

A Study on the Concept of Restoration through the Kaesong Manwoldae Digital Restoration Platform: Focusing on Cesare Brandi's Restoration Theory and the Concept of *Unità*

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Abstract

With the expansion of digital heritage practices, the concept of “restoration” has increasingly been applied in digital contexts. However, this trend has blurred the boundaries between restoration, reconstruction, simulation, and imaginative projection, weakening the philosophical legitimacy of restoration itself. This study revisits the proper criteria for applying the concept of restoration in digital environments, focusing on Cesare Brandi's restoration theory, particularly the notion of *unità potenziale* (potential unity). It argues that even without physical intervention, digital restoration must meet the ethical and philosophical standards inherent to restoration. To examine practical applications, the study analyses the Kaesong Manwoldae Digital Restoration Platform, which was designed to distinguish between conservation and reconstruction, thereby ensuring authenticity is clearly conveyed to users. This research asserts that the concept of restoration must continue to be grounded in ethical and philosophical principles in the digital age and proposes concrete strategies for implementing this standard.

1. Introduction

With the rapid rise of digital heritage, the term “restoration” has been increasingly applied to digital domains. In numerous projects that employ 3D scanning, digital modeling and virtual reality technologies, attempts to reconstruct forms that are no longer extant in the physical world have become commonplace, and such activities are now routinely labeled “restoration.”

Yet this practice is more than a simple extension of terminology; it represents a misuse – or at least an undifferentiated use – of the concept, stripped of the philosophical foundations on which restoration was originally built. Restoration emerged within the field of material conservation and was shaped through rigorous philosophical and aesthetic debate. Nevertheless, many virtual reconstructions conducted with digital technologies borrow the word “restoration” without adequate reflection on its original meaning and criteria.

This uncritical expansion blurs the boundaries among restoration, reconstruction, and imaginative projection across today's digital heritage projects, thereby weakening the theoretical legitimacy of the notion of restoration itself and causing confusion about the authenticity of the resulting content for viewers and users.

Scholars and practitioners have long recognized this issue. Various initiatives have sought to clarify the notion of restoration in digital visualization; most notably The London Charter (2009) and the Principles of Seville (2011) set out guidelines for transparency and the clear and explicit indication of the interpretative basis in digital visualization and virtual archaeology. Both documents stress that any digital restoration outcome must specify its evidential basis and level of conjecture so that audiences can distinguish fact from hypothesis, thereby establishing an ethical foundation for digital heritage practice.

Yet these frameworks remain advisory; they lack enforceability and leave considerable latitude undirected and unguided in practice. Moreover, few studies have fully integrated the

philosophical and aesthetic foundations of restoration or examined the ethics of digital intervention at an interpretive level. Consequently, the most crucial issue – the legitimacy of restoration itself within digital heritage practice remains theoretically fragile, calling for renewed philosophical clarification.

To sharpen the meaning of “restoration,” this study focuses on Cesare Brandi's theory of conservation, and particularly his key notion of *unità potenziale* (potential unity). Brandi regarded restoration not as a mere repair of form, but as an epistemic act aimed at recovering the aesthetic and conceptual unity of a work of art – an absolute criterion and minimal condition for any restorative endeavor. Building on Brandi's framework, the paper asks what standards must be met, and what conceptual distinctions should be observed, if the term *restoration* is to be legitimately applied in a digital context.

To test how such philosophical standards may operate in practice, the study analyses the case of Kaesong Manwoldae Digital Restoration Platform, which the author designed and developed. The platform deliberately marks a conceptual boundary between the conservation of extant remains and the imaginative reconstruction of lost elements, embedding that distinction in its technical architecture so that the ethical and theoretical criteria of the notion of restoration are enacted rather than merely asserted. By aligning theory with practice, the paper ultimately proposes a clearer and more coherent use of the term *restoration* in digital heritage workflows.

2. Revisiting Cesare Brandi's Concept of *Unità* in Conservation Theory



Figure 1. Cesare Brandi's "Teoria del Restauro" and its English Translation "Theory of Restoration".

Cesare Brandi (1906-1988) was a philosopher and art historian whose work profoundly shaped modern theories of cultural heritage conservation. His seminal book, *Teoria del Restauro* (1963), systematized the philosophical and aesthetic discourse on the conservation and restoration of works of art. Published the year before the 1964 Venice Charter, the treatise exerted a decisive influence on that foundational document, and Brandi himself was closely involved in its drafting.

As founding director of the *Istituto Centrale per il Restauro* in Rome, Brandi advanced both practical and theoretical approaches to the conservation and restoration of artworks. His ideas continue to serve as international reference points, and their core principles remain operative in contemporary conservation practice.

Although numerous subsequent scholars have expanded and refined Brandi's theory, the philosophical foundations he laid out still constitute one of the most authoritative and reliable theoretical frameworks for conservation and restoration of cultural heritage.

2.1 Philosophical Foundations of Conservation and Restoration

Conservation and restoration are often taken for granted as self-evident practices, yet strictly speaking, no one possesses an absolute right to intervene in cultural heritage. Their legitimacy must therefore be secured through philosophical and ethical justification. Brandi grounded this justification in a phenomenological notion of recognition: only by recognizing heritage objects not as mere physical matter but as carriers of historical and aesthetic meaning can intervention be justified. This phenomenological stance reframes conservation and restoration not as a purely technical measure but as a philosophically accountable act, supplying the ethical bedrock upon which conservation and restoration must rest.

Restoration, then, is not merely a technical action to repair damaged artwork, but fundamentally an act of recognizing and understanding it. In *Teoria del Restauro*, Brandi defines restoration as:

"Il restauro costituisce il momento metodologico del riconoscimento dell'opera d'arte, nella sua consistenza fisica e nella sua duplice polarità estetica e storica, in vista della sua trasmissione al futuro." (Brandi, 1963/1977)

This can be translated as follows:

"Restoration constitutes the methodological moment in which a work is acknowledged as both a physical entity and a bearer of intertwined aesthetic and historical values, undertaken so that it may be handed down to future generations."

This definition clarifies that restoration transcends technical intervention: it is a process of rediscovering and recovering a work's intrinsic value, ensuring that its historical traces and aesthetic significance are conveyed accurately to contemporary audiences and to posterity.

In other words, restoration is not about altering or arbitrarily modifying the work of art; it is about safeguarding its inherent meaning and authenticity so that viewers may perceive the work rightly and without distortion.

2.2 Meaning and Conditions of *Unità*

Another key notion in Brandi's theory – central to the present study – is *unità potenziale*. Brandi explains the concept as follows:

"Il restauro deve mirare al ristabilimento dell'unità potenziale dell'opera d'arte, purché ciò sia possibile senza commettere un falso artistico o un falso storico, e senza cancellare ogni traccia del passaggio dell'opera d'arte nel tempo." (Brandi, 1963/1977)

In English, this may be rendered:

"Restoration must aim at re-establishing the work's potential unity, and in doing so must not create artistic or historical falsehoods, nor erase the traces that attest to the work's passage through time."

2.2.1 Ontological Wholeness: The term *unità* here does not denote mere visual coherence or surface uniformity; it concerns the restoration of the work's essential, ontological wholeness. Even when portions are damaged or lost, the surviving parts must still be apprehended as a single integrated entity. An intervention in heritage may thus be called "restoration" only when it seeks not perfect replication, but a condition in which the work's original meaning can be adequately conveyed.

2.2.2 Principles of Restoration derived from the notion of *unità*: Based on the notion of potential unity of cultural heritage, Brandi formulates three principles of restoration.

"Il primo è che l'integrazione dovrà essere sempre e facilmente riconoscibile; ma senza che per questo si debba venire ad infrangere proprio quell'unità che si tende a ricostruire. Quindi l'integrazione dovrà essere invisibile alla distanza a cui l'opera d'arte deve essere guardata ma immediatamente riconoscibile, e senza bisogno di speciali strumenti, non appena si venga ad una visione appena ravvicinata." (Brandi, 1963/1977)

This is the first principle, which is about distinguishability. Rendered in English:

"First, any integration must be readily distinguishable, yet without disrupting the unity intended to be reconstructed. In other

words, retouching should be invisible at the normal viewing distance of the artwork but immediately recognizable, without special instruments, when observed at closer range.

"Il secondo principio è relativo alla materia di cui risulta l'immagine, la quale è insostituibile solo ove collabori direttamente alla figuratività dell'immagine in quanto cioè è aspetto e non per tutto quanto è struttura. Da ciò deriva, ma sempre in armonia con l'istanza storica, la più grande libertà di azione relativamente ai supporti, alle strutture portanti e via dicendo." (Brandi, 1963/1977)

The second principle is about the material. Translated:

"The second principle concerns the material that constitutes the image. Where the material contributes directly to the work's figurative aspect – as appearance rather than structure – it is irreplaceable. By contrast, in supports and other structural components, the restorer can have greater latitude of action, as long as all interventions remain in harmony with the object's historical context."

"Il terzo principio si riferisce al futuro: e cioè prescrive che ogni intervento di restauro non renda impossibili anzi faciliti gli eventuali interventi futuri." (Brandi, 1963/1977)

The third principle is a note about the concept of so-called reversibility. In English:

"The third principle looks to the future. Every restoration must not hinder, but rather facilitate any potential interventions yet to come"

2.3 Distinguishing Restoration from What Is Not Restoration

Brandi clarifies the very nature of restoration by distinguishing it from concepts that may appear similar yet are fundamentally different.

2.3.1 Scholarly Conjecture (historical research) is Interpretation, Not Evidence: Historical documents and records can provide essential baseline information for restoration, yet they must not be taken as complete and incontrovertible evidence. Historical research is inherently an interpretation. Eventually, filling lacunae with informed inference—rather than presenting absolute proof of what once existed—becomes the very essence of it. Consequently, historical research should serve as a guide to restoration, not as its ultimate foundation.

2.3.2 Imagination and Reconstruction Are Not Restoration: Brandi explicitly rejects the creative or arbitrary reconstruction of lost portions of a work. He labels such interventions *restauro di fantasia* – imaginary restoration – warning that they risk infringing upon the artist's original intent and distorting the intrinsic value of the piece. Authentic restoration must respect the essence of the work and proceed from what genuinely survives.

2.3.3 The Risks of Forgery and Falsification: Altering a work without adherence to its stylistic or periodic characteristics, or deliberately manipulating its historical truth during restoration, constitutes either *falso artistico* (artistic forgery) or *falso storico* (historical falsification). Brandi condemns such actions as violation of authenticity that deceive the viewer. Restoration must therefore preserve and safeguard the work's truth to the greatest extent possible.

3. Misuse of the Restoration Concept and Confusion of Practice in Digital Contexts

3.1 Expansion of the Restoration Concept through Digital Technologies

Advances in digital technology have dramatically altered the ways in which cultural-heritage practice is conducted. Technologies such as 3D scanning, digital modeling, virtual reality (VR) and augmented reality (AR) now make it possible to visualize damaged heritage and have prompted an extension of conventional conservation concepts beyond physical space into virtual environments.

During this process, the term "restoration" has been progressively broadened; in practice, activities that can be more accurately described as reconstruction, simulation or interpretive visualization are frequently carried out under the name of "digital restoration."

The problem is that this enlargement has proceeded without adequate philosophical reflection or reference to conservation theory. The freedom of expression and technical flexibility of the digital environment tend to blur the boundaries of the restoration concept, producing a situation in which non-restorative acts are labelled "restoration" without proper justification.

3.2 Examples of Misuse in Digital Practice

Two common cases illustrate how "restoration" is misapplied in digital settings:

3.2.1 Arbitrary Choice of Visualized Moment - Temporal Distortion : Suppose an archaeological site survives only as ruins, yet a black-and-white photograph documents its appearance at a particular moment in the past. That photograph likely represents the most reliable form verifiable today. Digital projects, however, often invent an imagined "*golden-age*" state—more ornate and spectacular—and present this conjectural reconstruction as a "restoration." Such work, undertaken without securing *unità*, amounts to romanticized memory or visualized imagination. To merit the term *restoration*, evidence more trustworthy than the photograph must exist; otherwise the result should be classified strictly as interpretive visualization.

3.2.2 Justification by "Historical Research" - Imagined Completions: A second case concerns the reconstruction of missing portions of a sculpture. Based on surviving fragments and historic research about comparative sources, practitioners may reconstruct the lost parts through interpretive imagination, craft a detailed 3D model, and present the finished image while claiming it has been "restored through scholarly research." Yet historical research is a mere act of interpretation that involves inference and comparison, not objective proof of unity; it cannot by itself guarantee the work's potential wholeness. Brandi regarded such interventions as "fictitious insertions masquerading as unity," categorizing them as reconstructions or even forgeries, rather than restorations.

These practices risk conveying distorted notions of authenticity and reliability to users, ultimately undermining the legitimacy of the very term *restoration*.

3.3 Proposal for More Elaborated Distinction of Concepts

Digital environments alleviate many constraints encountered in physical restoration—material decay, structural limitations, and so forth—and advances in visualization technology enable diverse forms of distinguishability. Yet this very freedom can jeopardize the conceptual boundaries of restoration. Inventions without evidence, modelling driven by subjective interpretation and the over-realistic presentation of reconstructed outcomes occur with increasing frequency; when such practices are performed under the label of “restoration,” they not only use the concept misappropriately but also convey distorted information and interpretations to audiences.

Admittedly, Brandi’s arguments were formulated with physical heritage in mind. Nevertheless, the essential point remains: restoration can claim legitimacy only when grounded in philosophical, aesthetic and ontological reflection. Whether the object of intervention is real or virtual, the act implicates cultural responsibility and interpretive weight beyond mere visual composition.

Therefore, even in digital contexts, the term “restoration” should not be employed arbitrarily; it is appropriate only when the philosophical implications and interpretive responsibilities of restoration are fulfilled. Other practices ought to be clearly identified as *reconstruction*. This is not a matter of terminological fastidiousness but a prerequisite for the theoretical coherence, epistemic transparency and ethical commitment upon which digital-age heritage practice must rest.

4. Applicability of Brandi’s Theory to Digital Practice

Cesare Brandi’s restoration theory was formulated within the domain of physical conservation, so its direct application to digital contexts encounters clear limits. Nevertheless, the theory’s philosophical foundations remain valid for digital-heritage practice. In particular, Brandi’s notion of *unità*, as a condition for recovering a work’s unity and authenticity, can still function as a conceptual touchstone in digital environments.

Digital restoration, being free from physical intervention, offers a technically unconstrained arena; yet the semantic weight of the word “restoration” must remain unchanged. The digital medium cannot relax or substitute the criteria of restoration, for the very use of the term implies authenticity and factual reliability to the viewer.

Accordingly, this study proposes the following reinterpretation of Brandi’s *unità*-based principles for application in digital practice.

4.1 Distinguishability

Because physical differentiation is impossible in digital space, restoration and reconstruction must be conceptually distinguished and visually, structurally, informationally expressed explicitly.

Example: represent extant archaeological remains and hypothetical components with distinct visual cues inside the digital model, or convey their status through metadata or the user interface, thereby preventing informational distortion.

4.2 Documentation and Transparency

Brandi’s axiom—“do not intervene in the material that constitutes the image”—cannot be applied literally in the digital realm. To prevent historical falsification while preserving authenticity, just as Brandi intended, the rule can be reframed as follows:

- Every digital-restoration project must explicitly record the provenance of each component, the evidential level and the degree of interpretive input in metadata.
- Version control, traceability and interpretive transparency are essential to guarantee the credibility of the results.

4.3 Reversibility → Flexibility, Sustainability and Plurality of Interpretation

As digital restoration does not intervene in physical matter, informational flexibility and sustained accessibility supersede traditional reversibility. This can be replaced with aligning concepts such as FAIR principles (Findable, Accessible, Interoperable, Reusable) that are being highlighted among researchers recently.

The environment should safeguard multiple interpretive possibilities, avoid imposing any single digitally produced outcome as the definitive “restoration,” and foster an open space in which communities and experts can revise, debate and expand the work over time.

These conditions are indispensable for protecting the historical and aesthetic authenticity of heritage and for securing the ethical legitimacy of digital restoration.

Such practices must rest on a clear understanding of restoration and a prior distinction from reconstruction, as discussed in earlier sections. The paper therefore proposes, with due caution, that future creations based on scholarly conjecture or research—not aimed at nor capable of recovering potential unity—be referred to as “**digital reconstruction**” rather than “restoration.”

5. A *Unità*-Inspired Case in Digital Heritage – The Kaesong Manwoldae Digital Restoration Platform



Figure 2. Kaesong Manwoldae Digital Restoration Platform Runtime Screen.

Kaesong Manwoldae, a Goryeo-dynasty royal-palace site, lost all its buildings to a fire some 650 years ago; only the foundations remain. From 2007 to 2018 South- and North-Korean scholars carried out eight joint excavation seasons. Subsequent political

tension and sanctions linked to North Korea's nuclear program have barred South-Korean researchers from further on-site access. To sustain research and organize the amassed data without returning to the site, a digital-platform project was launched in 2021.



Figure 3. Actual Photo of One of the Excavated Remains of Kaesong Manwolade.

The Kaesong Manwoldae Digital Restoration Platform is a product of fundamental reflection on the essence of "restoration" and its practical application. Rather than merely visualizing the site or presenting imaginative reconstructions, the project structures information and deploys technology in line with conservation philosophy. The following analysis maps the project to the *unità*-based digital-restoration principles outlined in Section 4.

5.1 Distinguishability: Technical Separation of Restoration and Reproduction Grounded in Conceptual Division

The Kaesong Manwoldae Digital Restoration Platform began by drawing a strict conceptual line between *restoration* and *reconstruction*. The first design task was to recognize and separate the excavated remains—verified through archaeological excavation—from superstructures built on historic research and imagination.

The remains, as physical heritage, were treated as objects of conservation, and their visualization followed principles of factual recording and preservation. By contrast, the superstructures, lacking direct evidence, had to be explicitly identified as imaginary reconstruction scenarios derived from interpretation and historical research.

Accordingly, every item in the visualized dataset is marked, both visually and technically, as either restoration or reconstruction, enabling users to see immediately what evidential status underlies each element.

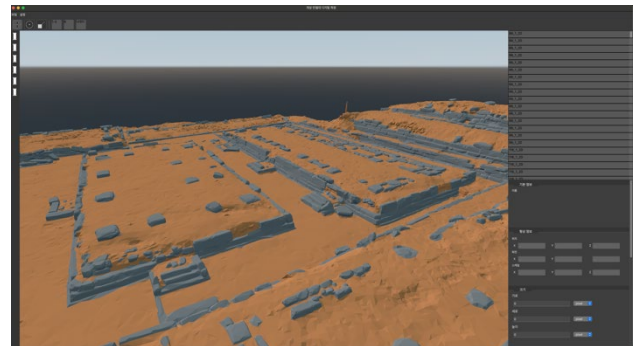


Figure 4. Visualized Result of Excavated Remains in Figure 3, Running on the Platform.

5.2 Documentation and Transparency: Structuring Information

To guarantee accurate recording of reconstruction result and interpretive transparency, the platform makes metadata structuring a core design principle.

Data on the extant remains are rigorously organized with Building Information Modelling (BIM), creating architectural units that can serve as baseline data for future physical conservation or maintenance.

Conversely, as reconstructions of the superstructure rest on varying levels of inference such as archival sources, expert opinion, comparable examples, they have been explicitly tagged in the metadata with their evidential basis and degree of interpretation. Scholars and users can thus assess how each model was composed and how conjectural it is.

5.3 Embracing Plurality and Safeguarding Interpretive Openness

Rather than offering a single "correct" outcome, the platform fosters an environment in which multiple interpretations can coexist. This approach counters the limits of authority-driven restoration and points toward a future where diverse viewpoints inform digital restoration.

To that end, the system provides a user-friendly 3D modelling interface. Traditional architectural components are modularized so that users can assemble and propose their own scenarios.

Such architecture aligns with the FAIR principles—Findable, Accessible, Interoperable, Reusable—and demonstrates how contemporary digital practice can rise from Brandi's philosophical foundations. Especially as "Reusability" here means not one fixed narrative but a reusable environment in which multiple ideas can flourish, it aligns with ethical direction for digital restoration.

In sum, the platform offers a philosophically informed, technically realized model that makes the nature of every piece of information transparent to viewers. Restoration is an act to secure unity. Reconstruction, on the other hand, is experiments with open interpretation. Both are valuable cultural acts, and an architecture that distinguishes yet integrates them points to an ethical future for digital heritage.

5.4 Limitations and Implications

The Kaesong Manwoldae platform demonstrates the practical viability of applying classical conservation theory to digital heritage, yet it also exposes limitations. Within the platform, metadata and visual cues clearly separate restoration from reconstruction, but many users still perceive any 3D rendering as restoration. This reflects a structural misunderstanding that the visual form itself appears to automatically confer authenticity.

This is because the persuasive power and visual completeness of digital visualization can cause audiences to accept outputs uncritically, without questioning authenticity. Even when metadata distinguishes restoration from reconstruction, transparency fails if users lack the literacy to interpret those cues. Hence, technical separation alone is insufficient; guidance and education aimed at raising conceptual understanding of restoration and literacy must accompany digital practice.

This raises the practical question of how to extend Brandi's theory—where restoration is completed through cognitive interaction with the viewer—into digital space. Authenticity may be less a matter of objective reality than of interpretive positionality. Digital restoration must therefore attend not only to *what* is shown but to *how* it is received, calling for tighter integration between philosophical reflection and user-experience design in future work.

6. Conclusion

This paper has argued for a philosophical re-grounding of the term "restoration"—now indiscriminately applied in digital-heritage practice—through Cesare Brandi's theory, with special emphasis on his concept of *unità*. Restoration is not simply an act of achieving visual completeness; it is an ethical practice aimed at recovering aesthetic and historical unity, a mandate that remains unchanged in digital environments.

Contemporary digital workflows frequently conflate reconstruction, scholarly conjecture and imaginative visualization under the label of "restoration," thereby jeopardizing the concept's credibility and authenticity. Restoration must always rest on evidential judgment, while interpretive constructions should be clearly identified as reconstructions.

The Kaesong Manwoldae Digital Restoration Platform demonstrates a philosophically informed and technically executed separation between restoration and reconstruction. By distinguishing the excavated remains, which require conservation, from speculative reconstructions, which foster interpretation, the platform maximizes the value of both and communicates the nature of each information layer transparently to users—pointing the way toward more authentic digital-heritage practice.

Brandi's philosophy of restoration remains valid even in an era led by digital technology, and every undertaking that claims the name of restoration must be evaluated against that philosophical yardstick. Ultimately, what matters more than technology is the question of what we are entitled to call restoration; the ethical stance we adopt in answering that question will determine the future of digital heritage.

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