In ‘Ornament and Education’ (Loos 1924) the author contrasts the architect who has knowledge of the past to the modern architect who has only experience of the present to rely on. Knowing the architectural grammar is the first step to decoding and interpreting architecture. Because of its strong realism, virtual restoration can easily result in historical fakes, so it is important to work with a rigorous method to improve authenticity and *build* the virtual restorations and clearly document sources of information and hypotheses.

As it will be further discussed in this volume (Chapter 3), transparency in the process of data elaboration is essential: it requires us to work with an open and accessible system that enables the interested public to access all available data, as well as the analytical and decision making processes used to propose the restoration hypotheses. The 3D virtual model can incorporate much data associated with different elements, joined by a common reference system that allows the interrelation between databases. From a constructive point of view, it thus represents a very important tool for better understanding historical buildings. 3D virtual model also has advantages when

it comes to the dissemination of this information to the wider public.

Following the constructive approaches introduced here, a virtual restoration of architectural elements can be done with a high level of certainty. Decorative aspects are however subject to greater uncertainty, since their reproduction depends on documentary sources and typological parallels. The decoration plays a key role in the perception of architecture, but the realism of the representation supported by 3D virtual model can overshoot authenticity, since the only way to control the hypothesis is by stylistics validation.

As opposed to physical restorations, 3D virtual models allow us to perform computer based simulations and analysis: once geometry is reconstructed, it is possible to simulate lights, acoustic or structural behaviour of the building and materials. This can be a first step towards physical restoration, allowing not only aesthetic simulations but also the analysis of functional aspects.

In physical restoration any intervention needs to be distinct from the original artwork composition and must bear a distinctive ‘contemporary stamp’ in order to preserve the authenticity of a structure. In addition, physical restoration must stop at the point where conjecture begins. In the virtual domain, restoration is not intrusive and can thus go further in proposing a ripristino of the artwork, if there is an explicit and scientific method to explain the level of authenticity of the intervention, and document the data and process that lead to the restoration hypothesis.

### Notes

- 1 For a critical review with bibliography about the lack of scientific accuracy and methodological consistency in Virtual Reconstruction, see Beacham et al. (2006) and Denard (2012) in the new introduction to the London Charter, p. 57, footnote 2.

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