



# Plaster Casts, Augmented. Architecture in the Museum and the Impact of Digital Media

## Francesca Torello

Among museum plaster casts, those of architecture have a peculiar status. They are not complete replicas of originals, as is the case for statuary, but copies of pieces, fragments or portions of buildings —one historical response to the problem of exhibiting architecture in a museum gallery. The complex relationship of plaster casts of architecture with their originals is at the origin of the Augmented Reality experience *Plaster ReCast*. Through the lens of this digital media project, the essay examines how digital reproduction techniques are changing our relationship with many tenets of modern culture: the concept of authenticity, the role of museums in our society and also the way we look at the objects contained in them.

### KEYWORDS

Plaster Casts, Exhibiting Architecture, Architecture Pedagogy, Augmented Reality, Digital Media

### PALABRAS CLAVE

Vaciados de yeso, exposición de arquitectura, pedagogía de arquitectura, realidad aumentada, medios digitales

### 1. ASKING REPLICAS QUESTIONS

On June 16, 2022 Simon Jenkins published in *The Guardian* a political commentary entitled: “The answer to the Parthenon marbles dispute: George Osborne and a 3D printer”<sup>1</sup>. The article refers of course to the famous and age-long quarrel about the substantial portion of frieze

detached from the Parthenon and brought to London by Lord Elgin in the early nineteenth century. Later purchased by the British Museum, the statuary is still exhibited there today, despite numerous Greek efforts

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Fig. 01

*Plaster ReCast Augmented Reality app. Play testing in the Hall of Architecture, Carnegie Museum of Art, Pittsburgh, PA, USA. Still from Video, Make Media, 2018.*

over many decades to obtain its repatriation. These efforts include the recent creation of a Museum in Athens, which could very well house the statues in the vicinity of their original site on the Acropolis.

After many years of attentively following this controversy and reading opinions in favor or against repatriation, I still found the article particularly striking, because of the language it adopts to discuss the nature and role of the replicas of the Parthenon marbles. Replicas, it argues, represent a radical new opportunity to solve this century-old dispute. The article describes copies made from the same marble and technically so good that they will be “indistinguishable from the originals, blemishes and all”, so that the question will cease to be related to aesthetic considerations and will become strictly political—at which point the author clearly sides in favor of the Greeks against “the hoarding instincts of the British Museum staff”.

Yet the technical perfection we can obtain today is just one more level of refinement in the already very sophisticated culture of the replica that developed over the nineteenth century. That culture had become so advanced, so refined and so globally networked that ideas very similar to those expressed by Jenkins in 2022 were saluted already in 1867 by an international agreement for the exchange of plaster casts among the most important museums in the world<sup>2</sup>.

What happened to that culture, and why has there been a recent rediscovery of it?<sup>3</sup> Replicas fell deeply into disregard and for decades were considered relics of the past, when not judged deeply un-ethical to produce and even to study<sup>4</sup>. Does the renewed attention for traditional models and plaster casts have anything to do with digital reproduction techniques, such as 3D scanning and 3D printing? Are the issues raised by these digital applications affecting our interest in seriality, multiplicity and copying, obliging us to reconsider our deep-seated value judgement about replicas? What about augmented and virtual reality? How are considerations on digital replicas affecting how we view curation, the role of museums and the ownership of originals?

The aim of this article is to discuss some of the shifts in our cultural context that are giving models and replicas renewed centrality. Through the lens of a digital media project, designed for a historical collection of plaster casts of architecture (fig. 01), I examine how digital reproduction techniques are changing our relationship with many tenets of modern culture: the concept of authenticity, the role of museums in our society and also the way we look at the objects contained in them<sup>5</sup>.

Plaster casts have a very long history, both as tools in the creative process of artists and as a mean to create reproductions<sup>6</sup>. Either mixed with original fragments in collections, such as Soane's<sup>7</sup>, or deployed as a teaching device in schools and museums<sup>8</sup>, plaster casts were one of the possible responses to the age-old conundrum of exhibiting architecture—the tension between showing and communicating, and that between the comprehension and appreciation of an architecture, the experience of it, and the physical limits of what can be shown in the galleries<sup>9</sup>.

Traditionally, the objects on display in lieu of architecture are either fragments or surrogates: drawings, models, plaster casts, each with a different, complex relationship to the original. Each of them effectively substitutes an architecture in one of its dimensions but fails to replace it meaningfully in some of its other attributes.

Plaster casts are defined by their full-size but fragmentary nature. They are particularly capable of representing articulated, eminently spatial pieces of buildings, such as corners, or especially complex ornamented pieces: for example, the rich capitals and entablatures of Roman architecture. In the historicist tradition, in an architectural milieu based on a deep familiarity with the canon, these objects, which were later despised as “fakes”, were instead appreciated for their effectiveness at transmitting the characteristics of the original architecture and for their ability to convey at least in part the direct experience of the original building.

## 2. THE POLITICS OF REPLICAS

My case study, the Hall of Architecture at the Carnegie Museum of Art in Pittsburgh, Pennsylvania, is a collection of almost 150 plaster casts of architectural pieces, many of really monumental proportions (fig. 02). Financed by steel magnate Andrew Carnegie and assembled under the supervision of John W. Beatty, Director of the Department of Fine Arts at what was then the Carnegie Institute, the Hall opened to the public in 1907—probably the last such collection to be assembled. Despite a change of layout, it is still housed in the grand exhibition space designed expressly for it by the local firm Alden and Harlow. It is today the third largest collection of its kind in the world, following the much more famous Cast Courts of the Victoria and Albert Museum in London and the Galerie des Moulages at the Cité de l'Architecture et du Patrimoine, in Paris.

Fig. 02

The Hall of Architecture, Carnegie Museum of Art. The term refers both to the collection of plaster casts and to the grand hall designed by architecture firm Alden and Harlow to house it. Photo by Luc Merx, used with permission.





Fig. 03

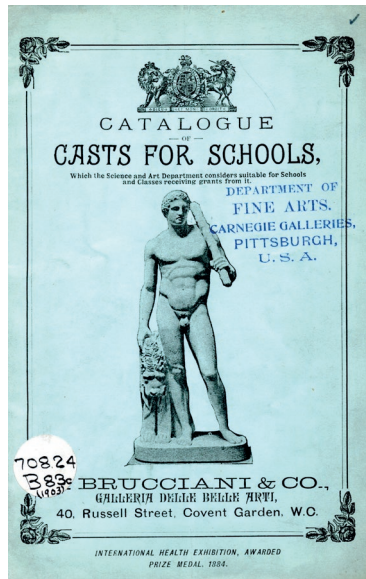
*Catalogue of Casts for Schools*, Brucciani & Co., with stamp of Carnegie Galleries Pittsburgh, 1903. Carnegie Museum of Art, Hall of Architecture Archive: box 11, folder 18, sheet 1.

Fig. 04

*Catalogo della collezione di opere d'arte di architettura, scultura ed ornato*. Formatore Michele Gherardi, Roma. Carnegie Museum of Art, Hall of Architecture Archive: box 10, folder 7, sheet 1.

Fig. 05

*Skulpturen-Sammlung. Preis-Catalog II. Studien- und Lehrgegenstände. Anatomien und Naturabgüsse. Architecturstücke und Ornamente*. August Gerber, Koeln a. Rh. Carnegie Museum of Art, Hall of Architecture Archive: box 10, folder 11, sheet 1.



03



04



05

Intentionally created with casts of architectural elements and fragments, while most of its contemporary plaster collections focused on sculpture, the Pittsburgh collection was assembled very quickly, for the most part between 1905 and 1906, ahead of a planned rededication of the Carnegie Institute. As such, it offers us a fascinating snapshot of the taste of early Twentieth century American elites and their architects.

From its inception, the Hall of Architecture was conceived as a museum display to educate the taste of the masses. Carnegie famously expressed the goal of offering an experience of the world to those who could not travel<sup>10</sup>, after realizing the suggestive power of grand plaster replicas at the 1893 Chicago Columbian Exposition. He certainly also had in mind the workers, patternmakers and draftsmen of his own industries as ideal recipients of the educational value of the plaster casts



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collection (figs. 03, 04, 05). The nearby Carnegie Technical Schools, where classes began in 1905-6, quickly adopted the collection as integral to their architecture offering. In the first school brochures, published in 1914, the Hall of Architecture is presented as part of the facilities of the school<sup>11</sup>, showing that it functioned just as the Hall of Casts did at Harvard, or the more famous Cour Vitrée did at the Ecole des Beaux Arts in Paris.

The technical mastery achieved in the field of plaster-casting and the vast budgets made available by turn of the century American philanthropists allowed this and other late-nineteenth and early twentieth century collections, such as the one at the MET, to feature really dramatic and grand displays, in which the small fragments, more commonly used for teaching, were relegated to the background.

The center piece of the Pittsburgh display, the porch of Saint Gilles du Gard, is a majestic cast that completely fills the gallery space and required hundreds of crates to be transported to the United States (fig. 06). The comparison that comes naturally is with the great efforts of the archaeologists to bring to Berlin the Pergamon Altar and the Miletus Gate around those same years<sup>12</sup>. Of course, Saint Gilles is a replica, while the Miletus Gate is an original piece from antiquity. However, these displays might have been at the time comparable achievements, because of their scale and theatrical effect, showcasing an “imperial” command of vast resources of money and people and the technical prowess and reach necessary for disassembling these gigantic monuments, transporting them and reassembling them in a sizable museum gallery<sup>13</sup>. Both displays were also able to entice a mass public and feed

Fig. 06  
The monumental plaster cast of the porch of Saint Gilles, Hall of Architecture. Photograph by Luc Merx, used with permission.

the imagination of the uninitiated with an immersive experience of architecture, in ways that were not possible with smaller fragments. In this sense they relate more to the outsized “fakes” at the World Fairs than to the small-sized, fragmentary pieces used by connoisseurs to complete their home study collections.

The effort of architecture to move away from the historicist model, separating history from design, marked a major shift in the role and relevance of the Hall of Architecture. As architecture education abandoned its reliance on the imitation of the canon, at the juncture often referred to as “passage to the modern”<sup>14</sup>, the collection progressively lost its function and its pedagogical role, and also part of its intended audience.

At the same time, other important cultural shifts were happening. The role of Museums was changing dramatically, and this was especially evident in the United States after 1870. From educational institutions dedicated to the betterment of the masses, American Museums became jealous custodians of original artwork, representing in the public sphere the interests and taste of their wealthy donors<sup>15</sup>. A changed European market and the newly acquired financial might of the American elites made available to American museums’ curators the original pieces that just a generation earlier had been considered completely out of reach. Curators—and the art dealers they worked with—had a vested interest in the purchase and display of originals and started advocating for the removal of replicas from public display. In the meantime, the practices of plaster-casting, which until that moment had been considered harmless, started to be indicted of damages to the precious originals, accelerating their falling out of favor, in a cultural environment more and more concerned with and shaped by a culture of historic preservation.

For what it entails for architecture, the last of these almost concurrent cultural shifts, the changing meaning and relevance of the concept of authenticity, is particularly interesting and relevant. Since in any case the object in the Museum gallery cannot be the original building, what can be deemed “original” instead? Around the turn of the twentieth century, as a preference for original artwork in place of educational “fakes” became established in the art museum environment, the definition of authenticity in architecture shifted to items related to the “direct touch of the architect-author”<sup>16</sup>, such as drawings—to the detriment of objects, such as casts, that despite their fragmentary nature actually approximate much more closely the characteristics of the original building. One could argue that one of the main features that make architecture what it is comes from its spatial, three-dimensional presence in space, which is more difficult to transmit through the two-dimensional nature of drawings or photographs. Yet visual material, especially when produced directly by the architects’ offices or even better, by their own hand, became the “original” mean of exhibiting architecture after the demise of plaster-casts<sup>17</sup>. Scale-models retained some of their flair, especially when they were produced directly and ennobled by the “architect’s touch”. With the advent of the Modern Movement, new ways of conceiving the exhibition of architecture started to gain ground, from 1:1 reproductions of portions of buildings to installation pieces—all of them with the mark of the architect as intellectual producer and often also direct maker.

We are now witnessing a shift and possible reversal: digital media makes available 3D models that cross the gap between what architecture is in its spatial and material characteristics and what can



be shown in the galleries of a museum. Once again what constitutes an “original” and what is a “replica” can be questioned and, more importantly, we can rediscuss the value and limitations of both media at transmitting to the public an appreciation of architecture’s features—in the impossibility of showing the actual, physical building in its completeness.

**3. PLASTER  
RECAST –  
VIRTUALITY,  
INTERACTIVITY  
AND THE  
CONTEXT OF  
ARCHITECTURE**

The longevity of the Pittsburgh collection is in part explained by its focus on architecture. Spared by the “Battle of the casts” that raged in Boston and at the MET starting at turn of the century, this collection remained untouched—the pressures in the museum environment might

not have been as intense in Pittsburgh; certainly, the casts of architectural elements were difficult to replace with originals.

The Hall of Architecture is still on display today, but few of its visitors understand the collection’s meaning or appreciate its craftsmanship. Fewer are able to unpack its many references to largely European sites, classical myths and histories, not to mention its many allusions to centuries of architectural culture.

Plaster casts of architecture, as copies of pieces, fragments or portions of buildings, require a very interesting mental process. The visitor, looking at an architectural fragment in the Museum gallery (fig. 07), has to conjure up and mentally visualize the entire building, which cannot be present in the gallery space. However, the interactivity implied by these objects, which used to happen purely in the mind of the beholder, to function properly requires a visitor thoroughly schooled in the canon, for whom each cast is simply the trigger of a mental image that is deeply familiar after years of repetition across media<sup>18</sup>. Today’s visitors do not have that familiarity, by virtue of being exposed to a much more critical kind of schooling, that has long replaced drills with discussion and the Western canon with a global, and constantly changing, set of references. The plaster-casts of the Hall of Architecture, while still on display in Pittsburgh, remain mute to their observers and the gallery, while still able to inspire an awe of its majestic pieces, is mostly used as a backdrop for events and contemporary art exhibits.

In the fall of 2017, our team piloted in the Hall of Architecture a mixed reality app called *Plaster ReCast*, created with the goal of enhancing the visitor experience of plaster cast collections of architecture and making the display in the Hall of Architecture legible to a contemporary public<sup>19</sup>. The app is based on the interplay between the virtual and physical dimensions of the cast collection—the required mental effort of imagining the original building in its complete state; the collection’s didactic connections to history, geography, and archeology; and the physical experience of observing highly crafted artifacts in spatial juxtaposition to each other. Using contemporary reality computing technologies, the app also explores new didactic possibilities for the collection.

*Plaster Recast* is built on the Google Tango Developer Platform. At the time of the app’s development Project Tango offered advanced positional tracking and mapping functionalities that were ideal for mixed reality applications. In addition to the standard camera, accelerometer, and gyroscope found in most mobile devices, a suite of onboard sensors including an IR projector, RGB-IR camera, and depth sensor, could



Fig. 07  
The display of the smaller architecture fragments on the back wall. Hall of Architecture. Photograph by Luc Merx, used with permission.



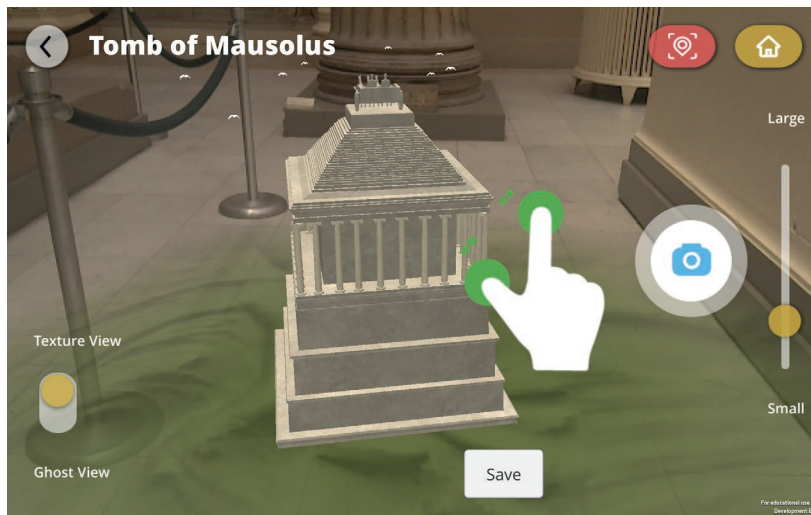
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enable area learning and real-time motion tracking of the tablet's position in a scene. Tango's positional tracking afforded real-time interaction with location aware information mapped in the space of the collection.

While the visitors explore the collection, the app runs a full screen, live camera view of the plaster collection, allowing them to remain visually connected with the physical artifacts in the gallery. When a cast is captured in the camera's field of view, interactive features are overlaid on top of the camera feed. Users can explore three primary interaction modes:

1. 3D Scan of Cast Fragment. In the first interaction mode users can explore a 3D scan of the plaster cast up close. Many of the casts are positioned high on the gallery walls, far from their observer. The scans provide a detailed reading of the fidelity of the plaster, including markings from the craftspeople making the cast. Hotspots on the scans also allow for architectural details to be called out and explained.

2. 3D CAD Model of Building. In the second interaction mode, users can place a virtual 3D model of the entire building represented



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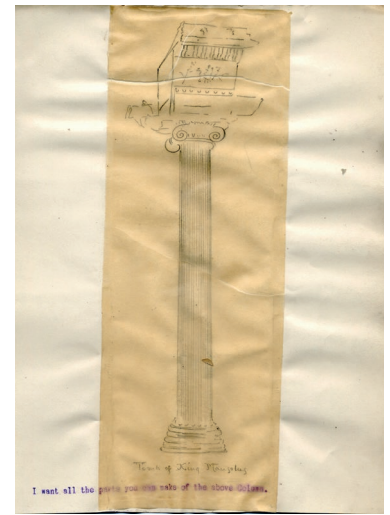
by the cast fragment on the floor of the museum. Physically moving the camera allows users to rotate, zoom, and pan to actively explore the building. Users can also toggle to see a ghosted view of the model with the location(s) of the cast fragment highlighted in the overall building (fig. 08).

3. History Notes and Archival Documents. In the third interaction mode users can explore the rich historical narratives associated with the casts and see historical source documents from the collection's Archive (fig. 09).

Architectural models are simultaneously objects in and of themselves and abstractions that signify other potential spatial realities. Models are always real and virtual. How can physical artifacts be both object and interface, physically present and virtually suggestive, true and false? Any exploration of the contemporary relevance of cast collections must contend with the dual nature of plaster casts. They are compelling artistic objects themselves, providing visitors a rich visual tapestry of juxtapositions, but they also contain complex associations, a dense web of historical and cultural references that are not typically accessible to visitors today.

Traditional plaster-cast pieces are in fact interactive *ante litteram*. They rely on the visitors' mental effort of summoning and visualizing the entire building, or even the entire collection of buildings, which are not present in the physical space. These mental models have inspired our digital ones, which in the same way work as aliases, entry points into larger, virtual and three-dimensional spaces. In the first instance, the process is not explicit but happens in the head of the observer. *Plaster ReCast* mimics this process but makes it unfold in digital space, under the eyes and in control of the viewer. It makes the interactive component of plaster-casts overt and observable—it could be said that it educates the viewer on how plaster-casts work, in addition to showing what each plaster piece originally meant and referred to.

Making the “conjured-up” model available digitally to a larger public, which is not specialized or trained specifically in the mental process of “completing” the cast, has other implications as well. It means intervening in how architecture is exhibited and understood by those



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Fig. 08  
Interactive 3D CAD model of the Mausoleum of Halicarnassus (referred to as Tomb of King Mausolus in the accession cards of the collection). Screenshot from app play testing. The digital model appears on the floor of the gallery; in the background, live view of the plaster cast column base.

Fig. 09  
*Tomb of King Mausolus*, unsigned sketch with typewritten note “I want all the parts you can make of the above column”. Carnegie Museum of Art, Hall of Architecture Archive: box 3, folder 88, sheet 26.



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Fig. 10  
Child enjoying *Plaster ReCast* in the Hall of Architecture during the exhibition *Copy+Paste*, 2018. Photo Tom Fisher for the Carnegie Museum of Art, used with permission.

outside of the disciplinary field. In a way, it reverses the logic of the model as a prop of power dynamics, surveyed in boardrooms and city halls by smoking white men, 20 and makes the model available to those who are not initiated and are not in a position of power—offering a completely different level of access to architecture in the Museum and empowering regular visitors and even children (fig. 10).

Despite the stigma attached to plaster-casts because of being copies, their tactile and spatial qualities are re-emerging as central facets of contemporary design due to the possibilities afforded by reality capture and 3D modeling. Architectural casts have traditionally addressed the role of three-dimensionality in experiencing, teaching and exhibiting architecture. In addition to this, the juxtaposition of forms from disparate geographic regions and time periods, emphasized by the uniformity of plaster, encourages unexpected adjacencies and the ability to curate and organize the fragments to form new structures of understanding.

The fact that this experience is achieved starting from massive physical artifacts raises interesting questions about the materiality of the collection and plaster in general. Because plaster was used as a primary material of architectural illusion in building construction it was cast aside as “fake”. Yet it is precisely this capacity for deceit that makes plaster relevant in a contemporary context. In fact, the Hall of Architecture provides a virtual tour within its walls. As is the case for other forms of educational media of the late nineteenth century, the initial effect of disorientation is instrumental to enhanced perception<sup>21</sup>. Just as VR experiences, the



Hall collapses space and time and creates a form of networked knowledge which breaks apart from traditional categories, for example highlighting similarities in pieces from different eras, sometimes irrespective of the collection stewards' desire to present neatly organized timelines. In the Hall, the pieces act as theatrical, illusionist portals, that can connect the viewer to faraway sites, different epochs and even, through their "twin" replicas anywhere else in the world, to other museum galleries.

We tend to think of cultural institutions, such as Museums, in terms of stability. In reality their roles continuously mutate and adapt, sometimes slowly, at times faster and often against the desires of their own leaders, to the changing society around them. It is not only the institution that is transformed, but also our relationship with the objects the museum contains and the ways we "see" them. The impact of digital media is not only an enhancement, or a different delivery for how we already see, but the opportunity to radically rethink given associations, such as the attributes of the objects in a museum.

At present, we conceive of the museum artifact as an object displaced out of its original context and isolated, to be observed from all sides, unfettered. It has not always been that way<sup>22</sup>, and while this is a tenet of modernity, with its white galleries and minimalistic gallery furniture, it is likely that digital media will create a deep reconsideration of these unwritten rules.

At the time of Napoleon (and Elgin)<sup>23</sup> Quatremère de Quincy already cautioned about the loss of meaning that would ensue from the removal of artwork from its context—a disruption that is of course even more substantial for architecture. Is displacing out of context into a museum different from displacing into digital or even virtual space? Will digital media further remove art objects into a virtual space and completely disjoin them from their materiality, leaving us disoriented and lost as to what it is we are looking at? I propose that digital media has the potential to return to the public the ability to read and understand a building not just as an isolated object, but as part of a complex system, and one that changes over time. VR/AR can help us plunge museum pieces in rich and satisfying reconstructions of their original sites.<sup>24</sup> This prefigures an entirely different culture of exhibiting architecture, based on the possibility of offering a digital, spatial reconstruction of the context around each piece, for how fragmentary it might be.

At the turn of the [Twentieth] century art theorist Adolf Hildebrand in "Raumkunst" defined the spatiality of form as a "sensitivity that had been lost with the development of museums and the conventions of considering works of art out of their original context, as individual, isolated." Hildebrand went on to explain that the most difficult task of his present moment was to "Open people's eyes to the general law of all art, namely that the work of art is always conceived as a part of something larger, as part of a situation... An artistic building is not valid solely in his own terms, but as part of an environment. [...]"<sup>25</sup> If a century ago Museum culture changed the way architects read the city, making them see individual buildings isolated from their contexts and conceived as free-standing objects, we could also question whether the current transformations in museum culture, connected with the use of digital tools, will have broader implications—not just a refashioning of the galleries, but changes in the way we look—which is, of course, also the way we think and we design. RA



## Notes

**01.** JENKINS, Simon, "The answer to the Parthenon marbles dispute: George Osborne and a 3D printer", *The Guardian*, June 16, 2022.

**02.** "Convention for Promoting Universally Reproductions of Works of Art for the Benefits of Museums of All Countries", initiated in 1867 by Henry Cole, Director of the South Kensington Museum, today the V&A, in London. In 2017, 150 years after Cole's Convention was signed, the V&A spearheaded ReACH (Reproductions of Art and Cultural Heritage), a global initiative concerning digital reproductions. CORMIRER, Brendan, ed., *Copy Culture. Sharing in the Age of Digital Reproduction*, V&A Publishing, London, 2018.

**03.** A non-exhaustive list of recent conferences devoted to plaster casts includes *Plaster and plaster casts: materiality and practice*, V&A, London (12-13 March 2010), and *Celebrating Reproductions: Past, present and Future*, London (17-19 January 2019), *Plaster Casts and Ancient Sculpture*, Pergamon Museum, Berlin (7-9 April 2011), *Destroy the Copy! International conference on the Fate of Plaster Casts Collections*, Freie Universität Berlin (8-10 October 2015), and the series of "Convegno Internazionale sulle Gipsoteche", held at the Museo Gipsoteca Antonio Canova in Possagno, Italy, starting in 2008. The exhibitions *A World of Fragile parts*, V&A London and La Biennale di Venezia, Venice (May-November 2016) curated by Brendan Cormirer, and *Serial Classic*, Fondazione Prada, Milan (May-August 2015), curated by Salvatore Settis and Anna Anguissola, respectively connect the nineteenth century and classical antiquity culture of the replica with the contemporary discussion on seriality.

**04.** Mari Lending gives an account of just such an instance right at the beginning of her book on architectural plaster cast collections. LENDING, Mari, *Plaster Monuments: Architecture and the Power of Reproduction*, Princeton University Press, Princeton NJ, 2017.

**05.** The National Endowment for the Humanities Summer Institute "Museums: Humanities in the Public Sphere", hosted at Georgetown University and the Smithsonian Institution in Washington, DC, in the summer of 2019 provided me with a wonderful opportunity to learn more about

changing Museum culture. I would like to thank organizers, lecturers and fellow participants for the great discussions and their insightful feedback.

**06.** FREDERIKSEN, Rune, and MARCHAND, Eckart, eds., *Plaster Casts: Making, Collecting and Displaying from Classical Antiquity to the Present*, De Gruyter, Berlin, 2010.

**07.** "[...] this was Soane's design method, inherited from such architects as Piranesi and George Dance the Younger: the collecting together and framing of selected fragments [...]" FURJÁN, Helene, "The Specular Spectacle of the House of the Collector", *Assemblage*, num. 34, December 1997, pp. 56-91 (here p. 69). On Soane and Soane's House-Museum there is a rich literature that cannot be here fully explored. I will only mention, in addition to Furján's, the memorable essay by Donald Preziosi, "Modernity Again: The Museum as Trompe L'Oeil", in Peter Brunette and David Wills, eds., *Deconstruction and the Visual Arts: Art, Media, Architecture*, Cambridge University Press, Cambridge MA, 1994, pp. 141-150.

**08.** On the use of plaster casts collections in architectural education see WIGLEY, Mark, "Prosthetic Theory: The Disciplining of Architecture", *Assemblage*, num. 15, August 1991, pp. 6-29 (here pp. 8-13), DOI: 10.2307/3171122; WHEELER, Katherine, "A Tangible Past: Plaster Casts in Nineteenth-Century British Architectural Education", *ARRIS. The Journal of the Southeast Chapter of the Society of Architectural Historians*, vol. 23, 2012, pp. 2-15, DOI: 10.1353/arr.2012.0000. Also, useful: BORN, Pamela, "The Canon Is Cast: Plaster Casts in American Museum and University Collections", *Art Documentation: Journal of the Art Libraries Society of North America*, vol. 21, num. 2, Fall 2002, pp. 8-13, DOI: 10.1086/adx.21.2.27949200.

**09.** ARRHENIUS, Thordis; LENDING, Mari; MILLER, Wallis and MCGOWAN, Jérémie Michael, eds., *Place and Displacement: Exhibiting Architecture*, Lars Müller Publishers, Zürich, 2014.

**10.** Part of the history of this collection is explored in Mari Lending's volume. See also SCHLOETZER, Mattie, "Andrew Carnegie's Original Reproductions. The Hall of Architecture at 100", *Western Pennsylvania History*, Fall 2007, pp. 36-47.

**11.** *Bulletin of the Carnegie Institute of Technology*, Department of Architecture, Pittsburgh, Pennsylvania, Series 10 Number 1, September 1914, p. 7. Carnegie Mellon University Archives, Architecture, Box 1, Folder 11.

**12.** MILLER, Wallis, "Schinkel's Museums: Collecting and Displaying Architecture in Berlin, 1844-1933," in *Museums and Biographies: Stories, Objects, Identities*, Kate HILL, ed., Boydell & Brewer, Boydell Press, London, 2012; and MILLER, Wallis, "Cultures of Display: Exhibiting Architecture in Berlin, 1880-1931," in Tim ANSTEY, Katja GRILLNER and Rolf HUGHES, eds., *Architecture and Authorship*, Black Dog Publishing, London, 2007, pp. 98-107. See also: BILSEL, Can, *Antiquity on Display: Regimes of the Authentic in Berlin's Pergamon Museum*, Oxford University Press, Oxford, 2012.

**13.** Mari Lending has noted how the steel industry's culture of efficient management was applied to the assembling of the Pittsburgh Hall of Architecture, for example in the use of the telegraph. LENDING, Mari, "Cablegram", in *The Printed and the Built. Architecture, Print Culture and Public Debate in the Nineteenth Century*, Mari HVATTUM and Anne HULTZSCH, eds., Bloomsbury, London, 2018, pp. 151-157. I will add that the Archive of the Hall of Architecture was also organized as corporate records would be, for example by archiving the material by medium: photographs and catalogues are separated from the correspondence they were originally attached to. This form of recordkeeping magnifies the role of institutional actors, while some of the other threads in the history of the collection remain obscured.

**14.** On the complex cultural implications of the rupture between history and practice of architecture, see VAN ECK, Caroline, "Modernity and the uses of history. Understanding classical architecture from Bötticher to Warburg", in Mari Hvattum and Christian Hermansen, eds., *Tracing Modernity. Manifestations of the modern in architecture and the city*, Routledge, London, 2004, pp. 56-67.

**15.** See Alan WALLACH, *Exhibiting contradictions: Essays on the Art Museum in the United States*, University of Massachusetts Press, Amherst, 1998,

especially chapter 3: "The American Cast Museum, an Episode in the History of an Institutional Definition of Art", pp. 38-56. Aline SAARINEN'S 1958 *The proud possessors: the lives, times, and tastes of some adventurous American art collectors* is still a fascinating exploration of American turn of the twentieth century private collections and their owners and of how many of those collections became part of famous civic museums.

16. At the background of these shifts are radical changes in how the role of the architect is defined in the discipline and in society at large. COHEN, Jean-Louis, "The architect as intellectual", in *Italian Imprints on Twentieth-Century Architecture*, Denise COSTANZO and Andrew LEACH, eds., Bloomsbury, London, 2022, pp. 11-27.

17. In fact, plaster casts are still exhibited without qualms when the architects or their offices make them – for example, they are often part of the display at the Venice Architecture Biennale. The early twentieth century refusal of plaster casts seems to originate from the nature of plaster-casting as an organized industry and a trade, independent from the architect as artist.

18. Many of the buildings represented in these collections appeared in elementary school stories, illustrated almanacs, and maps for children. Very often they were also subject of drills for schoolchildren, repeated both in written lists and in lantern slides used in the classroom. See TORELLO, Francesca, "History to look at: mediating architectural history in turn of the Twentieth century Pittsburgh", in Salvador GUERRERO and Joaquín MEDINA WARMBURG, eds., *Lo construido y lo pensado. Correspondencias europeas y transatlánticas en la historiografía de la arquitectura = Built and Thought. European and Transatlantic Correspondence in the Historiography of Architecture*, III International Congress of the Asociación de historiadores de la Arquitectura y el Urbanismo (AhAU), Madrid, 2022, pp. 566-579; CAIN, Victoria, "Seeing the world: Media and vision in US geography classrooms, 1890-1930", *Early Popular Visual Culture*, vol. 13, num. 4: Displaying Knowledge: Intermedial Education, 2015, pp. 276-292, DOI: 10.1080/17460654.2015.1111591.

19. The app was developed by the author with colleague Josh Bard, at the School of Architecture of Carnegie Mellon University, in collaboration with the CMU Entertainment Technology Center and the Carnegie Museum of Art. It was one of the projects showcased in the Museum's exhibition "Copy + Paste" in 2018 and helped the Museum receive that year's institutional award of the Soane Foundation in New York for its stewardship of the Hall of Architecture, also in 2018. <https://vimeo.com/246512552>

20. LEWANDOWSKA, Marysia, *It's About Time*, Pavilion of Applied Arts, V&A and La Biennale di Venezia, 2019.

21. RUTLEDGE, Alison, "Louis Norbert and the Travel Essays of Vernon Lee: Aesthetic Empathy, the *Genius Loci*, and the 'Historical Emotion'", *English Literature in Transition*, 1880-1920, vol. 62, n° 3, 2019, pp. 352-370, available at Project MUSE: [muse.jhu.edu/article/721843](https://muse.jhu.edu/article/721843).

22. KLONK, Charlotte, *Spaces of Experience. Art Gallery Interiors from 1800 to 2000*, Yale University Press, New Haven and London, 2009.

23. QUATREMÈRE DE QUINCY, Antoine Chrysostôme, *Lettres sur le préjudice qu'occasionneraient aux Arts et à la Science, le déplacement des monumens de l'art de l'Italie, le démembrement de ses Ecoles, et la spoliation de ses Collections, Galeries, Musées, & c.*, Librairie Desenne, Librairie Quatremère, et les Marchands de Nouveautés, 1796. The recent edition in English associates the letters to Miranda, written in 1796, and the letters to Canova, from 1818, in which Quatremère adopted a more nuanced position on Museums, in part exactly because of the Elgin Marbles. Antoine Quatremère de Quincy, *Letters to Miranda and Canova on the Abduction of Antiquities from Rome and Athens*, with an introduction by Dominique POULOT, English translation by Chris MILLER and David GILKS, Getty Publications, Los Angeles, 2012.

24. One example of this is the digital reconstruction of the Ishtar Gate of ancient Babylon and its immediate physical context, triggered by the relatively modest-sized piece shown in the galleries of the Detroit Institute of Arts. LUMIN project, DIA in collaboration with Google,

2017, consulted on 21 September 2022, available at: <https://www.youtube.com/watch?v=DEaNKZih4Dc>. I read this opportunity offered by digital media in the frame of the current interest for provenance studies and the efforts to document an object's complex histories, including its exhibition history and that of its presence in various collections, each with their physical context. However, the impact for architecture could be even greater, precisely in consideration of the present limits to exhibiting architecture.

25. Cited in SKANSI, Luka, "The 'Restless Allure' of (Architectural) Form: Space and Perception between Germany, Russia and the Soviet Union", in Andrew LEACH, John MACARTHUR, and Maarten DELBEKE, eds., *The Baroque in Architectural Culture, 1880-1980*, Routledge, London, 2015, pp. 43-60, (here pages 43-44).

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