

THE DIGITALLY RECONSTRUCTED ARCHITECTURAL OBJECT IN THE
AGE OF POST-ORTHOGRAPHY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY
BERİL ÖNALAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF ARCHITECTURE
IN
ARCHITECTURE

AUGUST 2020

Approval of the thesis:

**THE DIGITALLY RECONSTRUCTED ARCHITECTURAL OBJECT IN
THE AGE OF POST-ORTHOGRAPHY**

submitted by **BERİL ÖNALAN** in partial fulfillment of the requirements for the degree of Master of Architecture in Architecture, **Middle East Technical University** by,

Prof. Dr. Halil Kalıپçilar
Dean, Graduate School of **Natural and Applied Sciences** _____

Prof. Dr. Cânâ Bilsel
Head of the Department, **Architecture** _____

Assoc. Prof. Dr. İpek Gürsel Dino
Supervisor, **Architecture, METU** _____

Assist. Prof. Dr. Pelin Yoncacı Arslan
Co-Supervisor, **Architecture, METU** _____

Examining Committee Members:

Assoc. Prof. Dr. Ela Alanyalı Aral
Architecture, **METU** _____

Assoc. Prof. Dr. İpek Gürsel Dino
Architecture, **METU** _____

Assist. Prof. Dr. Pelin Yoncacı Arslan
Architecture, **METU** _____

Assist. Prof. Dr. Pınar Aykaç
Architecture, **METU** _____

Assist. Prof. Dr. Başak Uçar
Architecture, **TEDU** _____

Date: 24.08.2020

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Beril Önalan
Signature :

ABSTRACT

THE DIGITALLY RECONSTRUCTED ARCHITECTURAL OBJECT IN THE AGE OF POST-ORTHOGRAPHY

Önalan, Beril

Master of Architecture, Architecture

Supervisor: Assoc. Prof. Dr. İpek Gürsel Dino

Co-Supervisor: Assist. Prof. Dr. Pelin Yoncacı Arslan

August 2020, 106 pages

In his much-quoted essay "The Work of Art In The Age of Mechanical Reproduction," Walter Benjamin discusses that original artworks have an inherent *aura* and emphasizes the importance of material authenticity, arguing that mechanical reproduction leads to the loss of that auratic and iconic qualities. Thus, within this context of the materiality argument that fails to consider the values that might emerge as a result of the digital technology of reproduction, it is difficult to redefine the digitally reconstructed object as a legitimate source of knowledge. In the face of such arguments, this study aims to demonstrate the potential for a remanifestation of authenticity in architecture through the implementation of contemporary digital technologies of reproduction. From this perspective, it is suggested that the authenticity of the architectural reproductions can be preserved along its trajectory through time and space by the redefinition of the nature of its material relations. The study argues that architectural reproductions are essential for the original to survive beyond the conditions of its material presence since all prospective architecture originates from the architecture's past, and the profession of architecture as a cumulative form of knowledge relies on the making of copies. It is further discussed that as an act of inheritance itself, the act of drawing as the

fundamental method of architectural reproduction and the orthographic consciousness as the preconceptual shape space of architectural design, are being reinscribed by the logic of real-time and electronic interfaces in our present era of "post-orthography" as heralded by John May. In this context, in order to illustrate the critical role of digital reconstruction technologies in the field of architecture, the photogrammetry method will be employed to partially reconstruct the case study buildings in a specific space and time, resulting in 3D interactive models that reveal the existent texture, color, patina, and use.

Keywords: Digital Architectural Reconstruction, Photogrammetry, Authenticity, Aura, Object-Oriented Ontology

ÖZ

ORTOGRAFİ SONRASI CAĞINDA DİJİTAL OLARAK YENİDEN YAPILANDIRILAN MİMARİ NESNE

Önalan, Beril

Yüksek Lisans, Mimarlık

Tez Yöneticisi: Doç. Dr. İpek Gürsel Dino

Ortak Tez Yöneticisi: Dr. Öğr. Üyesi Pelin Yoncacı Arslan

Ağustos 2020, 106 sayfa

Walter Benjamin, çok atıfta bulunulan "Teknik Araçlarla Yeniden Üretim (Çoğaltma) Çağında Sanat Eseri" adlı makalesinde, orijinal sanat eserlerine içkin bir özellik olarak auranın bulunduğu tartışılmış ve teknik araçlarla yeniden üretimin bu auratik ve ikonik niteliklerin kaybına yol açtığını savunarak materyal özgünlüğün önemini vurgulamıştır. Bu suretle, dijital yeniden üretim teknolojilerinin bir sonucu olarak ortaya çıkabilecek değerleri dikkate almayan materyal merkezli argüman bağlamında, dijital olarak yeniden yapılandırılmış nesneyi meşru bir bilgi kaynağı olarak yeniden tanımlamak zordur. Bu tür argümanlar karşısında, bu çalışma çağdaş dijital yeniden üretim teknolojilerinin uygulanması yoluyla mimarlıkta özgünlüğün yeniden ifadelendirilmesi potansiyelini ortaya koymayı amaçlamaktadır. Bu perspektiften bakılarak, mimari yeniden üretimlerin özgünlüğünün, maddi ilişkilerinin doğasının yeniden tanımlanmasıyla, zaman ve uzam içindeki tarihçesi boyunca korunabileceği ileri sürülmektedir. Çalışma, kümülatif bir bilgi biçimini olarak mimarlık mesleği kopyaların oluşturulmasına bağlı olduğundan ve tüm olası mimari mimarlığın geçmişinden yola çıktığından, orijinal olanın maddi mevcudiyetinin ötesinde sürekliliğini koruyabilmesi için mimari yeniden üretimlerin

gerekli olduğunu savunmaktadır. Bir kalitim eylemi olmakla birlikte mimari yeniden üretim temel yöntemi olarak çizim eyleminin ve mimari tasarımlın önkavramsal biçim uzayı olarak ortografik bilincin, John May tarafından "post-ortografik" olarak nitelenen mevcut çağda gerçek zamanlı ve elektronik arayüzler mantığıyla yeniden yazılmakta olduğu tartışılmaktadır. Bu bağlamda dijital yeniden üretim teknolojilerinin mimarlık alanındaki kritik rolünü göstermek amacıyla, örnek çalışma binalarını belirli bir zamanda ve uzamda kısmen yeniden yapılandırmak için fotogrametri yöntemi kullanılarak mevcut doku, renk, patina ve kullanımı ortaya çıkan 3 boyutlu etkileşimli modeller elde edilecektir.

Anahtar Kelimeler: Dijital Mimari Yeniden Yapılandırma, Fotogrametri, Özgünlük, Aura, Nesne Yönelimli Ontoloji

To the loving memory of my grandmother Münire Çatav,
who has raised me to be the person that I am today and who has forever been my
source of aspiration. Thank you for all the endless love, guidance,
and support you have given, you are so loved and missed.

ACKNOWLEDGMENTS

First and foremost, I would like to express my sincere gratitude to my thesis supervisors Assoc. Prof. Dr. İpek Gürsel Dino and Assist. Prof. Dr. Pelin Yoncacı Arslan for their support, encouragement, and guidance throughout my architectural education and this study. I can not thank them enough for always believing in me and the confidence they showed in me.

I would also like to thank my jury members Assoc. Prof. Dr. Ela Alanyalı Aral, Assist. Prof. Dr. Pınar Aykaç and Assist. Prof. Dr. Başak Uçar for their valuable insights and suggestions.

I would also like to express many thanks and appreciation to my dear friends Neris Parlak Temizel, Ensar Temizel, and Aslıhan Günhan, who have kindly offered unconditional support, motivation, and mentorship as role models from my undergraduate years onwards.

My deepest gratitude is to my sister Dide Önalan, my parents Reşide Önalan and Göğßen Önalan, and my aunt Gülay Reis whose endless love and support can not be overstated and who have been the pillar stones to support and encourage me at all aspects of my life. I am forever grateful to them for always being there for me.

TABLE OF CONTENTS

ABSTRACT	Hata! Yer işaretü tanımlanmamış.
ÖZ	Hata! Yer işaretü tanımlanmamış.
ACKNOWLEDGMENTS	x
TABLE OF CONTENTS.....	xi
LIST OF FIGURES	xiii
CHAPTERS	
1 INTRODUCTION	15
1.1 Research Motivation and Questions.....	15
1.2 Chapter Outline	16
1.3 Research Methodology.....	17
2 THE DIGITAL AVANT-GARDE AND THE DEMISE OF THE PROJECTED IMAGE	21
2.1 The Paradigm Shift from Architectural Projection as An Objective Method	24
2.1.1 New Frames of Reference.....	27
2.2 The Second Digital Turn	40
2.3 The Demise of the Orthographic Age	44
3 OBJECT-CENTEREDNESS AND AUTHENTICITY IN THE ERA OF DIGITAL REPRODUCIBILITY	47
3.1 Reinterpretation of Socio-Cultural Meaning Through Reproduction	49
3.2 The Loss of Visual Identification and Indexicality	51
3.3 The Reproduction of Architecture.....	53
3.3.1 The Digitally Reconstructed Architectural Object	55

3.3.2	Excess of Data and The Aesthetics of the Digital Age	58
3.3.3	The Architecture of the Digital Archive and Cyberflâneur	59
3.4	The Culture of Digital Media.....	62
4	PHOTOGRAMMETRY AND ARCHITECTURAL RECONSTRUCTION.	67
4.1	The Other Method.....	69
4.2	Photogrammetry Method for Architectural Reconstruction	76
4.2.1	A New Connoisseurship and Reproduction as Knowledge Production 83	
4.2.2	The Digital Reproduction Technologies for Architectural Heritage Preservation	85
4.3	The Contemporary Politics of Copyright and Digital Colonialism	89
5	CONCLUSION	95
	REFERENCES	101

LIST OF FIGURES

FIGURES

Figure 2.1. The sets of geometries germane to architecture	30
Figure 2.2. Diagram to show the convention of Cartesian space.....	31
Figure 2.3. Philippe Morel / EZCT Architecture & Design Research Chair Model 'T1-M' after 860 generations (86,000 structural evaluations)	43
Figure 4.1. Leon Battista Alberti's finitorum	70
Figure 4.2. Orthographic projections of a head, De Prospectiva Pingendi, Piero della Francesca.....	70
Figure 4.3. The perspective of a head, De Prospectiva Pingendi, Piero della Francesca.....	71
Figure 4.4. The perspective of a head, De Prospectiva Pingendi, Piero della Francesca.....	71
Figure 4.5. Still images from the software interface of the 3D interactive model and related image dataset of La Sagrada Familia, displaying the reference images that are texture-mapped on the solid model for the 3D reconstruction.....	77
Figure 4.6. Still images from the software interface of the 3D interactive model in wireframe and point cloud display modes revealing the angle and position of the image dataset as thumbnails on the 3D environment.....	78
Figure 4.7. Partial reflected ceiling plan showing the central nave of La Sagrada Familia, Barcelona, from the photogrammetric texture model produced in January 2020.....	79
Figure 4.8. Still image showing the central nave of La Sagrada Familia, Barcelona from the photogrammetric texture model produced in January 2020	80
Figure 4.9. Still image showing the central nave of La Sagrada Familia, Barcelona, from the partial dense point cloud model produced in January 2020	82
Figure 4.10. Still image from the photogrammetric texture model of the façade of Dolmabahçe Palace, Istanbul, produced in June 2019.....	86

Figure 4.11. Still image from the photogrammetric texture model of the façade of Dolmabahçe Palace, Istanbul, produced in June 2019	86
Figure 4.12. Photogrammetric scan of the Nativity Façade of La Sagrada Familia, Barcelona, produced in January 2020	87
Figure 5.1. Gilles Retsin, Digital curves (after Greg Lynn), 2016.....	96

CHAPTER 1

INTRODUCTION

1.1 Research Motivation and Questions

What is the place of authenticity in the architecture of today? In this age of digital reproducibility, with its materials and technologies in a state of continuous flux, what role can material authenticity have for the contemporary architecture? How can object-centered architectural practices be re-manifested in digital technologies? Can material authenticity be morphed into the forms of different media? These are some of the questions that have been the catalyst for this thesis study, which investigates new definitions for authenticity through the existence of digital reproductions in architecture and for the concept of 'aura,' which embodies the relationship of materiality to culture, tradition, and historicity.

Regarding these issues, the study aims to demonstrate the potential for a remanifestation of authenticity in architecture through the implementation of contemporary digital technologies of reproduction. The conventional notion of authenticity based on the material presence of the object is questioned through the argument that materiality is not a question of materials but rather concerns the substance of material relations.¹ The study aims to investigate the space of those relations and how reproductions of architecture can manifest authenticity through a 'migration of aura' from the original to its potentially infinite copies.²

¹ Giuliana Bruno, *Surface: Matters of Aesthetics, Materiality, and Media* (Chicago, IL: University of Chicago Press, 2016), 2.

² Bruno Latour and Adam Lowe, "The Migration of the Aura, or How to Explore the Original through Its Facsimiles," in *Switching Codes: Thinking through Digital Technology in the Humanities and the Arts*, ed. Thomas Bartscherer and Roderick Coover (Chicago, IL: University of Chicago Press, 2012), 275–297.

1.2 Chapter Outline

The arguments regarding these fundamental questions are structured into three individual chapters, the first of which discusses how tools and techniques germane to architectural design and reproduction from earlier on defined the limits of the profession and critically analyzes the media-technical relations intrinsic to the making of architecture. The first chapter studies this scope from the early implementation of digital technologies, algorithmic and morphogenetic design concepts appropriated from computer sciences, shipbuilding, automobile, and aeronautical industries, as well as from biology, emergence and system theories into architecture up until today's Big Data era of advanced computational systems, pervasive automation, and mass-customization as contemporary design methods that engage with the posthuman complexity of information.³ Thus, the chapter focuses on how the conceptual and formal interest for continuity and seamlessness at the first digital turn has refashioned the architectural practices and its relations within more extensive networks.⁴ Furthermore, the breakthrough from deterministic, linear systems to nonlinear systems of more complex relationships in modern sciences is discussed within the scope of its media-technical implications in architecture.

The second chapter investigates how the transmission of architectural tradition has depended on contemporary media techniques and how historically the culture of architectural reproduction and identicity changed the making of architectural practices. In his essay "The Work of Art In The Age of Mechanical Reproduction", Walter Benjamin has postulated that the originals suffer a 'loss of aura' due to the exponential increase in the potential techniques and convenience of making copies, and the reproducibility of material entities. The chapter questions this convention on the nature of copies within the domain of architectural reproduction by arguing that

³ Mario Carpo, *The Second Digital Turn: Design beyond Intelligence* (Cambridge, MA: The MIT Press, 2017), 18.

⁴ For the first digital turn see Mario Carpo, *The Digital Turn in Architecture 1990-2012*. (Chichester: Wiley, 2012).

reproductions are essential for the original to survive beyond the conditions of its material presence.

The final chapter investigates the potential new kinds of authenticity and documentary, cultural, socio-political, and informational values that can emerge with digital reproduction technologies in the field of architecture. Through the case studies, the diverse role and impact of digital reproductions in areas concerning a wide range of fields such as heritage preservation, architectural design and history, digital humanities, digital culture, and media studies as well as postcolonial studies are examined under the light of the photogrammetry technique as a method of knowledge production at the convergence of architectural design, technology, and the humanities.

1.3 Research Methodology

To further develop the conjecture that is detailed out so far, a case-study project based on digital technologies for reproduction is carried out within the scope of the thesis. In this project, photogrammetry is assigned as part of the research methodology to illustrate the role of digital reconstruction technologies in the field of architecture. The researcher has realized the partial photogrammetric scanning of Antoni Gaudi's La Sagrada Familia Basilica in January 2020 to be able to construct an argument on the potentials of the photogrammetry technique through the selection of a work of architecture that demonstrates a sophisticated and intricate spatial atmosphere and thereby defies conventional methods of reading space. The digitalization of the Sagrada Familia becomes a means for setting a solid base for the discussion on the necessity of shedding light on a lacuna of architectural histories through semantically enriched and comprehensive 3-D scanned models of architecture.

Another aim of the use of digital technologies as a case study in this thesis work is to point out the significance of the archival of milestones in international and national

architectural history and the increasing urgency for such edifices to be conserved as permanent records. For that purpose, the surface models processed from the high-density point cloud scans of the façades of Dolmabahçe Palace will also serve as a proof-of-concept by illustrating the role of 3-D technologies in architecture to retrieve and restore a part of the heritage as well as the collective memory in digital format. The application of the photogrammetry technique as a method of preservation is also essential for opening the way up for political discussions on the rights to the cultural commons and an open-access model to digital architectural heritage. In this aim, through the use of methods such as photogrammetry, point clouds, and surface models to reconstruct the state of a building in a specific space and time, 3D interactive models revealing the existent texture, color, patina, and use will be reconstituted.

The photogrammetry method has been preferred for the production of point cloud models over the professional laser scanning for several reasons. Firstly, the convenience of the application of the photogrammetry technique provides greater liberty at the execution of the scans as the production of the dataset images only necessitates a portable camera. Whereas a laser scanning requires professional equipment, the use of which presents the need for additional funds that exceed the budgetary limitations of this study. Secondly, the ease of use of the photogrammetry software and the processing power required to operate the software have also been taken into consideration as professional laser scans produce point clouds consisting of millions of points which requires a high-performance computer hardware system to be able to process the loaded data. Another reason is that the photogrammetry technique enables to retrieve detailed information regarding the texture, patina and ornamentation of the modeled surfaces as existing information is texture-mapped onto the solid 3D model by means of the software.

It is crucial to point out that in the methodology of this research, there is no positivist claim to objectivity through the use of contemporary technologies, the compliance to which was among the pitfalls of the orthodox ideals of the project of modernity.

It is safe to assume that such arguments based on technological fundamentalism are now passé and have been heavily critiqued by postmodernists in the first place and by many others. Here, the discourse regarding digital reproduction technologies should not be taken as a eulogy to the means of the technique or an over-excitement about contemporary technologies that might register the problems stated.

This study aims to open a discussion that presents the digital reproduction technologies not necessarily as a technical means but rather an end, therefore not an architectural design tool per se but a method of knowledge production. The interactive point cloud display itself as a medium could have never been a neutral, objective representation but acts as an interface bearing particular aesthetics, carefully adjusted to a specific idea or format -arguing actively for an interpretation-and one that comes with a package of both benefits and predicaments.⁵

⁵ In using the term "representation," the intention here is to 'invoke a complex and nuanced understanding of the functioning of cultural objects developed in humanities over the last decades.' Lev Manovich, *The Language of New Media* (Cambridge, MA: The MIT Press, 2002), 40.

CHAPTER 2

THE DIGITAL AVANT-GARDE AND THE DEMISE OF THE PROJECTED IMAGE

In the architecture of the early 1990s, a revolution in digital design methods, the birth of the Internet and the strong impact of Gilles Deleuze's book *The Fold: Leibniz and the Baroque* promoted the notion of a cause-effect relationship between digital technologies and free form, complex geometries, which could have only been designed and mathematically defined by computers.⁶ The non-Euclidean, spline-based geometry that was all too readily accepted and embraced did become the hallmark of early computer-aided design. The first digital revolution was marked by the imminent results of spline-making and a search for rotundity, seamlessness, and continuity as a consequence of the convenience of the most computer graphics and computer-aided design software that featured spline modelers to rationalize any random cluster of points into a continuous curve.⁷

In this regard, it was not the digital tools per se that necessarily imposed those sinuous and curving shapes, and there seems to be no overarching reason other than the ease of use of the new spline-modeling software that the computers are primarily used for this purpose. The principles of mass-customization would suggest the opposite as it is for sure that the first generation of digitally intelligent designers were seeking beyond form-finding liberty from the modernist rationale driven by Fordian paradigms of industrial manufacturing, mass-production and standardization fervently advocated by the architecture of the golden age of the 20th century

⁶ Mario Carpo, *The Alphabet and the Algorithm* (Cambridge, MA: MIT Press, 2011), 83-93.

⁷ Carpo, *The Second Digital Turn*, 57.

modernism.⁸ Variation and customization were the preliminary objectives of the digital avant-garde of the 1990s as digital mass-customization promised the mass-production of variations at fixed marginal costs.⁹ In his book *The Second Digital Turn*, Mario Carpo articulates the same notion as:

Digital mass-customization is one of the most important ideas ever invented by design professions: an idea that is going to change, and to some extent that has already changed, the way we design, produce and consume almost everything, and one that will subvert-and to some extent that has already subverted-the cultural and technical foundations of civilization.¹⁰

Similarly, architect Branko Kolarevic asserts that the digitally-driven architectural production processes introduced a logic of seriality in architecture based on local variation and differentiation in series. He also maintains that the digital mass-customization as the post-Fordian paradigm for the economy of the 21st century challenges the idea of industrial production as it is no longer defined as the mass-production of a standard product to fit all but a production of non-standard and customized design differentiated through digitally controlled variation.¹¹ Since economies of scale¹² do not apply in digital mass-customization, which involves no additional cost than standardized mass-production, digital technologies could be seen as a postmodern dream come true. However, this was not the case for the field of architecture and design, which was dominated exclusively by the single tool of

⁸ Branko Kolarevic, "Mass-Customization + Non-Standard Modes of (Re)Production," in *ACSA 101: New Constellations, New Ecologies: Proceedings of the 101st Annual Meeting of the Association of Collegiate Schools of Architecture (ACSA)*, ed. Ila Berman and Edward Mitchell (Washington, D.C., DC: ACSA Press, 2013), 401.

⁹ Carpo, *The Second Digital Turn*, 161.

¹⁰ Ibid., 4.

¹¹ Kolarevic, "Mass-Customization + Non-Standard," 400.

¹² The economies of scale refers to concept in microeconomics where the cost per unit product decreases with the increasing scale of production. In the case of digital mass-customization, the scale of production can be increased without compromising from variation as digital fabrication does not require the reuse of templates or molds. Therefore mass-production of digital copies will not amortize their cost, on the contrary each item can be customized at no additional cost.

spline modelers that almost wholly monopolized the emerging digital design scene and was acknowledged as the quintessential style of the early digital age.¹³

The endeavor to define principles of production based on variation and customization in the field of architecture originates from the work architect Bernard Cache carried out with Gilles Deleuze and Patrick Beaucé through the publication *Objectile* where the idea of *non-standard* in architecture is primarily introduced. In this context, the *non-standard* can be defined as the theoretical and practical rejection of mass-production in post-industrial societies. Instead of using the term mass-customization, however, Cache refers to non-standard seriality and insists on the notion of associativity that renders the design process into a formalized generative system where partial alterations can be automatically applied to the whole.¹⁴ Cache specifies the notion of associativity as:

The architect is an intellectual worker whose mode of production is conditioned by digital technologies, but these hardly develop along natural lines. Thus, the writing of software programs is at the same time the main genre of contemporary culture and the privileged terrain for confronting the forces that organize production in our societies. In this regard, there is one strategic concept that will determine the form that standard architecture will take in the years ahead – the concept of associativeness... Associativeness is the principle used in software that organizes the architectural project in a long chain of relationships, from the first conceptual ideas to the driving of the machines that will prefabricate the components to be assembled on site. Designing on an associative software program comes down to transforming the geometrical design into a programming language interface.¹⁵

Today, the extensive discussion on generative design processes that follows the technical notion of associativity often derives from Cache's and Deleuze's definitions

¹³ Mario Carpo, "Breaking the Curve: Big Data and Design," *Artforum International*, February 1, 2014, <https://www.artforum.com/print/201402/breaking-the-curve-big-data-and-design-45013>.

¹⁴ Bernard Cache and Patrick Beaucé, "Towards a Non Standard Mode of Production," in *Objectile: Patrick Beaucé + Bernard Cache: Fast-Wood: a Brouillon Project*, ed. Wolfgang Fiel (Wien: Springer, 2007), 26-39.

¹⁵ Ibid., 35.

of the Objectile.¹⁶ As Cache has pointed out, the mode of production conditions the design process that we employ, thus it can be stated that all tools exert an operation on the gestures of the user and leave a particular imprint on the output. Such reciprocal phenomena that occur in the intersection of the domains of technology, technogenesis, and anthropology is concretized in Bernard Stiegler's maxim "Technics, far from being merely in time, properly constitutes time."¹⁷ In the architecture and design field, the traces of the tools (mechanical or digital) that become consistently visible and that prevail over time, culture and geographies consolidate the visual style and the zeitgeist of an era. Such was the case when digital tools called for a new architectural style of smooth and continuous curves at the first digital turn and led to a fascination with digital form-finding that was pursued in the late '90s, and prevailed in the millennium.

2.1 The Paradigm Shift from Architectural Projection as An Objective Method

Among the modes of architectural production that are namely writing, building, modeling and drawing which is historically deemed as the key element, the means of production employed reverberate throughout all timelines of the processes of architectural design and production, and the social practices that depend on them even more so in these times of fast and critical technological and epistemic changes.¹⁸ In the publication *Perspective, Projections and Design*, Mario Carpo and Frédérique Lemerle acknowledge how developing digital tools in the field of design and architecture offer alternative ways for imaging and modeling as "Perhaps digital technologies are indeed heralding a major turning point in the five centuries-old

¹⁶ Bernard Cache and Mario Carpo, "Introduction," in *Architecture Words 6: Projectiles* (London: AA Publications, 2010).

¹⁷ Bernard Stiegler, *Technics and Time* (Stanford, CA: Stanford University Press, 1998), 27.

¹⁸ Mario Carpo and Frédérique Lemerle, "Introduction" in *Perspective, Projections, and Design: Technologies of Architectural Representation* (London: Routledge, 2008), 4.

traditions of the architectural drawing that started with the humanists' invention of perspective, projections, and design."¹⁹

Along with the orthographic drawing that set the architectural drawing as the principal mode of architectural production, the invention of geometric perspective has defined the architectural conceptions of space and appearance since the Renaissance. Carpo and Lemerle recall that Leon Battista Alberti, who famously defined the rules of the one-point perspective and helped traditional architectural design tools to acquire their modern form and use, warned architects to use perspectival drawings sparingly as they do not provide the precise measurements required for architectural design.²⁰ Carpo and Lemerle also maintain that:

If all architecture must be drawn prior to be built, architects can only build what they can draw and measure in drawing, and drawings (and drawings and methods of quantification related to them) become the inevitable bottleneck through which all that is buildable has to pass. From Brunelleschi to Gehry, three-dimensional models have always offered a handy back up when drawings could not do the job, occasionally leading to even trickier problems of measurement. And right from the start Alberti singled out the conflict between drawings that simulate vision (the painter's task, according to Alberti) and those that should provide accurate measurements for builders. From Alberti on, architects have had to choose between what we now call central and parallel projections.²¹

It is not in the scope of this study to discover the origins of architectural projection however it is crucial to stress on how tools and techniques of architectural design and production from earlier on defined the limits of the profession and to discuss why today we require other processes in the imagining and realizing of architectural form for the future of the profession.

¹⁹ Carpo and Lemerle, *Perspective, Projections, and Design*, 4.

²⁰ Ibid., 2.

²¹ Ibid.

Considering that architectural drawing can not be singled out as a medium of representation and it is a medium of design as well, surely the notion of engaging with complexity through order and principles of design is what preceded the ideals to picture the world in a precise, stylized fashion of architectural projection. Alongside specific other historical figures, it was Vitruvius in his fundamental treatise *De Architectura* who canonized those principles and orders that consequently raised the rationale for taking architecture from a branch of knowledge to entitling it as a scientific discipline. This argument, in turn, justifies architecture as a source of objective knowledge and its means of parallel projection as a perceptual mode that might offer an expression of the nature of built things.

In his essay "The Theory and Practice of Perspective in Vitruvius's *De Architectura*" Pierre Gros elaborates that it was Vitruvius who retained the idea that our eyes are the origin of an erroneous judgment.²² Moreover, he articulates this argument on the fallibility of vision, explaining that:

The scientific explanation he gave for all these visual adjustments was based on the theory that under certain conditions, human vision, whose rays allegedly traveled in straight lines but through layers of air of different densities (and therefore differing resistance), provided no guarantee of presenting the real appearance of a building...This situation calls for a corrective intervention on appearances, which must be modified in order to recover what Vitruvius calls, in VI: 3.11, the *non dissimiles veris symmetriis venustates*, that is to say a harmony that does not contradict the real modular relationships, which are true insofar as they correspond to the reality of construction yet must be modified in order to appear true.²³

Generations of architects in the past have pursued the challenging task of fully attaining information on the nature of geometries, their precise dimensions, and measurements to describe their particular shape. In his book *Translations from*

²² Pierre Gros, "The Theory and Practice of Perspective in Vitruvius's *De Architectura*," in *Perspective, Projections, and Design: Technologies of Architectural Representation*, ed. Mario Carpo and Frédérique Lemerle (London: Routledge, 2008), 7.

²³ Ibid., 8.

Drawing to Building, Robin Evans studies the relationship between projective techniques and architecture through which he challenges the essentialist belief that ideas can be seamlessly conveyed from the architect's mind through the drawing to the constructed building.²⁴ His discussion on the subject reveals that the geometry of vision has dominated the architectural form-making as it became an internalized and pervasive pictorial method of construction throughout history. Thus, he remarks that there is more to the scope of the architect's vision of a project than what can simply be drawn.

2.1.1 New Frames of Reference

In his article "Nonlinear Perspective," architect Kiel Moe challenges this issue concerning how architectural conventions render the conceptions of space and form. He elaborates that by imposing a singular point of view as a particular frame of reference, linear perspective, along with orthographic projection as the fundamental shape spaces of architectural design, impose a singular world view on the design, organization, and representation of architecture.²⁵ He articulates that with this, "it establishes path-dependent conventions about the organization and appearance of architecture that dogmatically survive today."²⁶ On that view he retains that:

Contemporary pedagogies and practices continue to depict architectural objects in this 15th century repertoire of description and coordination, despite fundamental changes in knowledge and life that challenge its hegemonic persistence. To the detriment of disciplinary relevance and imagination, the unquestioned persistence of linear perspective and orthographic projection methodologically segregates architecture from what surrounds and presupposes it.²⁷

²⁴ Robin Evans, *Translations from Drawing to Building* (Cambridge, MA: MIT Press, 1997) referenced in Bryony Roberts, "Expanding Modes of Practice," *Log*, no. 48 (2020): 11.

²⁵ Kiel Moe, "Nonlinear Perspective," *Log*, no. 47 (2019), 119.

²⁶ Ibid.

²⁷ Ibid.

It is an understatement to indicate that these conventional methods are mostly unquestioned as the dominance of the perspectival images has been heavily critiqued and proclaimed dead by the modernist avant-gardes many times during the 20th century.²⁸ In his book *The Second Digital Turn*, Carpo postulates that today might be the time that we call the end of the projected image and puts it as "Today, at long last, the demise of the projected images might be happening for good—this time around, however, not by proclamation, but by sheer technological obsolescence."²⁹ On that historical break, he asserts that until very recently the Renaissance perspective remained as the dominant paradigm of our visual culture due to the established optical, mechanical, and then digital technologies for the creation of perspectival images. Furthermore, he resumes that this phenomenon presumably lasted until today because perspectival images were quite successful in data compression as they "converted infinite distances in space into a limited register of points and lines drawn on a flat, measurable picture plane."³⁰

This enduring and pervasive status of linear perspective and parallel projection in architecture is further discussed in the article "Nonlinear Perspective." Moe constructs an argument that suggests alternative frames of reference for architecture to relocate itself in the ways that these conventions would fall short of as methods of composition and organization "that can only describe the static edges of corporeal objects and fixed spaces."³¹ To illustrate that argument, Moe quotes an allegory of cloud depicted as the sign of the shortcomings of linear perspective given by Hubert Damisch in his interview with Yve-Alain Bois from the October Journal's 85th issue in which Damisch explained:

In the perspectival system, which is linear, the cloud is something that has nothing linear about it and that within a system of spatial coordinates can't be delimited...I incessantly return to Brunelleschi's experiment in which he

²⁸ Carpo, *The Second Digital Turn*, 99.

²⁹ Carpo, *The Second Digital Turn*, 99.

³⁰ Ibid., 101.

³¹ Moe, "Nonlinear Perspective," 119.

represents the Baptistry in Florence by all the means available to geometrical perspective but when he gets to the sky, geometry defaults and he has to insert a mirror in which to reflect the real clouds and sky.³²

Moe further theorizes this allegory of the cloud as a signifier that refers to similar exceptions to architecture's established and internalized relations, the very dynamics that constitute the incorporeal field of relations surrounding architecture. Moe claims that these externalized relations, which cannot be expressed within the conventional Cartesian reference system, not unlike the allegory itself, have to be reconsidered in the context of different reference systems.³³

Capable of expressing spatial relations in terms of a strict coordinate system, the Cartesian has been so far accepted and employed as the de facto system in architecture constituting the base of mechanical and digital practices alike.³⁴ The Cartesian system and geometry are also the mathematical foundation of computer graphics and computer-aided design. This insistence on the Cartesian reference system leads to what Moe elucidates as:

The apprehension of architecture as simply located in a Cartesian frame of reference is demonstrative of this fallacy and ultimately only serves to reify both architecture and its manifold relations in the world. The unquestioned persistence of the Cartesian organization has instilled a false sense of stability for the project of architecture.³⁵

On that note, the field of architecture must renounce the idea that there is only one fundamental geometry and that geometry solely consists of drawing lines and circles. In the chapter "Elements of Digital Architecture" from the co-authored publication *Coding as Literacy: Metalithikum IV*, architect, and computer scientist Ludger Hovestadt define geometry as "the rationalization of thought patterns amid known

³² Yve-Alain Bois, Denis Hollier, Rosalind Krauss, and Hubert Damisch. "A Conversation with Hubert Damisch." *October* 85 (1998) 8, quoted in Moe, "Nonlinear Perspective," 119.

³³ Moe, "Nonlinear Perspective," 121.

³⁴ Ibid.

³⁵ Ibid.

elements."³⁶ In this context, Hovestadt also differentiates the sets of geometries germane to architectural practice and distinguishes between three principal geometries: *Euclidean geometry*, which operates in space; *analytical geometry* which operates in time; and *digital code* which operates in values.³⁷

EUCLIDEAN GEOMETRY	ANALYTICAL GEOMETRY	CODE AS GEOMETRY
characters	ciphers	signatures
phonetic writing	functional printing	operational coding
space	time	value

Figure 2.1. The sets of geometries germane to architecture

Source: Hovestadt, *Coding as Literacy*, 34.

It is effective to scrutinize this categorization in the light of architect and researcher Nikola Marinčić's introduction of the mathematical bases of geometric modeling from his book *Computational Models in Architecture* where he makes a point by stating that:

In his 1637 work *La géométrie*, French mathematician and philosopher René Descartes introduced analytical geometry. Using algebra, he parametrized the Euclidean paradigm and captured time, which in turn fixed a new reference system for all physical processes. Unlike Euclidean geometry, described by text, analytic geometry operates with numbers, making its character formulaic and principally non-visual. To represent it out of equations, they must be drawn and thereby need to be parametrized and evaluated. Only in this sense can one say that Cartesian geometry is the foundation of CAD and computer graphics.³⁸

The mathematical notation of analytic geometry based on the abstraction of space in a set of coordinates bounds the architects who intuitively think spatially to define

³⁶ Ludger Hovestadt, "Elements of Digital Architecture," in *Coding as Literacy Metalithikum IV*, ed. Bühlmann Vera, Ludger Hovestadt, and Vahid Moosavi (Basel: Birkhäuser Verlag GmbH, 2015), 34.

³⁷ Ibid., 35.

³⁸ Nikola Marinčić, "An Overview: Architecture and Computation," in *Computational Models in Architecture -Towards Communication in CAAD Spectral Characterisation and Modelling with Conjugate Symbolic Domains* (Basel: Birkhäuser, 2019), 35.

and represent spatial complexities by mathematical equations. To which crucial exceptions of defining and designing through geometrical methods and physical form-finding experiments might be counted as Francesco Borromini's description of the roof of San Carlo alle Quattro Fontane, the French mathematician Gaspard Monge's principles of descriptive geometry, the infamous hanging model for the Colonia Güell chapel realized by Antoni Gaudí whose works will be delved in detail later in this study.³⁹

Concerning the relative nature of the Cartesian system, architect Mark Burry demonstrates its fallibility by giving the explicit example of a diagram where the conventional Cartesian method is defied. If we were to consider each of the three intersecting xy, xz and yz planes as an arced surface similarly oriented as the Cartesian planes and intersecting at the same origin, we would end up with the same coordinate values existing at different locations for each construct.⁴⁰

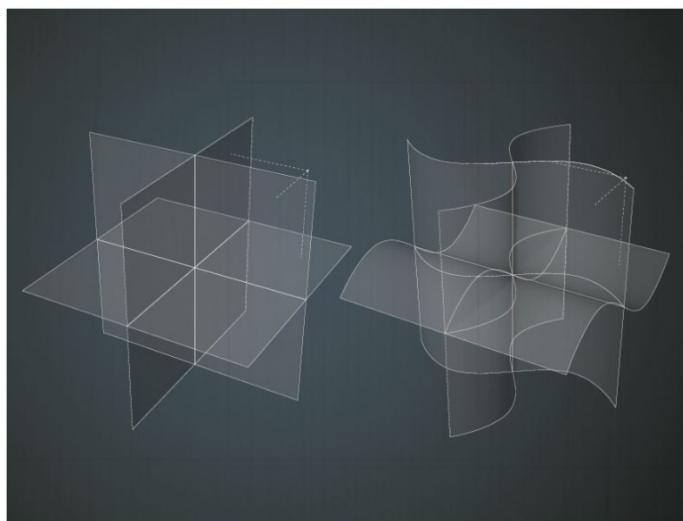


Figure 2.2. Diagram to show the convention of Cartesian space

Source: Burry, *Scripting Cultures*, 92.

³⁹ Mark Burry, *Scripting Cultures: Architectural Design and Programming* (Chichester, UK: Wiley, 2011), 92.

⁴⁰ Ibid., 93.

On this demonstration of the relativity intrinsic to Cartesian system's nature, it is of reason to further the discussion in the milieu of the Euclidean space as Cartesian coordinate system's invention was conceived as a contribution to the study of the objects in Euclidian space itself by making use of the algebraic equations satisfied by the coordinates of the points of each such object.⁴¹

In their critical and engagingly written essay philosopher Bruno Latour and his student, architect Albena Yaneva, lay out a discussion on the ontology of architectural design conceived in Euclidean space. As they identify architecture with a concept of a "moving modulator regulating different intensities of engagement," Latour and Yaneva argue for a visual vocabulary to picture architecture 'as a navigation through a controversial datascape,' and state that contemporary digital tools might finally enable us to capture that complexity.⁴² The challenges posed by the conventions of linear perspective that confine the conception of architecture as a static entity are outlined as:

It is probably the beauty and powerful attraction of perspective drawing that is responsible for this strange idea that a building is a static structure...But when you draw a building in the perspective space invented in the Renaissance (and made more mobile but not radically different by computer assisted design), you begin to believe that when dealing with static objects, Euclidian space is a realist description. The static view of buildings is a professional hazard of drawing them too well.

Following this discussion, Latour and Yaneva make a statement that the Euclidean space as our way of "accessing objects (of knowing and manipulating them)" do reduce the material world to what can be *drawn* and this act is legitimized by

⁴¹ Richard M. Green, "Euclidean Space, Cartesian Space, Arrows and Vectors." Colorado: Colorado University, Mathematics Department, n.d., Accessed June 29, 2020. <https://math.colorado.edu/courses/CalculusIII/spaces.pdf>

⁴² Bruno Latour and Albena Yaneva, "Give Me a Gun and I Will Make All Buildings Move : An ANT's View of Architecture," in *Explorations in Architecture: Teaching, Design, Research*, ed. Reto Geiser (Basel: Birkhauser, 2008), 87.

presupposing that projective geometry offers an 'objective' description to the material world. This reification is centered on the Cartesian duality of object-subject distinction that places the human at the center as the subject prior to all other external worlds of things. Human as *res cogitans* or "thinking substances" is assumed as the subject who has access to knowledge of the objects -all of which constitutes the Cartesian understanding of the mathematical and physical external world- by orienting itself towards it. In this context, Latour and Yaneva assert that constraining architecture's existence to the Euclidian space does not serve to express "the thingly nature" of architecture vis-à-vis the so-called 'objective' nature.⁴³ They clarify the trajectory of their argument by making a point that:

To press the (admittedly philosophical) point further, it could be said that Euclidean space is a rather subjective, human-centered or at least knowledge-centered way of grasping entities, which does no justice to the ways humans *and things* get by in the world. If phenomenology may be praised for resisting the temptation to reduce humans to objects, it should be firmly condemned for not resisting the much stronger and much more damning temptation to reduce materiality to objectivity...So during its flight, a building is never at rest and never in the shape of this Euclidian space that was supposed to be its "real material essence," to which one could then add its "symbolic," "human," "subjective," or "iconic" dimension.⁴⁴

Architecture, with its tangible and intangible relations, constitutes an inexhaustible meaning that cannot be reduced to its sole expression in the Euclidean space. On taking such position, however, Latour and Yaneva base their argument on a model of architecture as a multiverse of continuous flow, as a long succession of transformations that incorporate and regulate the controversies of the actors, data, resources, expertise, and links existing in a complex network. Nevertheless, this methodology suffers from the kind of *correlationism*⁴⁵ intrinsic to Latour's

⁴³ Latour and Yaneva, "An ANT's View," 89.

⁴⁴ Ibid., 84-85.

⁴⁵ A term defined by philosopher Quentin Meillassoux for the kind of view that bases all philosophy on the mutual interplay of human and world. This relationist notion is challenged within the context of *speculative realism* that opposes the idea of reducing entities to their relations.

philosophy, also evident in his renowned Actor-Network Theory,⁴⁶ which can be criticized for reducing individual entities -in this context, the architectural object- to their relations.

Latour, within his philosophical inquiry, manages to counter the object-subject duality in question that dominated most of the Western philosophy since Descartes. This long-standing ontological view assumes that reality has no existence independently from the human that perceives it and therefore constitutes of mostly mental entities like thought as transcendent objects or as linguistic representations or social conventions.⁴⁷ Contrary to the anthropocentrism intrinsic to the object-subject duality, this distinction implies that Latour and other philosophers' ontology relies upon a conception of the reality autonomous from the human mind. Instead of this established hierarchy, as philosopher Graham Harman asserts, "Latour's universe is populated with countless human and non-human *actors*...Prior to any distinction between animate and inanimate, between 'naturally real' and 'socially produced,' the world is a duel of genuine discrete entities."⁴⁸ Through *flat ontology*,⁴⁹ which allows objects to have equal ontological dignity, the ideas of vertical stratification of part to whole relationships and micro- and macro-reductionism of entities either to their components or to their relationships are renounced in favor of objects that manifest themselves as whole things with their irreducible properties. Although, by definition Latour's *actor* assumes such ontological character based on the flat democratic

⁴⁶ Actor-network theory (ANT theory) is a sociological theory developed by Bruno Latour, Michel Callon, and John Law. It suggests that all entities are constituted by their relations and differs from other network theories in that it presents a breakdown of the typical modern distinction between humans and the world, or culture and nature, therefore considers not merely people, but objects and organizations as actors as well. Graham Harman, "Bruno Latour Reassembling the Political," in *Bruno Latour Reassembling the Political* (London: Pluto Press, 2014), 12.

⁴⁷ Manuel DeLanda, *Intensive Science and Virtual Philosophy* (London: Bloomsbury, 2013), 13.

⁴⁸ Graham Harman, *Towards Speculative Realism: Essays and Lectures* (Ropley: O Books, 2010), 81.

⁴⁹ It was Manuel DeLanda who coined the term flat ontology as: "While an ontology based on relations between general types and particular instances is *hierarchical*, each level representing a different ontological category (organism, species, genera), an approach in terms of interacting parts and emergent wholes leads to a *flat ontology*, one made exclusively of unique, singular individuals, differing in spatio-temporal scale but not in ontological status." DeLanda, *Intensive Science and Virtual Philosophy*, 51.

assumption of all entities on the same plane, the ANT theory reduces entities to their broader contexts of relations in which they are enmeshed, without a solid understanding of the *relata* behind these relations.⁵⁰

2.1.1.1 Architectural Object as An Autonomous Agent

The ontological arguments within the discourse of the autonomy of the architectural discipline that establish a hierarchy of parts to wholes in architecture's relations to external entities present problems similar to Latour's philosophy's pitfall as architecture becomes contingent upon wider milieus. Such a relationist view becomes evident among the discussions that consider architecture as the manipulation and sum of the dynamic relationships based on field conditions that consist of networks, forces, fields, swarms, and alike. In his article on the object-oriented ontology titled "Returning to (Strange) Objects," architect David Ruy has pointed out to the fact that this discourse of architectural field⁵¹ has gained gravitas against the discourse of architectural object since the mid-nineties.⁵² Ruy delivers this condition of architecture becoming contingent upon its external relations as:

Architects today are preoccupied with considerations of architecture as a by-product of socio-cultural milieus, as a conditional component of technocratic systems and networks, or even as the provisional end calculations of measurable parameters within the literal of construed environment... This desire for relevance and participation in current events has de-emphasized the architectural object and emphasized the application of architectural intelligence to a wider field of operations...The mysterious power of architecture is rarely spoken of today without embarrassment, but still, the loss of architecture's significance and influence as an independent object seems to be an ever-present source of lament.⁵³

⁵⁰ Todd Gannon, Graham Harman, David Ruy, and Tom Wiscombe. "The Object Turn: A Conversation," *Log*, no. 33 (2015): 75. Accessed June 29, 2020. www.jstor.org/stable/43630852.

⁵¹ On the concept of *field conditions* defined by Stan Allen see Stan Allen, *Points + Lines, Diagrams and Projects for the City*. New York:Princeton Architectural Press, 1999.

⁵² David Ruy, "Returning to (Strange) Objects," *Tarp Architecture Manual*, Spring Issue (2012): 38-42. Accessed June 29, 2020. <http://www.ruyklein.com/essays.htm>

⁵³ Ibid.

In his article, Ruy makes clear that this understanding of the network of relations of a given system as the more profound reality renders appearances of objects as superficial and subservient. Such that the individual constituents of a field of discernible relations like nature become less of a concern than the relations in question.⁵⁴ Here, the ever-existing discourse on architecture's relationship to nature resurfaces as "nature is the ultimate milieu, the all-encompassing field of material phenomena."⁵⁵ Therefore Ruy argues that architecture's move from object to field cannot be discussed without looking into architecture's move towards nature in an effort to bridge the divide in-between. In this respect, similar to Latour's ontology's reduction of entities to their relations, architecture's movement from object to field may lead to the architectural object dispersing into a field of relations, which "then dissolves into a general ecological field of relations that constitutes the world."⁵⁶ Within the context of field conditions that encompass subjects such as ecology, sustainability, and urban planning, architectural objects are atomized into the flux of their environmental and political contexts.⁵⁷ Ruy refers to philosopher Graham Harman in order to point out to the problematic assumptions surrounding the theories of the architectural field from an ontological point of view, as they cannot fully account for the change in networks of relations.

One of the thinkers that cultivated the object-oriented ontology commonly referred to as OOO, Harman introduces the idea that "*relationism* leaves no room for conditions in excess of those relations (by its own definition), and therefore provides an inadequate account of how change comes about."⁵⁸ Questioning the centrality of the human being in philosophy and aiming to develop an ontology of objects that democratizes the ontologies of phenomenology which places the human as an

⁵⁴ Ruy, "Returning to (Strange) Objects," 38.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 74.

⁵⁸ Graham Harman, *The Quadruple Object*, (Alresford: Zero Books, 2011), 7-19, quoted in Ruy, "Returning to (Strange) Objects," 40.

enlightened mind external to the world of objects but in an ever-present correlation with the world, the object-oriented view assumes that the human being itself is an object like any other and the objects withdraw from one another. Among two main principles of OOO pinpointed by Graham, first is that the world is primarily made up of individual entities of various scales, and the latter is that these entities can never be exhausted by any of their relations as objects withdraw from relation.⁵⁹ Regarding these principles of OOO, Ruy clarifies the underlying line of thought as:

If an object could be completely exhausted by a summation of its relations, there can be no way for the object to change its relations. Therefore, there must always be something about the object that is in excess of its qualities and relations... that is withdrawn from access by other objects. The being of the object is always more than its relations.⁶⁰

When this ontological argument is applied to the field of architecture, the architectural object always becomes more than any summation of its internal relations.⁶¹ This idea that the whole qualitatively exceeds the sum of the parts finds its roots in the emergence theory and can be put as whole things are made of other whole things and not of parts. OOO's ontological model presents that objects simultaneously are discrete components of others and a whole object themselves. For architecture, this also suggests unorthodox relations of multiple insides and outsides, resulting in a kind of perpetual deferral of interiority that flattens any hierarchical and relational structure.⁶² That way, instead of a whole with constituent parts, architecture becomes an object, wrapped in objects, wrapped in objects, and so on.⁶³

⁵⁹ Graham Harman, *Bells and Whistles: More Speculative Realism* (Winchester: Zero Books, 2013), 13.

⁶⁰ Ruy, "Returning to (Strange) Objects," 40.

⁶¹ Ibid.

⁶² Tom Wiscombe, "Discreteness, or Towards a Flat Ontology of Architecture," *Project* no.3, Spring (2014): 35. Accessed June 29, 2020. <https://tomwiscombe.com/TOWARDS-A-FLAT-ONTOLOGY-OF-ARCHITECTURE>

⁶³ Graham Harman, *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things* (Chicago: Open Court, 2005), 85.

In alignment with the object's definition within the object-oriented ontology, this study is written from a standpoint that posits the architectural object as a kind of hermetic object that cannot be fully acknowledged and expressed in their relations, that is always to some degree withdrawn and strange, and that exceeds the intentions, techniques, and aesthetics that generated them.⁶⁴ In *Guerilla Metaphysics*, Harman postulates that "object-oriented philosophy has a single basic tenet: the withdrawal of objects from all perceptual and causal relations."⁶⁵ That is partly because relational models are based on a problematic ontological view that poses the networks and fields as real in the same sense that the object is.

Following the contemporary posthuman interests in philosophy, the return to the object in the field of architecture requires us to recognize that "the mysterious power of the architectural object persists beyond individual readings or individual interpretations."⁶⁶ Ruy points that this discourse has effectively undermined "the notion that our particular relationship to the real, as human beings, is somehow privileged and that the absolute is somehow disclosed through the genius of the great architects."⁶⁷ This discrete model of architectural objects challenges the idea of architecture being diffused into constellations of forces, flows, continuities, and being overpowered by those networks of relations as such interests in relationist models which were intensified by digital technologies, have become the norm at the first digital turn in architecture. The impact of diverse factors from the compelling concept of the Fold intrinsic to Deleuze and Guattari's philosophy to the Internet boom (also referred as Web 2.0) and the new emphasis on interactivity along with the changing perspective of a global, interconnected network model of the world defined the zeitgeist of the era.

⁶⁴ Harman, *Bells and Whistles*, 238.

⁶⁵ Harman, *Guerilla Metaphysics*, 20.

⁶⁶ Ruy, "Returning to (Strange) Objects," 7.

⁶⁷ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 81.

The effort in the architectural field to come to terms with these implications of interconnectivity was a by-product of the anxiety that architecture was on the verge of being phased out by that model of the world-as-open-network.⁶⁸ Hence, this relationist view brought about by the changes of an accelerated and wired-up world was architecturally reified as the unprecedented production of conceptual and formal continuity and the resulting contingency of architecture to external entities. This approach where architecture becomes either subservient to external substances or reduced to the image of its underlying network of relations, then found its architectural expression in the formal tendency towards seamlessness, smoothness, and continuity with the emergence of spline-making at the first digital turn, defining the aesthetics dominant to architecture over the last decade.

In this manner, the early digitally intelligent designers employed spline modelers, which was one of the novelties of early CAD/CAM technologies that can script perfectly smooth free-forms curves from any random cluster of points in order to notate reality in terms of mathematically defined continuous lines and uniform surfaces. These digitally constructed forms in physical reality are certainly no more than the geometrical approximation of the mathematical functions they employed for the computers to calculate them.⁶⁹ This theoretical analogy of digital curvilinearity has emerged with the literal interpretation of the abstract concepts of the Deleuzian Fold as well as the Objectile, neither of which necessarily stood for any kind of architectural formalism. Such that the Deleuzian Fold, which initially is the point of inflection of continuous curves and the Objectile, which is an open-ended algorithm, were both reduced to the physical idea of an angular crease in the following tradition of deconstructivism.⁷⁰ As in many fields, this tendency of architecture to regard philosophy as a kind of master discipline to draw concepts from has led to the

⁶⁸ Sanford Kwinter, "Virtual City, or the Wiring and Waning of the World," *Assemblage* (April, 1996), 86-101, quoted in Ruy, "Returning to (Strange) Objects.", 38.

⁶⁹ Carpo, *The Second Digital Turn*, 63.

⁷⁰ Ibid., 58.

misreading of the Fold, which revealed itself in an outburst of folded topologies and iterative-section projects in the architecture of the '90s. Evidently, instead of depending on philosophy as an infallible alibi to legitimize new theoretical and formal agendas, what is critical for the autonomy of the discipline of architecture is to investigate how these concepts can set forth new values for the primacy of aesthetics in general.⁷¹

2.2 The Second Digital Turn

Thirty years after the first digital revolution in architecture, there is a new agenda for the digital avant-garde followed up by the theoretical and technical implications of a new culture and economics of data. It seems safe to conclude that today's computational revolution is well underway and brings about a new way of thinking. The data opulence that has become symptomatic of the second digital turn in the millennium is a result of the fact that contemporary media technologies have made information radically available, and thereby the collection, transmission, and processing of data has become much more convenient.

Historically for the first time, data has become abundant and cheap, providing the grounds for today's economics of information that has brought the term Big Data which references the technical capacity to collect, store and process increasing amounts of data at decreasing costs. In his book *The Second Digital Turn*, Mario Carpo posits that unlike human beings, computers do not need to sort data as they can search through any number of disarrayed items in a matter of milliseconds.⁷²

The digital technological advancement has led to a major paradigm shift in architecture comparable to that which was brought about by the invention of

⁷¹ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 81.

⁷² Carpo, *The Second Digital Turn*, 29.

perspectival and then photographic images. Now that the conventional technologies of data compression such as the linear perspective, parallel projection, and analytic geometry have become obsolete with the access to unprecedented data storage and processing power, Carpo elucidates that:

Designers use the power of today's computation to notate reality as it appears at any chosen scale, without converting it into simplified and scalable mathematical formulas or laws. The inherent discreteness of nature (which after all, is not made of dimensionless Euclidean points or of continuous mathematical lines but of distinct chunks of matter, all the way down to molecules, atoms, electrons, etc.), is then captured and, ideally, kept as it comes, or in practice as close to its material structure as needed, with all of the apparent randomness and irregularity that will inevitably show at each scale of resolution.⁷³

Carpo maintains that even though splines can be mathematically defined and conceived as a seamless flow of Euclidean points, the conceptual continuity of the spline itself does not exist in nature and that "in physical reality we can only make most of them by discrete pieces, by pixels or voxels-which can only be as small as the maximum resolution supported by the display, printer, or physical interface we are using."⁷⁴ Wiscombe states that now the formal experimentation based on smooth manifolds and continuous variations seems to have exhausted itself as a project.⁷⁵ As he aptly elaborates, in the face of the design approach that is principally based on spline modeling and subdivisions:

An alternative is gaining traction, one focused on a world made of discrete, withdrawn entities, things that vex and exceed definition through relations alone. This impulse decenters the human-object or mind-world relation that weaves through architecture as phenomenology or other modes of direct human access, instead tapping into a strange subphenomenal world that we can't see or know but can try to imagine...After a long period on fluidity and connectivity, a new formal lexicon is in order. Chunks, joints, gaps, parts,

⁷³ Carpo, *The Second Digital Turn*, 71.

⁷⁴ Ibid.

⁷⁵ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 76.

interstices, contour, near-figure, misalignment, patchiness, low res...and above all, *mystery*, are the terms that resonate for me.⁷⁶

Describing one of the core traits of the second digital style, this formal vocabulary reflects the new digital tools and technologies that play an indispensable part in the making of architecture. Today's digital avant-garde has already applied Big Data and computation to engage with the discreteness of nature in its de facto state without resorting to the mediation of stripped-down mathematical formulations. With the technology available today, the material realm can be captured and notated in high resolution, made up of discrete points or pixels. The contemporary ways of engaging with and processing the physical reality in its disjointed and fragmentary state have resulted in a new aesthetics of high-density point clouds and volumetric units of design, which is often referred to as voxelization. The Discrete, as an emerging architectural paradigm, favors segments or patches that give a rough and angular look to surfaces over continuous curves and surfaces. In the AD issue 'Discrete - Reappraising The Digital in Architecture,' guest editor and architect Gilles Retsin makes a definition as:

Discreteness is a notion that comes from the sciences, referring to what is individual and separate. It is the opposite of the continuous, that which is uninterrupted and seamless. In architecture, it is traditionally through the notion of 'part-to-whole' relations,...that a discussion about continuity and discreteness enters the discipline...More recently, discrete design techniques and algorithms have also been used by architects working intensively with computation, which Carpo refers to as the 'second digital turn.'⁷⁷

An earlier demonstration of this approach is the T1 Chair Studies produced by Philippe Morel of EZCT Architecture & Design Research in 2004.⁷⁸

⁷⁶ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 76.

⁷⁷ Carpo, *The Second Digital Turn* referenced in Gilles Retsin, "Discrete Architecture in the Age of Automation," *Architectural Design* 89, no. 2 (2019): 6-13, <https://doi.org/10.1002/ad.2406>.

⁷⁸ Carpo, *The Second Digital Turn*, 70.



Figure 2.3. Philippe Morel / EZCT Architecture & Design Research Chair Model 'T1-M' after 860 generations (86,000 structural evaluations)

Source: Philippe Morel, "The Origins of Discretism: Thinking Unthinkable Architecture," ed. Gilles Retsin, *Architectural Design* 89, no. 2 (2019), 20.

Splines were tools employed for simplification, whereas Big Data, "a disorderly offspring of postmodern digitality," is a tool for coping with complexity and the posthuman level of information management.⁷⁹ In his article "Breaking the Curve," Carpo theorizes that "Yesterday's spline-dominated environment was elegant and modern; today's data-driven design environment is messily postmodern: disconnected, broken, fragmentary, rickety, patchy and aggregatory."⁸⁰

⁷⁹ Carpo, "Breaking the Curve," 7.

⁸⁰ Ibid., 8.

2.3 The Demise of the Orthographic Age

Since the breakdown of modern science in the 20th century, indeterminacy and nonlinearity have become norms of contemporary discourse and engrained in the recent digital technologies and tools. On the social, material, technical, and architectural implications of this phase shift from linear to more complex systems of nonlinear relationships, architect Sanford Kwinter marks this distinction as "arguably the single most important conceptual development in recent sciences."⁸¹ With the implementation of the principles of nonlinear behavior, self-organizing systems, and emergence from natural systems into the field of architecture through computational systems, morphogenetic design strategies have been largely adopted by the computer-aided design practices in architecture. In this conception of a material world in a state of constant flux, Kwinter speculates on how these models might influence the field of architecture that:

We are passing from an age dominated by competence—one realized through techniques of mimesis, representation, and reproducibility—to one characterized by a performance, that is of pragmatics or modeling...Now, as it turns out, our capacity to describe reality according to this new model far exceeds our capacity to explain it.⁸²

Through the application of information retrieval (the search for a precedent), simulation, iteration, and optimization, the new data science of searching can engage with posthuman complexity that transcends the modern sciences' fundamental application of the small-data logic of causality, determinism and empirical research to deduce universal laws.⁸³ Inspired by the iterative process of physical form-finding and modeling process of architects like Gaudi and Otto, iterative digital design

⁸¹ Sanford Kwinter, "Soft Systems," in *Culture Lab 1*, ed. Brian Boigon (New York: Princeton Architectural Press, 1993), 211.

⁸² Kwinter, "Soft Systems," 213.

⁸³ Carpo, *The Second Digital Turn*, 46-47.

practices can now simulate the evolution of form, material behavior, and performance of structures within digital environments. Through iterative digital modeling, the self-organizing material effects of form-finding inherent in natural systems can be implemented in architecture to produce complex structures that are geometrically dynamic, responsive, and capable of change that translate the concepts of morphogenesis and emergence into architecture.⁸⁴

The computational form-finding, as the architectural precursor of this process of heuristic, data search-based alternative to modern science, has inevitably defined today's digital style as the techniques we use inevitably feed into the things we design and produce. In his book, *Signal. Image. Architecture*, John May affirms that we no longer write but process words by transforming the digital alphanumeric text on our screens; we no longer draw, but we process images by transforming the geometric approximation of the mathematical notations employed on our screens as a direct consequence of the tools we employ today.⁸⁵

May recalls that as certain things could only become visible once they disappear if we are to understand what has radically changed today, we have to consider the origins of the technical age known as 'the orthographic age' that no longer exists. Only then, we could acknowledge that in architectural orthography, which depends on *mechanical-gestural-medial*⁸⁶ techniques of the precedent (overlaying, tracing, redrawing), all prospective architecture originates from the architecture's past. Such automatism of orthographic projection as a technique inherently based on past instances of geometric order, proportion as well as norms of symbolic expression and format (line weight, line type), stem from its cultural means of gestural

⁸⁴ Michael Hansel, Achim Menges, and Michael Weinstock, "Morphogenesis and Emergence," in *The Digital Turn in Architecture 1992-2012*, ed. Mario Carpo (Chichester: Wiley, 2013), 158-181.

⁸⁵ John May, *Signal. Image. Architecture*. (New York (N.Y.): Columbia Books on Architecture and the City, 2019), 70.

⁸⁶ Ibid., 69.

repetition.⁸⁷ May further explains that orthographic projection with its inherited gestures, linear character, and its speed produced a historical sensibility that ties the past to the future.⁸⁸ On that note, he postulates that:

The act of drawing was always an act of *drawing put the historical present*, of retracing the past, and drawing the past into the present. The drawing itself, in its surface-labor time, was an act of inheritance (the past, passed down), and a staging of history...the silent geometric-tectonic history of architecture past...*The speed of the medium is decisive*. The age of orthography has drawn to a close. Kittler's dictum is its epitaph: Only that which can be switched, can be.⁸⁹

May concludes that the orthographic age has come to an end as emerging technologies of the digital age, such as Big Data, predictive analysis, performative design and form-finding, 3-D processing, and computation alter our mechanistic training routines and orthographic gestures that were engrained to our physiology since now we practice the training of machines. Today, 'real-time' has replaced historicity inherent in gestural routines as parallel projection is now being phased out by the advance of digital technologies of computer-aided design practices. Long past the first *ceci tuera cela* epiphany of the computer killing the book, the first moment of awareness of the digital revolution in the making, digital technologies have shifted from verbal to visual to spatial media, from word processing to image processing and finally to 3-D processing.⁹⁰

⁸⁷ John May, *Signal. Image. Architecture.*, 69.

⁸⁸ Ibid.

⁸⁹ Ibid., 70.

⁹⁰ Carpo, *The Second Digital Turn*, 99.

CHAPTER 3

OBJECT-CENTEREDNESS AND AUTHENTICITY IN THE ERA OF DIGITAL REPRODUCIBILITY

Today, the modern multimedia has provoked a discourse revolving around the opposition of the material world and the virtual world, based on the categorizations between originals and reproductions that are perceived as copies, ephemeral, immaterial, and surrogates. Overlooking the values that might come forth with the reproductions, this discussion ensures that the order of object value is not subverted, and the hegemonic presence of real objects over reconstructed objects is maintained.⁹¹ From that point of view which fails to consider the emergent qualities of digital reproductions, the contemporary digital technologies of 3-D processing and reproduction pose a threat as they lead to a loss of aura and institutional authority and therefore the death of the object as material evidence, the authentic as representative of the passage of time.⁹²

This way of posing the copy as a dissenting force has its roots in the 19th century empiricist and evolutionist way of thinking, where historical objects were valued based on the assumption that they reify time and history originating from a process of material authentication. This cult of real-material that poses the physical manifestations as an objective, reliable marker of culture, has made its way well into the 20th century. In the current context where historical objects are museumified as physical evidence of a particular time, event or person, physicality and material

⁹¹ Fiona Cameron and Sarah Kenderdine, *Theorizing Digital Cultural Heritage: a Critical Discourse* (Cambridge, MA: MIT Press, 2010), 52.

⁹² Ibid., 35.

properties mark and identify the culture, condemning the digital as lacking aura.⁹³ As theorist Jonathan Crary argues, this approach presents the vision as the ultimate objective source of knowledge where materialistic sensibilities and categories of value are attributed accordingly.⁹⁴ In his seminal essay "The Work of Art In The Age of Mechanical Reproduction," Walter Benjamin discusses that original cultural objects have an auratic presence and he emphasizes the importance of material authenticity arguing that mechanical reproduction leads to the loss of that auratic and iconic qualities by stating that:

In even the most perfect reproduction, *one* thing is lacking: the here and now of the work of art—its unique existence in a particular place. It is this unique existence—and nothing else—that bears the mark of the history to which the work has been subject.... The authenticity of a thing is the quintessence of all that is transmissible in it from its origin on, ranging from its physical duration to the historical testimony relating to it. Since the historical testimony is founded on the physical duration, the former, too, is jeopardized by reproduction, in which the physical duration plays no part. And what is really jeopardized when the historical testimony is affected is the authority of the object, the weight it derives from its tradition.... One might focus these aspects of the artwork in the concept of the aura and go on to say: what withers in the age of technological reproducibility of the work of art is the latter's aura.⁹⁵

Hence, in the context of the materiality argument which is inseparable from the deployment of vision as an objective source of knowledge and the object-centered practices it establishes, it is not easy to redefine the digitally reproduced object as a legitimate source of knowledge and the values that might emerge with digital technologies of reproduction.

⁹³ Ibid.

⁹⁴ Jonathan Crary, *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, MA: MIT Press, 2001).

⁹⁵ Walter Benjamin, *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media*, ed. Michael W. Jennings, Brigid Doherty, and Thomas Y. Levin (London: The Belknap Press of Harvard Univ. Press, 2008), 22.

3.1 Reinterpretation of Socio-Cultural Meaning Through Reproduction

What Benjamin has elaborated in his much-quoted essay on the difference between the reproduction by hand or technical means is that although original work maintains its authority over the handmade copy, it cannot over the technological one for two reasons: firstly, technical reproductions are independent of the original as they bring out aspects of the original and instill new values of perception. He makes his mark on the subject by giving the example of photography since it can articulate aspects of the original that are not necessarily visible to the human eye but only to the lens. Secondly, the replicas can be placed instead of the original by recontextualizing itself in space and time.⁹⁶ He maintains that:

Technological reproduction can place the copy of the original in situations which the original itself cannot attain. Above all, it enables the original to meet the recipient halfway, whether in the form of a photograph or in that of a gramophone record. The cathedral leaves its site to be received in the studio of an art lover; the choral work performed in an auditorium or in the open air is enjoyed in a private room.⁹⁷

That is the critical situation that Benjamin argues that devalues the temporal and spatial specificity of the cultural content, detaching it from the sphere of tradition. In his essay "On the Invention of Photographic Meaning," Allan Sekula states a similar idea to that of Benjamin's, that the meaning of a digital image, like that of any other entity, is inevitably subject to cultural definition.⁹⁸ Connoted meaning is imposed on a digital copy at different levels of production so that the meaning is open to interpretation and context-determined. In the same vein, William J. Mitchell, in his book *The Reconfigured Eye: Visual Truth in the Post-Photographic Era*, points out that the main power of modern photography lied in verisimilitude, or the indexical

⁹⁶ Benjamin, *The Work of Art*, 21.

⁹⁷ Ibid., 22.

⁹⁸ Allan Sekula, "On the Invention of Photographic Meaning," in *Thinking Photography*, ed. Victor Burgin (London: Palgrave Macmillan, 1982), 84–109.

value as a physical signifier of the signified, which was undermined by the technical logic of digital photography.⁹⁹ Digital images are now losing all their notational functions after the loss of the indexical value with the emerging technology of digital image and video manipulation and synthesis as the instances such as deep fakes effectively render our notion of authenticity. For this very reason, this discussion of authenticity based on verisimilitude and vision as the objective source of knowledge should be reconsidered as a discourse that emerged with the age of mechanical copies and should be recontextualized in the contemporary era of digital reproducibility. In his essay "The Postmodern Cult of Monuments," Carpo makes a parallel remark as "The electronic distribution of works of art and of their digital copies is already blurring the traditional distinction between originals and reproductions: digital technologies are mostly indifferent to Benjamin's auratic requirements."¹⁰⁰

David Joselit has addressed this thriving need for looking at Benjamin's discourse on the concepts of authenticity and aura under a different light in his book *After Art* where he discusses how art and architecture are being radically transformed by modern technologies and cultural networks under the influence of globalization. Joselit poses ideas about the enduring influence of Benjamin's theory and why we should no longer nostalgically succumb to despair at the loss of aura:

Benjamin's essay can hardly account for the revolution in image production and circulation initiated by media like television, the Internet, and mobile phones since its publication in the mid-1930s...This problem is due not to Benjamin's failure but to our own. There is still no better analysis than his of the economic-aesthetic "regime change" that occurs when mechanical reproduction causes the unit of aesthetic analysis to shift from individual works to virtually unlimited population of images... But as Benjamin was well aware, one of the primary aesthetic and political struggles of modernity has been the dislocation of images from any particular site, and their insertion in networks where they are characterized by motion, either potential or actual,

⁹⁹ William John Mitchell, *The Reconfigured Eye: Visual Truth in the Post-Photographic Era* (Cambridge, MA: MIT Press, 2001), 119.

¹⁰⁰ Mario Carpo, "The Postmodern Cult of Monuments," *Future Anterior: Journal of Historic Preservation, History, Theory, and Criticism* 4, no. 2 (2007): 50-60. August 26, 2020, <http://www.jstor.org/stable/25835012>.

and are capable of changing format—of experiencing cascading chains of relocation and remediation. Images are no longer and probably can never again be site specific, as Benjamin diagnosed, which means that instead of witnessing history they constitute its very currency. This is why the restitution debates I have discussed belong to our historical moment: they represent a fundamentalist effort to restore aura at a juncture when the potential of image circulation and the population explosion of images is irreversible.¹⁰¹

The oversupply of the mechanically made identical images and their continuous circulation may entail a loss of visual indexicality and relevance as signs that change too often or randomly may lose all meaning. However, this was already the case in the artisanal age of handmade copies as the economy of visual communication had become dysfunctional due to a lack of discernible images, whereas now it is dysfunctional due to an excess of them.¹⁰² Nevertheless, it was then for the first time in history that mechanical reproducibility has emancipated the material object from its embeddedness in the context of tradition and its parasitic dependence to ritual.¹⁰³ This way of approaching the copy as a means of not only mechanical reproduction but a means of emancipation and reinterpretation can also be discussed for the yet-to-be-defined directions such as the use of digital technologies in the current reproduction practices.

3.2 The Loss of Visual Identification and Indexicality

From the beginning of the Modern Age, with the advent of emerging technologies and tools for mass-production, the technical supply of identical copies has risen significantly. The continuity between the designer/maker and the object as part of the classical notion of the artifact has disappeared as the reproduced object no longer carries the traces of its maker. Such that this relationship is reversed by standardized

¹⁰¹ David Joselit, *After Art* (Princeton, NJ: Princeton University Press, 2013), 24.

¹⁰² Carpo, *The Alphabet*, 10.

¹⁰³ Benjamin, *The Work of Art*, 24.

mass-production as the distinction between the product (i.e., the original) and the samples (i.e., the copy) has blurred.¹⁰⁴ In Benjamin's words:

From a photographic plate, for example, one can make any number of prints; to ask for the "authentic" print makes no sense. But as soon as the criterion of authenticity ceases to be applied to artistic production, the whole social function of art is revolutionized. Instead of being founded on ritual, it is based on a different practice: politics.¹⁰⁵

This kind of visual identification based on the sheer indexicality of a mechanical imprint is quickly becoming irrelevant with the rise of digital technologies and new forms of postindustrial digital craftsmanship. For the culture of variation based on handmaking, visual similarity and imitation were the norms, and visual identicality and replication were the exceptions.¹⁰⁶ On the mechanical rise and the digital fall of the identical copies, Carpo articulates as:

The modern power of the identical came to an end with the rise of the digital technologies. All that is digital is variable, and digital variability goes counter to all the postulates of identicality that have informed the history of Western cultural technologies for the last five centuries.¹⁰⁷

This loss of visual significance as 'indexical sameness,' which was a quintessential feature of the mechanical age, has led to other paradigms of identification following the age of digital copies. Unlike mechanical means of reproduction, digital tools produce copies in the format of encoded numbers that have to be digitally verified for authenticity. This aspect of digital processing instead of material processes promises an unlimited visual variability and a capacity to mass-produce serial variations, as discussed in the previous chapter. The fundamental shift from artisanal

¹⁰⁴ Beatriz Colomina and Joan Ockman, eds., *Architectureproduction* (New York, NY: Princeton Architectural Press, 1988), 8.

¹⁰⁵ Walter Benjamin, "The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media," in *Illuminations* (New York: Schocken Books, 1969), quoted in Colomina and Ockman, eds. *Architectureproduction*, 8.

¹⁰⁶ Carpo, *The Alphabet*, 3.

¹⁰⁷ Ibid., x.

age of handmaking and variability to the mechanical age of manufacturing and identicity has later left its place to the digital age of serial variation.

By the traditionalist scholars, the defining transition from handmade to mechanical copies is related to the invention of the print and geometric perspective in the Renaissance. Before photography, Leon Battista Alberti had defined the trace of light rays on a surface as perspectival images.¹⁰⁸ The history of architecture constitutes of different timelines of reproduction techniques from modeling to blueprint drawings that align with the media history as the continuity of the discipline of architecture depended on reproduction through various forms of media for the documentation and transmission of its body of knowledge.

3.3 The Reproduction of Architecture

The theoretical, socio-cultural, and practical consequences of modern technology have constituted a critical subject that was widely discussed in the history of modern criticism. However, it is hard to make a parallel claim regarding the introduction of mechanical reproduction into the field of architecture and the crisis that emerged from it.¹⁰⁹ During the industrial revolution, architects' fascination with the assembly line, industrial manufacturing, mass-production, and standardization has left its mark on the 20th century modernism. First with the advent of photography and the rise of illustrated architecture magazines, later with design and mass-production of master models, imprints and molds during the industrial revolution, the relationship between the designer (i.e., producer), the user (i.e., consumer) and architecture (i.e., product) itself has been radically transformed ways in which that catalyzed the postmodern period.

¹⁰⁸ Ibid., 12.

¹⁰⁹ Colomina and Ockman, eds. *Architectureproduction*, 9.

The conventional understanding of modernism's connotations of an autonomous, inward, and self-referential architectural practice called for a reconsideration of critical methods by the postmodern discourse that defined architecture as institutions instead of a series of individual protagonists or edifices. In that, the attention to the internal attributes of work has shifted to its production and dissemination in and across the institutions where its meaning is produced.¹¹⁰ The reproduction of architecture in different mediums and the modernist avant-gardes finding other contexts of production and dissemination through publications and exhibitions affected the design of architecture itself. These media-centered architectural practices led to the critique of architecture's confusion with its image as illustrated architecture magazines, periodical publications, architectural exhibitions, and their accompanying catalogs, retrospective shows, and advertising took the field by storm.

How architecture is produced, advertised, distributed, and socially consumed is redefined by the modernist rationale of the mechanical age of production and identicity. As the architectural historian and theorist Beatriz Colomina postulates:

The history of the architectural media is much more than a footnote to the history of architecture...They invent "movements," create "tendencies," and launch international figures, promoting architects from the limbo of the unknown, of building, to the rank of historical events, to the canon of history. And later they may kill of these same figures.¹¹¹

The history of architectural media can trace architectural production's change of cultural meaning as instances of reproduction and identicity change the making of architectural practices. For centuries the transmission of architectural tradition has depended on the media techniques that were available at the time to document, preserve, and distribute them across space and time. A phenomenon that goes back since the initial definition of architectural design by Leon Battista Alberti where a

¹¹⁰ Peter Bürger, *Theory of the Avant-Garde* (Minneapolis: University of Minnesota Press, 1984), quoted in Colomina and Ockman, eds. *Architectureproduction*, 12.

¹¹¹ Colomina and Ockman, eds. *Architectureproduction*, 23.

building is the identical copy of the architect's design, a cultural revolution which has differentiated the conventional idea of the maker from the designer which is the origins of the modern definition of the architect as *auteur*.¹¹² Another instance that transformed the architectural practices was the idea of seriality and standardization introduced by the industrial revolution. In the long succession of historical time, the interlude of the mechanical age of mass-produced and identical copies has drawn to a close by the age of digital copies of serial variation and randomness intrinsic to digital processes.¹¹³ Architectural design and its processes as an informational operation, which has been defined by the present media technologies during history, are now being redefined by contemporary digitally induced media technologies.

3.3.1 The Digitally Reconstructed Architectural Object

Today, the affordability of processing power has rendered the marginal cost of advanced computation close to zero, which eliminated the need to select, cull, or compress data in order to make information easier to handle. The first experiments with reproduction technologies of 3-D scanning and processing in the field of architecture started with the adaptation of the existing engineering scanning technologies to the scale and process of the then-burgeoning computational design. A decade later than the initial scanning and digitalization of Frank Gehry's handmade sculptural model in the 90's, nowadays with the new generation of 3-D scanners and digital manufacturing tools, the bulky, expensive, and performance-limited tools have become much more affordable and convenient.¹¹⁴ A 3-D scan can now be taken and processed as quickly as a photographic snapshot and can capture much more information than any perspectival image; therefore, it is possible to deduce that inevitably *ceci tuera cela*.¹¹⁵

¹¹² Carpo, *The Alphabet*, x.

¹¹³ Ibid., 10.

¹¹⁴ Carpo, *The Second Digital Turn*, 120.

¹¹⁵ Ibid.

Never before the potential of making copies has been so open-ended, which leads to a growing intensity of searching for the 'authentic' original version. The notion of authenticity based on the material presence of the object can be questioned as Bruno Latour, and Adam Lowe suggested that reproductions can indeed acquire authenticity through a 'migration of aura' from the original to its potentially infinite copies.¹¹⁶ Since the notion of originality translates as being the *origin* of a long lineage, Latour and Lowe state that "To say that a work of art grows in originality thanks to the quality and abundance of its copies, is nothing odd: this is true of the trajectory of any set of interpretations."¹¹⁷ Considering that reproductions as parts of a historical succession of interpretations are essential for the original to survive, they argue that what is crucial is a distinction based on the quality of the resulting output as well as the nature of their reproduction.¹¹⁸ On the importance of this distinction, Latour and Lowe articulate that:

The quality, conservation, continuation, sustenance and appropriation of the original depends entirely on the distinction between good and bad reproduction... A badly reproduced original risks disappearing while a well accounted for original may continue to enhance its originality and to trigger new copies. This is why we want to show that facsimiles, especially those relying on complex (digital) techniques, are the most fruitful way to explore the original and even to help re-define what originality actually is.¹¹⁹

From this perspective, the potential of retrieving the aura from a succession of copies can be considered. The authenticity of the object can be maintained along its continuous path through time and space, thanks to the temporal and material fluidity of its aura. The digital reproductions of architecture form dynamic and convoluted relationships with the original architectural objects they represent. Thus, these

¹¹⁶ Latour and Lowe, "The Migration of the Aura," 3.

¹¹⁷ Latour and Lowe, "The Migration of the Aura," 5.

¹¹⁸ Ibid., 4

¹¹⁹ Ibid., 4-5.

relations include forms of partial migration of aura and the emergence of new kinds of authenticity and documentary, cultural and informational values.¹²⁰

Concerning materiality, the study aims to demonstrate "the physicality of an object does not vanish with the disappearance of its material but can morph culturally, transmuting into another medium."¹²¹ Architect and media theorist Giuliana Bruno refers to this phenomenon as 'technological alchemy' which occurs on the surface of different media. Concerning the reconstructed object in the digital age, materiality can be reactivated as it was always a virtual condition.¹²² The cultural turn for digital objects is constituted in the discourse of *epistemic relativism*, where the notion of 'real' is derived from ideas and concepts, and original authenticity becomes a social construct.¹²³

With the conflation of new technologies for capturing and reproducing reality directly in three dimensions, and with the advent of digital media as a cultural construct, the digital object can be seen as an object in its own right, not as an inferior representation of originals, but as a kind of reinterpretation of them. For what begins as a copy of the material and the real, then acquires its reality, independent of the original as they bring out aspects of the original and instill new values of perception. Digital reconstruction technologies can also enact a particular operation on the objects they record, which constitute its own currency. This advancement of digital technologies has not only brought about a discretized method of engaging reality without abstraction but also introduced its formal lexicon based on the aesthetics of pixels and voxels, which constitute the smallest units of complex systems.

¹²⁰ Paola Di Giuseppantonio Di Franco, Fabrizio Galeazzi, and Valentina Vassallo, eds., "Authenticity and Cultural Heritage in the Age of 3D Digital Reproductions," in *Authenticity and Cultural Heritage in the Age of 3D Digital Reproductions* (Cambridge: McDonald Institute for Archaeological Research, 2018), 2.

¹²¹ Bruno, *Surface: Matters of Aesthetics*, 7.

¹²² Bruno, *Surface: Matters of Aesthetics*, 7.

¹²³ Cameron and Kenderdine, *Theorizing Digital Cultural Heritage*, 52.

3.3.2 Excess of Data and The Aesthetics of the Digital Age

Another subject of discussion regarding today's digital avant-garde in architecture is the way it processes the material realm using the power of today's computation to capture reality in high resolution as it appears at any chosen scale, resulting in high-density point-clouds, complex surfaces, simulating a physical reality in discrete points or pixels.

In the article "The Object Turn," David Ruy theorizes that "Architecture's engagement with the real has less to do with what the world might be in an absolute sense and more to do with a problem of what we think the real should look like."¹²⁴ As architecture is the prominent device for fictionalizing the world, and its representations are mistaken for the world itself, there remains in the architectural practice a belief that there is a reality that architects have to compromise with. This very notion implies that our senses provide us with direct access to the world as it is, also referred to as *naive realism*.¹²⁵

Along with the ubiquity of the digital reproduction tools and their stylistic feature of the overwhelming abundance of digitally created detail, a desire to break and misuse them has emerged. On that stimulation of discomfort and estrangement that is reified in *weird realism*,¹²⁶ Ruy underlines that there now lies an "interest in low-fidelity forms, the inexact, narrative fictions and glitches, and a turn away from the naive realism of digital tools."¹²⁷ The opulent detailing and excessive resolution existing in today's digital architectural avant-garde are also interpreted as an *estrangement device*, coined by Viktor Shklovsky in his essay "Art as Technique," where he develops his concept of *ostranenie*, usually translated as 'defamiliarization' or

¹²⁴ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 81.

¹²⁵ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 81.

¹²⁶ See Graham Harman, *Weird Realism: Lovecraft and Philosophy* (Winchester, UK: Zero Books, 2012), 57-59.

¹²⁷ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 79.

'estrangement.'¹²⁸ As pointed out by Graham Harman, the distancing effect and the estrangement of objects is not solely a part of how architectural discipline deals with the material realm but an ontological problem between all real objects.¹²⁹

Considering objects as things that remain withdrawn and inaccessible, things that are weird and estranged in certain ways, a parallel claim can be made regarding the digital objects. It is interesting to look at the digitally reproduced architectural object in a spatial realm where conventional relations between inside and outside are dysfunctional, such that a litany of digital objects in various orientations that are typically encountered on a plane of the city can come together in new forms of coherence. The isotropic interface of an archive formed of digital architectural replicas in part-to-part relationships might produce a weird coherence that transcends the conventional notion of unity in the classical tradition, as the interior and exterior become entities that still retain their discreteness other than the architecture.¹³⁰

3.3.3 The Architecture of the Digital Archive and Cyberflâneur

Regarding the digital collections, although, as a general rule, they are no longer attributed to their physical origins in spatial terms, there is a tendency to express them in spatialized terms envisaging the spaces of digital collections. In the book, *The Politics of Mass Digitization*, Nanna Bonde Thylstrup introduces the idea that this form of spatialized logic did not emerge with the digitization of cultural heritage collections, however, has its origins in some of the most influential early digital theories which conceptualize the web as an emerging form of architectural infrastructure, not only in material terms (such as cables and servers) but also as a new experiential space. She further indicates that in this spatialized logic, the figure of the flâneur became a central character. In the 1990s, a digital interpretation of the

¹²⁸ Victor Shklovsky, "Art as Technique," in *Theory of Prose*, trans. Benjamin Sher (Dalkey Archive Press, 1991).

¹²⁹ Ibid., 81.

¹³⁰ Gannon, Harman, Ruy, and Wiscombe, "The Object Turn," 84.

flâneur – the former emblematic figure of modern urban culture at the turn of the 20th century – has emerged in the form of the virtual or cyberflâneur. For the cyberflâneur, the Internet or the *information superhighway* constitutes what the city used to be for the flâneur.¹³¹

Similarly, in the publication *Hypercities: Thick Mapping in the Digital Humanities*, the redefinition of the 19th century figure flâneur is discussed within the context of a *hypercity* articulated as a real city overlaid with information networks. The book centers itself around a digital platform project that maps the historical and cultural layers of city spaces through media archaeology in an interactive, hypermedia environment based on the idea that the space of modern metropolis itself is radically rendered by the various media through which it is represented including photography, film, television, computer simulations or geo-browsers.¹³² Tracing the historical genealogy of such urban and architectural database projects back to Benjamin's cultural history of 19th century Paris in *The Arcades Project*, the figure is reinterpreted as "The flâneur in the age of new media becomes a kind of digital dandy, navigating a world that is open, under construction, and, to a certain extent unknown."¹³³ New media reconfigures and reorders the urban space and its experience in a way that the mythical figure of flâneur could never perceive such that physically non-contiguous locations are rendered consecutive. Such a phenomenon is articulated further as:

Not only space is transformed by new media, allowing it to be apprehended and experienced in ways that were previously not possible, but the figure of the flâneur is also transformed, as spectatorship migrates to the screen and eventually the computer interface. Today, we are all digital dandies, and thus it is no coincidence that the figure of the flâneur has frequently informed discussions of the co-constitutive relationship between urban modernity and

¹³¹ Steven Goldate, "The Cyberflaneur: Spaces and Places on the Internet," in *Art Monthly Australia*, no. 91, 15-18, quoted in Nanna Bonde Thylstrup, *The Politics of Mass Digitization* (Cambridge, MA: The MIT Press, 2019), 112.

¹³² Todd Samuel Presner, David Shepard, and Yoh Kawano, *Hypercities: Thick Mapping in the Digital Humanities* (Cambridge, MA: Harvard University Press, 2014), 29.

¹³³ Ibid., 36.

new media, whether photography, film, computer simulations, or other digital technologies.¹³⁴

As the epoch-making consequence of the digital avant-garde in architecture, the advances in 3D-scanning technology could enable 'virtual tourism' in the future as cities will be scanned at such high resolution that will provide a life-like experience of being at that place, materializing that very idea of virtual flâneur.

Architect and the co-founder of 3D-scanning company ScanLab, William Trossell states that cities in the future will exist in both a physical and digital form, such that the lines between the two will become increasingly blurred. Specializing in producing extremely high-resolution 3D scans of the built environment with his team, Trossell indicates that as the technology proliferates, more and more of our cities will be captured this way. He also maintains that in a future scenario, where there are infinitely large data storage and no need to compress data, having the digital replica of cities might even enable us to implement in items that we designed for it that do not exist in the real world, taking the profession of architecture to new dimensions by providing an opportunity to explore and create alternative scenarios.¹³⁵

The concept of a cyberflâneur compels us to think about the impact of the emerging media technologies on architectural making and the perception of architectural and urban space in large. Now that the power of today's computation and data storage technologies render the 3D-processing of milieus as vast as cities possible, the physical relationship of individuals with architecture and the urban context will inevitably be transformed as the spatial experience become ever more virtual and no longer site-specific.

¹³⁴ Ibid., 30.

¹³⁵ Benedict Hobson, "The City of the Future 'Will Be Both Physical and Digital,'" Dezeen, October 26, 2014, <https://www.dezeen.com/2014/10/26/movie-city-future-both-physical-digital-scanlab-william-trossell/>.

At this present moment when this study is written in self-isolation under the influence of a global pandemic, as spatial experiences of individuals have shrunk down to the confines of personal households, the lack of mobility in private spaces and the lack of access to public spaces have irreversibly changed the individual's relationship with space. Depending on participatory experiences conducted solely in the virtual domain as part of the palliative measures taken, it is crucial to question whether the individual's need for physical accessibility to space has drastically been reconditioned and a new notion of accessibility and participation in virtual environments has been brought about by an alternative global scenario of social deprivation, solidarity, and confinement. Often referred to as the 'new normal,' the physical notion of public space has shifted to real-time digital platforms, and ubiquity has replaced site-specificity as new norms of architectural practice. Along with the changing spatial needs, the concept of digital spatial and urban experiences has become more critical than ever before. By now the object-based tradition that has defined material authenticity as a cultural expression is being phased out by digital media objects of various kinds and an emerging culture of digital media, and its discourse manifests itself in the contemporary theory's scene, paving the way for alternative lines of thought for architectural and urban space.

3.4 The Culture of Digital Media

In his book *Simulacra and Simulation*, social theorist and philosopher Jean Baudrillard states that reality is changing as a result of the radical changes in information and communication technologies that lead to critical epistemic and ontological changes. Thereby, he coins the term *simulacrum* to define a copy that either had no original or that no longer have an original and that which becomes the truth in its own right. This condition of the real as indistinguishable from a simulation of reality in technologically advanced postmodern societies is specified as *hyperreality*. In his definition of *hyperreality* as an emerging linguistic condition of society, Baudrillard theorizes the emergence of a new culture that is inflicted from

the changes of "the new media that employs montage principle of film and time-space distancing (unlike face-to-face conversation) to structure a unique linguistic reality."¹³⁶ Media theorist Mark Poster articulates Baudrillard's position as:

The distinctions between object and representation, thing and idea are no longer valid. In their place Baudrillard fathoms a strange new world constructed out of models or simulacra which have no referent ground in any "reality" except their own. A simulation is different from a fiction or lie in that it not only presents as absence as a presence, the imaginary as real, it also undermines any contrast to the real, absorbing the real within itself.¹³⁷

Poster also maintains that "Culture is now dominated by simulations, Baudrillard contends, objects and discourses that have no firm origin, no referent, no ground or foundation. In this sense, what Walter Benjamin wrote about 'the age of mechanical reproduction,' Baudrillard applies to all reaches of everyday life."¹³⁸

In the chapter "The End of Panopticon," Baudrillard defined the spatial perception in a hyperreal society where the Cartesian dualism of object-subject relationship dissolves as deterministic, objective and perspectival modes of thought along with the notion of an objective space (originating from Renaissance) are no longer valid as "simulacra of spaces in which the effect of the real again comes into play."¹³⁹ Such posthuman vision disintegrates the distinction between subject and object as Merleau-Ponty famously puts it, "the world looks at me just as I look at it" in his *The Visible and the Invisible*. Baudrillard associates this kind of mutation from the objective perception of reality into hyperreality with the fact that the medium as a *mediator*¹⁴⁰ is no longer identifiable from the message. In alignment with McLuhan's famous ditto, Baudrillard asserts that "There is no longer a medium in

¹³⁶ Jean Baudrillard, "Introduction," in *Jean Baudrillard: Selected Writings*, ed. Mark Poster (Stanford, CA: Stanford University Press, 2001), 1.

¹³⁷ Ibid., 5.

¹³⁸ Baudrillard, *Jean Baudrillard: Selected Writings*, 1.

¹³⁹ Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Glaser (Ann Arbor: University of Michigan Press, 2018), 22.

¹⁴⁰ Harman, *Bells and Whistles*, 216. See also Marshall McLuhan, *Understanding Media: The Extensions of Man* (Cambridge, MA: The MIT Press, 1994).

the literal sense: it is now intangible, diffused, and diffracted in the real, and one can no longer even say that the medium is altered by it."¹⁴¹

This specific concept where medium's presence surpasses that of the explicit content is embodied and resonated in Baudrillard's use of an analogy to the fable derived from "On Exactitude in Science" by Jorge Luis Borges. In it, Borges depicts a vast empire's obsession with the extensive mapping of its lands through cartography. The story goes as the map becomes so detailed that it reaches the size of the empire itself. Eventually, it becomes obsolete and withered, decaying into the landscape as the empire declined. Baudrillard elaborates this phenomenon in the chapter "The Precession of Simulacra" as:

Today abstraction is no longer that of the map, the double, the mirror, or the concept. Simulation is no longer that of a territory, a referential being, or a substance. It is the generation by models of a real without origin or reality: a hyperreal. The territory no longer precedes the map, nor does it survive it. It is nevertheless the map that precedes the territory – precession of simulacra – that engenders the territory, and if one must return to the fable, today it is the territory whose shreds slowly rot across the extent of the map. It is the real, and not the map, whose vestiges persist here and there in the deserts that are no longer those of the Empire, but ours. The desert of the real itself.¹⁴²

In Baudrillard's rendition of this fable as "the most beautiful allegory of simulation,"¹⁴³ it is not the reality of the territory, but its simulation as a map that lasts and in which people dwell as beings captured one-to-one by cartographers. Baudrillard's interpretation of the story leads to contemplating whether the act of digital reproduction is similar to the creation of a one-to-one map of the world overlaid by a plethora of digitally reproduced objects, so vast that one day it might become as vain and redundant as the fictional one itself, only to wither in the

¹⁴¹ Baudrillard, *Simulacra and Simulation*, 22.

¹⁴² Baudrillard, *Simulacra and Simulation*, 3.

¹⁴³ Ibid.

unfathomable digital datascape of the future.¹⁴⁴ Thus, it is a useful reminder for asking the essential question 'why' so that the impulse to document does not outweigh the reasoning, and the task of reproduction does not become a self-fulfilling prophecy. On this note, it is of further subject to this study to scrutinize the motives for reproduction in the field of architecture and provide the main reasons to this end.

¹⁴⁴ Brendan Cormier, ed., *Copy Culture: Sharing in the Age of Digital Reproduction* (London: V&A Publishing, 2018), 25.

CHAPTER 4

PHOTOGRAMMETRY AND ARCHITECTURAL RECONSTRUCTION

In the history of architectural media techniques from linear perspective and parallel projection as the primary notational tool of architecture to modern computer-aided design and computer graphics, the transition from the 2-D abstraction of spatial information to 3-D processing has reached its apex with the digital renaissance of 3D printers and scanners as surfaces dissolved into the constellations of dots.¹⁴⁵ The modern CAD-based tools were mainly employed for three-dimensional modeling in architecture before the convenience of contemporary 3-D processing technologies that display the reality in its raw and pristine state. As a spatial-centric method, CAD is based on modeling objects by defining the parts of the space they occupy. Under the umbrella of CAD modeling, multiple modeling schemata can be categorized to represent space and objects.¹⁴⁶ On this categorization of modeling schemata Nikola Marinčić elucidates that:

Different schemata may utilize different notions of space to encode objects, but what they all have in common is the Euclidean notion of space in which the user creates and manipulates the object and in which that object is rendered. The encoding of the space in a modeling schema imposes the encoding of objects.¹⁴⁷

In this respect, Marinčić classifies computer-aided modeling schemata according to the physical fidelity of the objects they encode and identifies them as *curve modeling*, *surface modeling*, and *solid modeling*, respectively. The 2-D computer drawings produced by the first-generation digital drafting CAD tools introduced

¹⁴⁵ Robin Evans, *The Projective Cast: Architecture and Its Three Geometries* (Cambridge, MA: MIT Press, 2000), 151.

¹⁴⁶ Nikola Marinčić, *Computational Models in Architecture*, 55.

¹⁴⁷ Ibid.

the infrastructure of geometric modeling. Following these initial advances with curve modeling, two-dimensional representations of space extended with three-dimensional modes of polygonal modeling of surfaces. In comparison with this surface subdivision-based method that approximates the topology of an object through triangulation, solid modeling is a mathematically precise modeling schema whose topological properties enable distinguishing the boundary between the interior and the exterior of the modeled object.¹⁴⁸

The advent of CAD tools, the development of architectural modeling, and the development of computer graphics all served to render realistic images of objects and provide objective and realistic simulations of the world.¹⁴⁹ Architects' mastery over manipulating lines and rationalizing increasingly complex geometry can be related to architects' desire for centuries to visualize their ideas and document their impressions of existing architecture in simulated three dimensions.

Architects' will to record through reproduction can be traced back to the Renaissance, where linear perspective was formerly used for the primary purpose of depicting architectural scenes not for taking measurements for construction, which could be achieved through the use of orthographic projection. The limits of architectural representation challenged architects in order to reproduce objects in a method that is true to their nature. The appeal to represent geometry by lines for the description of surfaces and volumes and on linear constructs such as perspective and parallel projection gave rise to architect's reliance on contour edges for organizing reality by means of abstraction.¹⁵⁰

¹⁴⁸ Nikola Marinčić, *Computational Models in Architecture*, 59.

¹⁴⁹ Ibid., 72.

¹⁵⁰ Yasmin Vobis, and Aaron Forrest, "Other Methods," *Perspecta*, no. 52 (2019), 120.

4.1 The Other Method

An alternative to the approach based on lines has been presented by Piero della Francesca in the 15th century treatise *De perspective Pingendi*, particularly in the third book, where Francesca introduces the "Other Method." This method enables the perspective mapping of nonrectilinear geometry that cannot be effectively reproduced by linear perspective as they are out of alignment with the picture plane, unlike buildings drawn by Alberti's method.

As a systematization of foreshortening, the method was effectively illustrated by the human head as a geometrical type of such unruly objects that do not submit to perspectival projections based on the principles of Euclidean geometry.¹⁵¹ Francesca's approach begins by measuring a person's head by a sculptor's tool known as *finitorum*, which is a disk divided into radial segments placed on top of the head.

By way of radially recording the curves, angles, and shape of contours, the head is precisely sliced into horizontal sections to produce orthographic projections of the head in different orientations.¹⁵² After the orthographic set is prepared, the perspective of the head is achieved by mapping the vertical and horizontal coordinates obtained from the plan and side elevation of the picture plane. This process produces an array of dots which are mapped from irregular surfaces onto a picture plane.¹⁵³

¹⁵¹ Evans, *The Projective Cast*, 154.

¹⁵² Ibid., 155.

¹⁵³ Ibid., 151.



Figure 4.1. Leon Battista Alberti's finitorum

Source: Evans, *The Projective Cast*, 154.

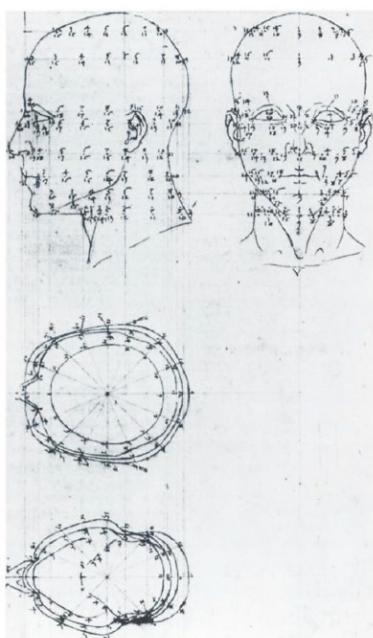


Figure 4.2. Orthographic projections of a head, *De Prospectiva Pingendi*, Piero della Francesca

Source: Ibid., 153.

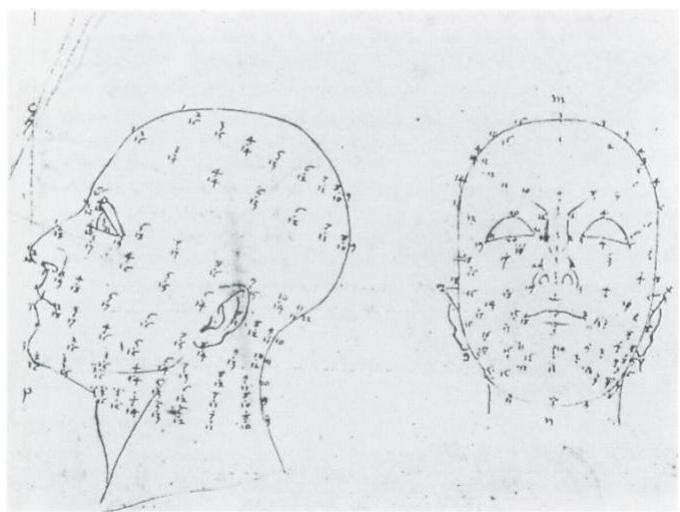


Figure 4.3. The perspective of a head, De Prospectiva Pingendi, Piero della Francesca

Source: Evans, *The Projective Cast*, 157.

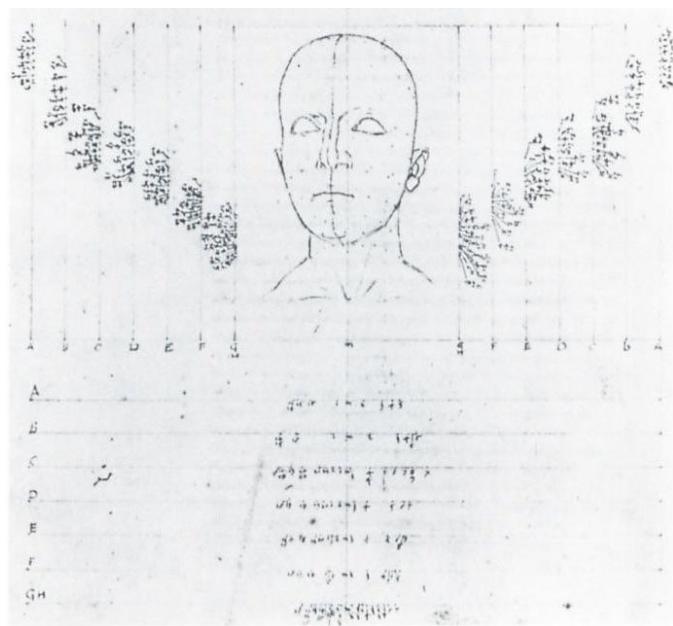


Figure 4.4. The perspective of a head, De Prospectiva Pingendi, Piero della Francesca

Source: Ibid.,153.

In his book *The Projective Cast*, Robin Evans emphasizes that linear perspective is based on the description of lines which was defined by Francesca as "profiles and outlines put proportionately in their place."¹⁵⁴ Instead of the abstraction of geometries to the projected contour edges, Francesca's "Other Method" as interpreted by Evans, constitutes the geometrical sampling of points directly from the surface of the object.¹⁵⁵

This method's significance lies in the fact that it demonstrates that the vanishing point – the symbolization of the observer's eye – does not necessarily have to construct the perspective space and thereby challenges the petrification of the observer by the principles of linear perspective. Evans states that the "Other Method" has enabled "the drawing of discrete objects with no preordained metrical relation to one another."¹⁵⁶ Therefore the object is liberated from the contingencies of the projection method and the perspective grid produced by vanishing points that organize the Albertian space as Francesca's method concentrates on the local relations among eye, picture plane, and object.¹⁵⁷

The pivotal aspect is that the resulting form of the object is derived not through lines but by the mapping of points. In their article "Other Methods" from the 52nd issue of *Perspecta*, architects Yasmin Vobis and Aaron Forrest elaborate that Francesca's method implies relationships through accumulation rather than abstract rule sets and underline the method's significance by stating that "Whereas lines can summarize whole areas by mapping key features, a point method treats each piece of information as discrete and constructs features via a process of building up the many pieces of information."¹⁵⁸

¹⁵⁴ Evans, *The Projective Cast*, 154.

¹⁵⁵ Vobis and Forrest, "Other Methods," 120.

¹⁵⁶ Evans, *The Projective Cast*, 158.

¹⁵⁷ Ibid., 148.

¹⁵⁸ Vobis and Forrest, "Other Methods," 120.

On that note, Francesco's technique of dissolving objects into sparse point clouds and the construction of an overlaid system of annotations was acknowledged to be difficult, labor-intensive, and failure-prone by his contemporaries and most certainly by himself. Due to the inefficiency and difficulty of this approach, Francesco's method did not receive much reputation.¹⁵⁹ Vobis and Forrest maintain that nevertheless, the method has promised an ability to map and draw complex and irregular surfaces and spaces in terms of their perceptible qualities of texture, color, form, as well as light, shadow, and contours. They also maintain that expanding the canon of objects that could be precisely reproduced, this method of drawing is much more sophisticated in the sense that Francesco establishes the archetype of a low-resolution virtual model with the potential to produce an infinite series of views.¹⁶⁰ Meaning that from a virtual point cloud model of the head assembled from the related information of the orthographic set, the head can be modeled from any orientation and position in space as there no longer exists a defined stationary point. Vobis and Forrest articulate this notion as:

Other Method points to a concept of drawing that is less a static, singular projection than it is a modeling of space in three dimensions. This brings attention to a particular combination of attributes necessary for the description of surface qualities and forms in three dimensions and leads to a way of drawing space and surface qualities, including color, simultaneously.¹⁶¹

In this regard, the precise mapping of the architectural effects of surface and spatial articulation and the integrated display of the textural and formal qualities of architecture which are intrinsic to the point cloud scans has proved to be crucial aspects as well for the case of the contemporary architectural media dominated by hyperrealistic renders and post-digital collage craftsmanship which dissects the

¹⁵⁹ Evans, *The Projective Cast*, 147.

¹⁶⁰ Vobis and Forrest, "Other Methods," 121.

¹⁶¹ Ibid.

texture from the form. This duality of the fundamental notions of texture and form can be traced back to the 16th century when historian Giorgio Vasari has coined the terms of *colore* (color) and *disegno* (drawing) as two distinct modes of artistic production and heralded the latter as "the animating principle of all creative processes."¹⁶² Vobis and Forrest assert that the nascent dichotomy was reified by orthographic projection as an abstraction method that stripped architecture of texture, contingency, and atmosphere. Such that the line drawing, which comes under the concept of *disegno* was established as the primary mode of architectural design along with the conjunctive concepts of architectural form, space, geometry, and structure as the primary *loci* of architecture.¹⁶³

Today with the ubiquity of digital tools for spline-making, form-finding, and image-making, the manipulation of curves and mathematically complex geometries, as well as images has become second nature to architecture. The conflation of photorealistic renders, collages, and other architectural image-making practices based on digital processes has called for an approach that treats color (i.e., *colore*) as an applied surface treatment subservient to form.¹⁶⁴ This process only leads up to architecture being substituted by its photorealistic, post-processed simulacrum and reduced to the craftsmanship of image manipulation, or the practice of two-dimensional optical illusion, that of *trompe-l'œil*. This argument suggests that there is an urgency for a contemporary alternative to the "Other Method" for reimagining the terms of the contemporary architectural media techniques to feature information about spatial and textural qualities simultaneously. In this sense, photogrammetry as a holistic reproduction technique treats *disegno* and *colore* not as mutually exclusive but as complementary concepts that come into play in the emergence of the architectural design.¹⁶⁵ In the historical succession of architectural reproduction techniques, photogrammetry manifests the desire to capture reality in its entirety without

¹⁶² Vobis and Forrest, "Other Methods," 118.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

¹⁶⁵ Vobis and Forrest, "Other Methods," 121.

compromise through the abstraction of irregular geometries much like the human head that defies parallel projection techniques referenced in Cartesian space.

The technique of photogrammetry is based on making measurements from input photographs taken from equidistant positions of a real-world object in order to capture and model complex three-dimensional forms in the de facto state. Employed for a wide range of purposes and scales from historic preservation and the survey of façades (terrestrial/close-range photogrammetry) to cartography and topographic mapping (aerial photogrammetry), the contemporary method operates by extracting 3-D measurements from the 2-D data in order to map the point coordinates in a digital environment. Another operation is the extraction of precise color hues and ranges from the photographs uploaded to the software through ambient occlusion, specular reflection, and other modes of rendering to provide accurate information on the physical matter's texture and material properties.¹⁶⁶

At the architectural scale, close-range photogrammetry is first and foremost used for producing digital point cloud models of architecture reconstructed from the spatial coordinates and RGBA values of the given photographic dataset. Relying on a perspective machine as simple as the everyday camera for the production of the dataset, photogrammetry has proved to be one of the most convenient, cost-effective and efficient methods among the state-of-the-art technologies of 3-D scanning.

The dense point cloud output can be post-processed by cleaning the noise around, optimizing the count, angles, and alignment of the photos before building mesh or surface models. In terms of Marinčić's classification of computer-aided modeling schemata, the photogrammetry technique as a contemporary alternative to curve modeling might be identified as solely an intermediary step towards other modes of texture mapping and surface modeling. However, the resulting raw data of colorful, navigable point clouds presents a dynamic and engaging digital environment.

¹⁶⁶ Vobis and Forrest, "Other Methods," 121.

Reconstructing information regarding color, texture, light, and form in a single, cohesive 3-D model, the 3D reconstructions promises different than hardline drafting of parallel projection, the rendering of precise atmospheres.¹⁶⁷

4.2 Photogrammetry Method for Architectural Reconstruction

Since photogrammetric scans thrive on geometric irregularities, this technique is convenient to map the geometric complexities, architectural qualities, and idiosyncrasies of some of the larger structures built over many centuries. The point cloud scans reveal the deviations and subtle changes in geometry, how buildings grow incrementally over many centuries, as well as the complex ways in which surface scaffolds geometry and vice versa.¹⁶⁸

One such building is La Sagrada Familia, which defy conventional methods of reading space due to the complexity and richness demonstrated by Gaudi's work that foreshadows the contemporary ways of digital from-finding. The convoluted nature of its geometric formation and tectonics can be ideally captured and represented by a sampling process like photogrammetry. To further develop the conjecture that is detailed out so far on the digital technologies for architectural reproduction, scanning projects produced by photogrammetry has been carried out within the scope of the thesis. Agisoft Metashape Pro has been chosen as the 3D reconstruction software to compile the data set of 215 photographs taken at various points along the axis of the central nave. The data set of photographs have been produced on a Canon 5D Mark III with a 28 -70 mm lens at the fixed focal length of 28 mm to produce wide-angle shots. The photographs are taken in the morning within an hour after the opening to ideally maintain the same light conditions during the shoot. A point cloud model of 91,977 points and relevant texture models have been produced based on the dataset.

¹⁶⁷ Vobis and Forrest, "Other Methods," 121.

¹⁶⁸ Ibid., 124.

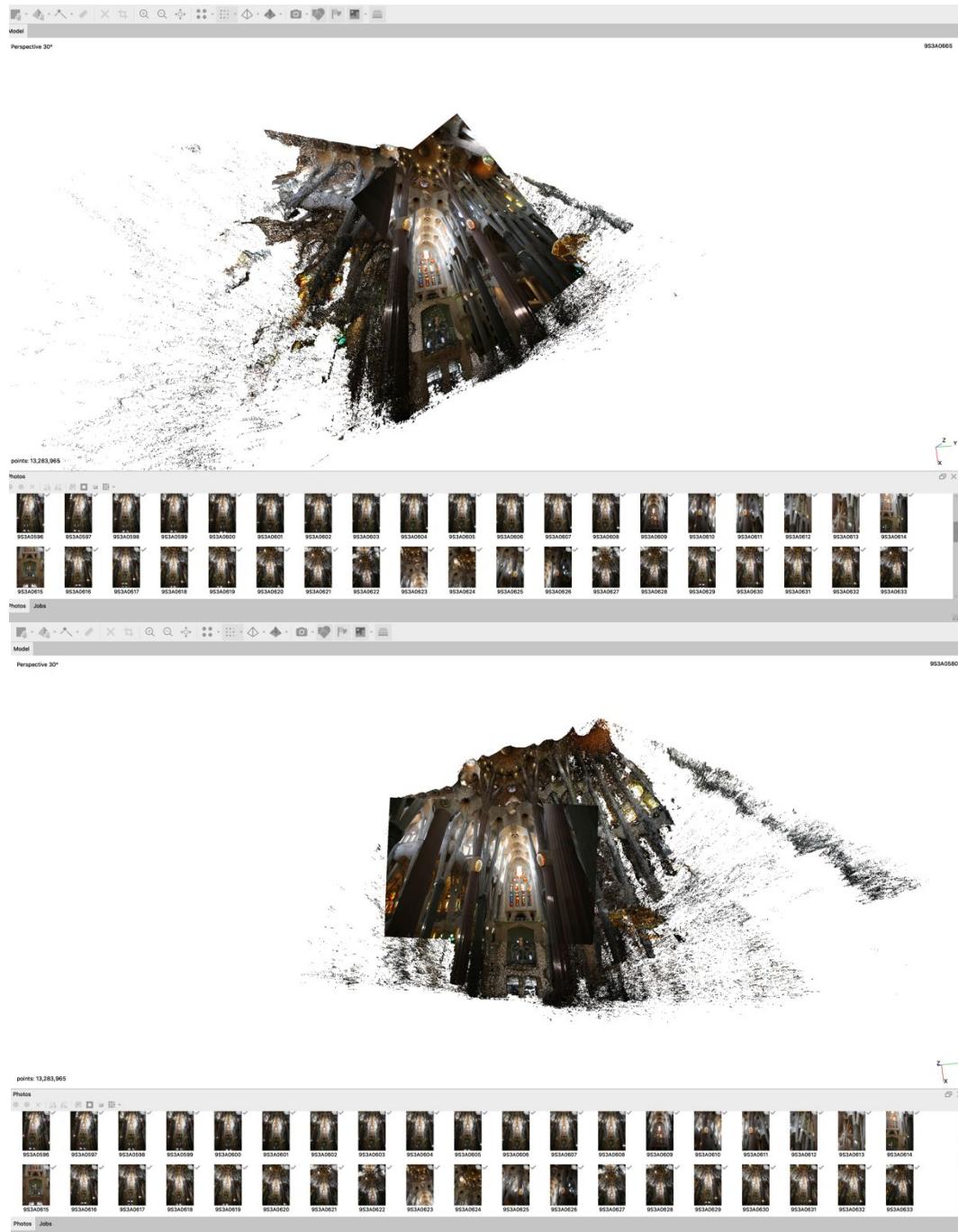


Figure 4.5. Still images from the software interface of the 3D interactive model and related image dataset of La Sagrada Familia, displaying the reference images that are texture-mapped on the solid model for the 3D reconstruction.



Figure 4.6. Still images from the software interface of the 3D interactive model in wireframe and point cloud display modes revealing the angle and position of the image dataset as thumbnails on the 3D environment.

Assigning photogrammetry as part of the research methodology, the digitalization of Sagrada Familia¹⁶⁹ enables the perception of the subtle and sophisticated set of relations formed between the iterations of ruled geometry consisting of second-order surfaces (hyperbolic paraboloid, the hyperboloid of revolution, and the helicoid germane to Gaudi's geometric vocabulary) with the material intricacies that reinforce the tectonics through close alignment.¹⁷⁰

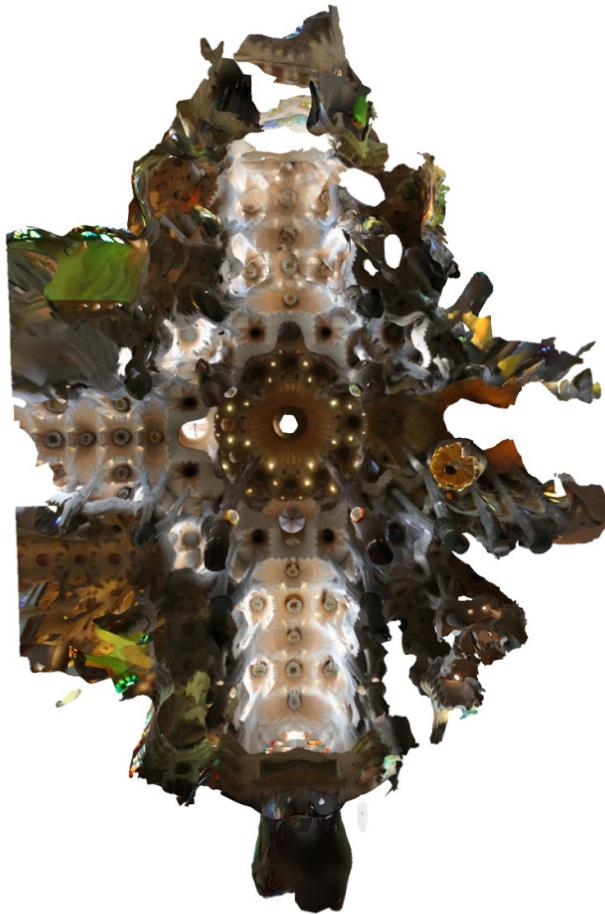


Figure 4.7. Partial reflected ceiling plan showing the central nave of La Sagrada Familia, Barcelona, from the photogrammetric texture model produced in January 2020.

¹⁶⁹ Further information of the scanning and the model can be found at: <https://berilonalan.cargo.site/>

¹⁷⁰ Burry, *Scripting Cultures*, 144.

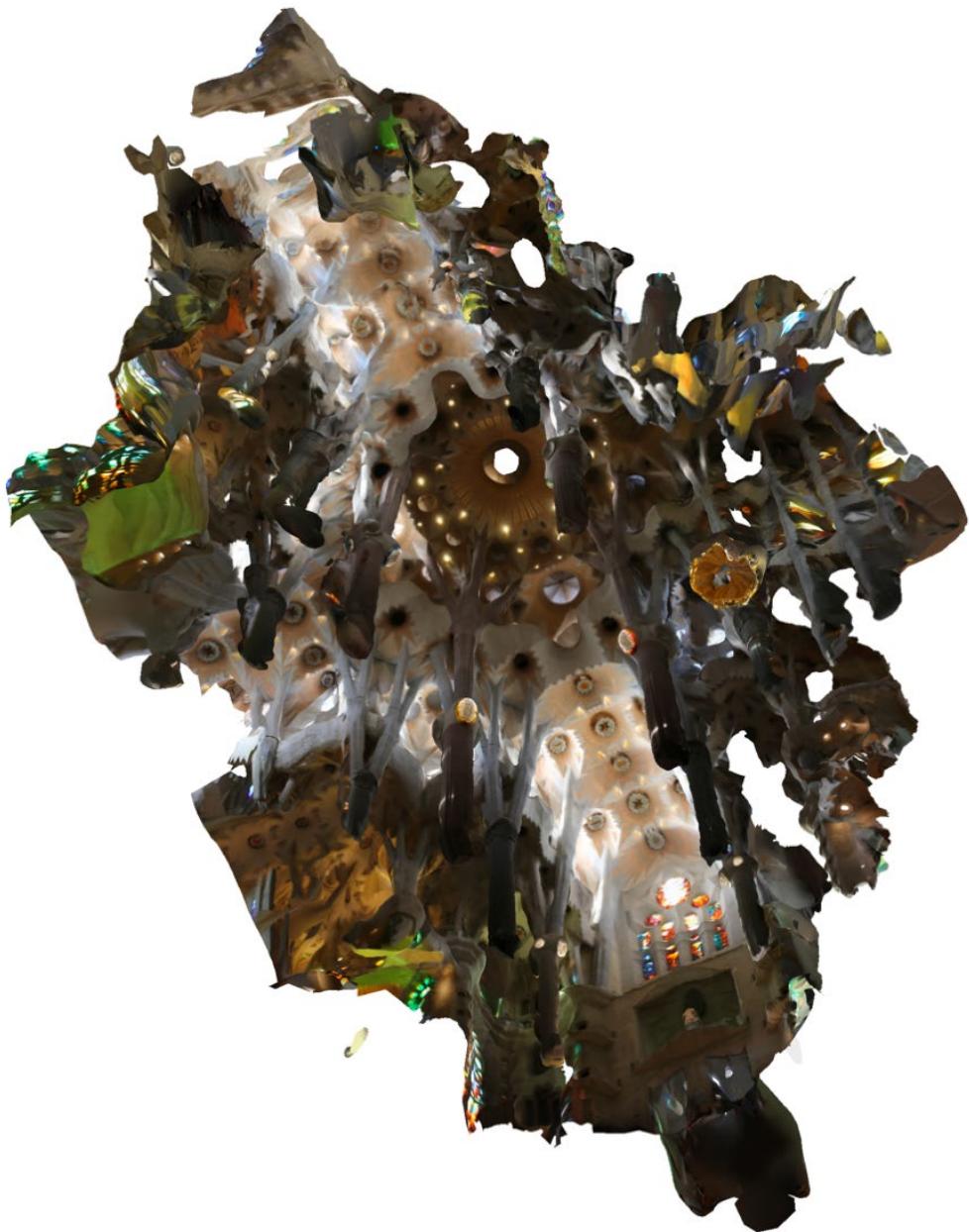


Figure 4.8. Still image showing the central nave of La Sagrada Família, Barcelona from the photogrammetric texture model produced in January 2020.

The interior represents a continuous, arborescent conception of complex geometry converted into space with the verticality of the section comprised of forest-like piers of doubly helical revolution and paraboloid vaults that instill a sense of nature.¹⁷¹ As color leaps from the stained glass to become a spatial condition, a play of light similar to light beams floating through the trees of columns dominates the atmosphere. The polyform of parabolic, organicist abstractions and the polychromatic conditions of light can be captured in precision through photogrammetry. Thereby the photogrammetric models succeed in revealing the complex interrelations between a building's tectonics and surface articulation by relating the spatial, geometric, and multi-temporal data to the color and material realm of the architecture.¹⁷²

Gaudi's lifelong interest in higher geometrical forms and surfaces of double curvature is crucial as the principal driver of the masterful creation of the signature spatial atmospheres present in his complete oeuvre. As the senior architect and lead researcher at Sagrada Familia Basilica, Mark Burry states that the multi-dimensional thinking evident in Gaudi's universal employment of second-order surfaces such as helicoids, paraboloids and hyperboloids demonstrates that Gaudi was able to operate beyond the limitations of Euclidean space. He was able to masterfully design architectural elements such as the Basilica's piers of doubly helical revolution that manifest their form as iterations of shape without shifting location since he conceived of the fourth dimension as the time or more precisely the displacement parameter that translated into the movement of his architectural forms.¹⁷³

The architectural finesse and formal dexterity of Gaudi's works stem from his meticulous design process that encompasses manually executed empirical evaluations of gravity-affected forms, graphical mapping of surface curvatures, and

¹⁷¹ George R. Collins, "Antonio Gaudi: Structure and Form." *Perspecta*, no. 8 (1963), 82.

¹⁷² Vobis and Forrest, "Other Methods," 122.

¹⁷³ Burry, *Scripting Cultures*, 94.

Boolean operations performed by plaster modeling which all constitute his avant-garde approach to iterative and reflective design technologies at the pre-digital era. Indeed, the research conducted on his architecture based on the 2-D data of plans, sections, diagrams, and photographs can be executed much more effectively in the 3-D environment of photogrammetry to reveal the intellectual rigor and sophistication behind such geometric and chromatic delicacies of Gaudi's work which otherwise elude straightforward analysis. The point-cloud scans that reconstruct the interior of Gaudi's spaces by the mapping of discrete, isotropic points form a cloud of color space probability that create a compelling aesthetic and emotive effect of an implicitly delineated atmosphere.¹⁷⁴



Figure 4.9. Still image showing the central nave of La Sagrada Família, Barcelona, from the partial dense point cloud model produced in January 2020.

¹⁷⁴ Vobis and Forrest, "Other Methods," 124.

4.2.1 A New Connoisseurship and Reproduction as Knowledge Production

One of the promising aspects of digital reconstruction technologies is that they lead to a deeper understanding and inspection of works of architecture. Buildings, the repositories of evidence that reveal the many subtle decisions taken during their creation, can now be studied with forensic accuracy.¹⁷⁵ The photogrammetry technique promises more enriched and informed readings of spaces that came to be represented stripped of chromatics and other architectural contingencies through the conventions of orthographic projection. Providing critical insights through the systematical and comprehensive recordings, the 3D reconstructions shed light on a lacuna of architectural narratives that calls for further understanding of the interplay between architectural form and surface treatment that is extant in the making of the architecture. Combining geometric coordinates with RGBA data enables the superimposed reading of the concepts of image and form that ceased to be in opposition since the times of the Renaissance.¹⁷⁶ On the extended reading of architectural making through the point cloud models, Vobis and Forrest postulate that:

Rather than reinforce accepted narratives, the point clouds upend architectural-historical narratives, and suggest a possible reevaluation of the works themselves as well as some of our disciplinary assumptions...They propose a means of rethinking the dominance of the line-as-generator in architectural design, as well as the fixed and sometimes stale relationship between surface and volume—or image and structure—in buildings themselves. Indeed, the very three-dimensionalization of the image that is distinguished in the photogrammetry point cloud models implies a new mode of architectural realism whereby image and space are valued as co-equal elements and are placed in structured simultaneity rather than left in abstract isolation.¹⁷⁷

¹⁷⁵ Brendan Cormier, ed., *Copy Culture*, 58.

¹⁷⁶ Vobis and Forrest, "Other Methods," 122.

¹⁷⁷ Ibid., 124.

Therefore, it is safe to conclude that photogrammetry makes apparent the consistent narrative produced by the architect's intellect and careful conception that plays a significant role in the materialization of space. What is collapsed in terms of space, structure, and surface articulation and flattened into the 2-D plane of a single view is not only exposed but can also be accurately measured and scrutinized in the isotropic interface of the scans while preserving the distance and proportions such that they depict every instance of the building's existing condition. The extensive scan of a building features a whole range of scales going as small as a slight deviation from the orthogonal plan, which is indiscernible to the eye and mostly overlooked by the orthographic constructions that rationalize architecture through representational conventions. Indeed, the scans reveal the inconsistencies of the construction, the material, and ornamentation, signaling to the fact that imperfections of construction become irrelevant to the builders of the past whose intention was to construct a particular atmosphere rather than a perfectly built geometry.¹⁷⁸

It is crucial to stress that digital recordings and physical replicas not only provide long-term preservation, but they initiate the emergence of a new kind of connoisseurship, one which can unveil the complex history of a building; enabling new insights and ways of engaging with the historical architectural object.¹⁷⁹ With the advance of digital technologies, copies become much more faithful to the original, higher in resolution, thereby capturing details that are naked to the human eye that result in digital collections of massive data consisting of photography, 3-D scans, and many digital resources.

In the case of the digitally reconstructed architectural object, it is clear that they represent some features of physical reality at the expense of others, one world view among many, one possible system of categories among numerous others possible. In this study, it is suggested that not only individual reconstructed objects but also the

¹⁷⁸ Vobis and Forrest, "Other Methods," 125.

¹⁷⁹ Brendan Cormier, ed., *Copy Culture*, 58.

interfaces act as representations. That is, by organizing data in particular ways and by making it possible to access it in particular ways, they privilege particular models of the world and the subject. The creation of a complete 3-D repository of various formats and content data can lead to semantically enriched and intelligent 3-D digital models of architecture. Therefore, digital reproduction in the field of architecture serves not only for a more profound understanding of edifices but also enables the preservation, production, and dissemination of architectural knowledge and, most significantly, the preservation of cultures and collective histories on a broader scale.

4.2.2 The Digital Reproduction Technologies for Architectural Heritage Preservation

Several aspects shed light on the need for digital technologies in the field of architecture to record, document, and in some instances reconstruct works of architecture as more and more go under risk with conflicts, terrorism, rapid economic development, mass tourism, thefts, environmental hazards and other natural or human-made disasters.¹⁸⁰ In this period of history, where iconoclasm has become a weapon of choice, heritage sites like Palmyra, the archaeological site of Samarra, along with many other cultural properties in conflict zones, were exposed to hazards or deliberately damaged during warfare for political ends. Director General of UNESCO Irina Bakova states that we are currently witnessing to extreme forms of cultural cleansing.¹⁸¹ To begin with, in cases where the copies serve as the only surviving record as iconoclastic acts destroy the original objects, reproductions can be crucial in safeguarding architectural heritage. The photogrammetry technique enables the precise documentation of buildings and the historical survey of façades for future preservation in case of a risk of destruction or removal.

¹⁸⁰ Brendan Cormier, ed., *Copy Culture*, 1.

¹⁸¹ Sarah Kenderdine, "The Era of Digital Replication," in *Authenticity and Cultural Heritage*, ed. Di Giuseppantonio Di Franco, Galeazzi, and Vassallo, xii.



Figure 4.10. Still image from the photogrammetric texture model of the façade of Dolmabahçe Palace, Istanbul, produced in June 2019.



Figure 4.11. Still image from the photogrammetric texture model of the façade of Dolmabahçe Palace, Istanbul, produced in June 2019.



Figure 4.12. Photogrammetric scan of the Nativity Façade of La Sagrada Família, Barcelona, produced in January 2020.

In addition to pre-emptive scanning of edifices against all kinds of instances, the role of architectural heritage protection, preservation, and rebuilding can be further discussed in post-conflict zones. As preserving heritage is not just about buildings or monuments, but it is actually about culture in the broadest form, both tangible and intangible.¹⁸² Such is the case with the recent catastrophic fire that consumed the roof of Notre Dame Cathedral in Paris, raising the controversial question of how to restore an architectural masterpiece. Luckily, in 2010 architectural historian Andrew Tallon has taken a comprehensive laser-scanning, providing a high-tech blueprint for the preservation and safeguarding of the edifice. Nevertheless, solving the rebuilding

¹⁸² Brendan Cormier, ed., *Copy Culture*, 81.

and preservation of Notre Dame is one of the most significant architectural challenges of the 21st century.¹⁸³

In this context, in order to enhance the understanding and appreciation of architectural heritage globally and especially locally, engaging the local community to construct a database of resources that institutions, practitioners, organizations, and individuals can draw from constitutes a critical goal. For the creation of the vessels that store collective histories, initiatives such as the digital humanities project *Hypercities* serve as an inspiring example as they preserve and produce knowledge through the assembly of different kinds of media (text, sound, video, photographs, and others) taken from various sources in cities into a cohesive, single digital platform.¹⁸⁴

Another project that should be referenced regarding the collective use of digital reproduction technologies and the co-creation of 3D models of cultural heritage is the ACCORD project, which seeks to address the community-based social value of digital objects. Such that ACCORD aims to create an open-access collective dataset of 3D digital models of heritage that will be co-produced by community groups and will serve as a permanent archive.¹⁸⁵ A similar model of projects based on community engagement and co-production of digital reproductions of architectural heritage can be implemented in order to help create a local-level of cultural awareness that would reinforce not solely the historical value of buildings or monuments but also address the lived culture, how the community practices and engages with their historic property.¹⁸⁶

¹⁸³ For further reading on the subject see: Jorge Otero-Pailos, "In Notre Dame, We Find a Heritage That Invites Us to Breathe and Reflect," April 26, 2019, <https://www.theartnewspaper.com/comment/a-proustian-call-to-arms-on-notre-dame>.

¹⁸⁴ Jonathan Shaw, "The Humanities, Digitized," Harvard Magazine, June 20, 2014, <https://www.harvardmagazine.com/2012/05/the-humanities-digitized>.

¹⁸⁵ "About," ACCORD, April 1, 2014, <https://accordproject.wordpress.com/about/>.

¹⁸⁶ For a open-access project of digital architectural reconstruction by the artist trio Oddviz, see: "El Orfelinato," Oddviz collective, August 26, 2020, <https://www.oddviz.com/work/el-orfelinato>.

4.3 The Contemporary Politics of Copyright and Digital Colonialism

Although the learned interest in the remains and cultural heritage of the past is as old as the world's historical record, it is evident that the origins of collection and ownership of the antiquities of the past intangible or tangible are directly related with the ownership of the idea that they represented civilization itself.¹⁸⁷ It was the idea that the West has the right to assert the ownership of the past and identified itself with the civilization that led the antiquities being removed and shipped to museums of European capitals where they became national symbols during the imperial period. Such is the case with the Parthenon sculptures - so-called Elgin marbles - sold to the British Museum by Earl of Elgin or The Venus of Milo in the Louvre that came to represent another national identity through repatriation of cultural property.¹⁸⁸ If we were to look into the culture of digital reproductions, it is possible to trace the same sense of historical colonialism implicit in a physical artifact's past of ownership.

The debates on repatriation of the cultural property beginning in the mid-1700s still maintain their validity in the first decade of the 21st century and constitute a contemporary conflict between a neoliberal model of free circulation and a fundamentalist belief in the site-specificity of cultural property. Today's technological currents of change have become deeply intertwined with the political, cultural, and social policies surrounding the contemporary politics of cultural property since what is at stake is not only the material possession of cultural artifacts themselves but their digital replicas as well. There is an ever-growing concern on safeguarding copyrights since a digital file can be infinitely reproduced. It is now crucial to acknowledge the integral role of information technologies in order to discuss the contemporary definition of cultural property and the politics of digital reproductions.

¹⁸⁷ Zainab Bahrani, Zeynep Çelik, and Edhem Eldem, "Introduction: Archaeology and Empire", in *Scramble for the Past: A Story of Archaeology in the Ottoman Empire, 1753-1914* (Istanbul: SALT, 2011), 16.

¹⁸⁸ Bahrani, Çelik, and Eldem, *Scramble for the Past*, 32.

In today's context, where architecture is becoming commodified by the late capitalist business practices in which anything may be monetized as a universal currency, the ownership and rights to the digital replicas of architecture are in question. In this order of discussion that took the most formulaic tenets of neoliberalism and gave them a veneer of scientific realism, one needs to question digital replicas' circulation or their 'currency' as it defines their international exchange value in a capitalist system.

A term coined by the activist artist Morehshin Allahyari, *digital colonialism* defines the continuation of the West's hegemonic ownership over the remains of the past within the newly established digital heritage domain. In her words, "*digital colonialism* is a framework for critically examining the tendency for information technologies to be deployed in ways that reproduce colonial power relations."¹⁸⁹

Many of Allahyari's artistic works centers themselves around the aim of documentation and digital reproduction of cultural heritage that suffered from acts of vandalism and destruction. It is important to note that Allahyari not only aims to reconstruct heritage in their physical form, but one of her main concerns lies in their democratization. With her projects such as *Material Speculation: ISIS*, she provides open access to the digital research material that she recovered on certain heritage artifacts, including the 3-D model file of her digital reconstruction. By way of that, she points to the importance of a model of open access to world heritage and, in turn, one which might render possible reconciliation between two existing *modus operandi*: that of neoliberalist and fundamentalist. The former aligns with the free neoliberal circulation of copies where cultural content is a form of currency rendered by open markets, and the latter posits that art and architecture belong to a specific place.¹⁹⁰

¹⁸⁹ The New Museum, ed., "Morehshin Allahyari: Physical Tactics for Digital Colonialism," Morehshin Allahyari: Physical Tactics for Digital Colonialism :: New Museum, 2019, <https://www.newmuseum.org/exhibitions/view/morehshin-allahyari-physical-tactics-for-digital-colonialism>.

¹⁹⁰ Joselit, *After Art*, 15.

These two distinct attitudes on the circulation of cultural property differ in their approach to the ethical dilemmas that arise with the population and circulation of cultural property in digital format as they are freed from the limits of time and space. However, they operate in the same way as the neoliberal approach posits cultural property as a currency to be traded and the fundamentalist approach also reduces material culture to an economic asset such that value is solely accrued to ownership, since possessing them aligned with the imperialist idea of the ownership of the civilization itself. The continuation of the Western fascination with cultural property into the digital domain has become a contemporary condition as reproduction, imitation, and replication have come to define the cultural exchange of the present global age.¹⁹¹ Therefore, it is not just a question of reproducibility, but rather our entanglement with copies of all kinds has to do with the fact that intrinsically cultures propagate and perpetuate through constant replication as a form of copying, which Hillel Schwartz has postulated in his book *Culture of the Copy*.¹⁹² Inevitably, throughout architectural history, all movements which defined the making of architecture in a particular way were also dispersed and recognized as the style of an era through constant imitation and production of copies that featured the aesthetics of that particular style.

Amid this discussion, there is yet a mediation between these opposing notions where Allahyari's approach might lay as she offers a method that democratizes and allows open access to digital cultural content liberating it from the issues of copyright ownership, monopoly of information and monetary benefits that come along with the privatization of digital cultural property. By way of scrutinizing research, she not only reconstructs cultural artifacts physically but manages to reconstitute their relationship to their original site and cultural roots through systematic documentation

¹⁹¹ Neil Leach, "The Culture of the Copy," *Architectural Design* 86, no. 5 (2016): 126-133, <https://doi.org/10.1002/ad.2098>.

¹⁹² Hillel Schwartz, *The Culture of the Copy: Striking Likenesses, Unreasonable Facsimiles* (New York, NY: Zone Books, 1996), quoted in Leach, "The Culture of the Copy," 129.

to produce a holistic body of knowledge. Even though artifacts removed from their place of origin are deemed as 'attenuated' or 'dematerialized' by the object-centered materialist discussions that rely on the idea that there is an objective basis for the definition of authenticity, Allahyari underlines that the documentary value and knowledge produced as a consequence of such study remain part of the cultural commons.¹⁹³ In such a model, digital reproductions do not conform to the monetary agents as they become publicly available and autonomous, in alignment with the contemporary paradigm celebrated as *information era*. Thus, the presence of not the material object but its information augmented by 3-D technologies is ensured and maintained within the historical timeline.

Another inspirational artistic intervention aiming to reclaim the rights to the cultural property is *Nefertiti Hack* by artists Nora Al-Badri and Jan Nikolai Nelles. The artists' project consisted of scanning one of the world's most renowned historical artifacts, head of Nefertiti at the Neues Museum in Berlin without granted access to neither the material object nor its digitization. This case itself exemplifies the monopolization and commodification of cultural property as the Neues Museum profits from the sale of a replica of Nefertiti's head as a commercial product obtained using 3-D scanning techniques. After the scanning, the artists have proceeded to release the 3-D data of Nefertiti's head under a Creative Common Licence.¹⁹⁴ As an act against the notion of private possession of cultural heritage, the artists were able to democratize the rights to the artifact by sharing them publicly. The project's aim explained in their own words as "With the data leak as a part of this counter-narrative we want to activate the artifact, to inspire a critical re-assessment of today's conditions and to overcome the colonial notion of possession in Germany."¹⁹⁵ With similar projects that engage with the digital reconstruction of the architectural past,

¹⁹³ Morehshin Allahyari, "On Re-Figuration, Digital Colonialism, and Monstrosity," *UCLA Regents Lecture* (July 10, 2020), <https://www.youtube.com/watch?v=VyPXTp6wSgs&t=1115s>.

¹⁹⁴ Nora Al-Badri and Jan Nikolai Nelles, eds., "Nefertiti Hack," *Nefertiti Hack*, 2015, <http://nefertitihack.alloversky.com/>.

¹⁹⁵ Ibid.

the reproduction of identical copies becomes a means for an act of resistance against the destruction and removal of histories as copies serve for the safe-keeping and preservation of not only architecture but the lived culture itself that propagate through them.

Pointing out to a fact that goes mostly unacknowledged in the field of digital heritage, these projects also bring forth how ownership and copyright policies are under the direct influence of power and authority relations. Such that technology reflects and replicates established colonialist relationships over the digital cultural properties as the ownership of copies is disproportionately distributed to Western nations. In his article "The Humanities, Digitized," Jonathan Shaw from the Harvard Magazine articulates the significance of digital archives by stating that "In this sense, the digitization of archives and collections holds the promise of a grand conclusion: nothing less than the unification of the human cultural record online, representing, in theory, unprecedented democratization of *access* to human knowledge."¹⁹⁶ Today, it is crucial that we reconsider how standard practices in the field of digital heritage and reconstruction serve to reinforce the existing inequalities in terms of access and rights to digital data and what measures need to be taken to democratize the policies of cultural property and knowledge production.

¹⁹⁶ Shaw, "The Humanities, Digitized."

CHAPTER 5

CONCLUSION

This thesis study has examined the fundamental role of the analog and digital production of replicas, facsimiles, and identicals in forms of various media throughout the history of architecture. The reciprocal relationship between the changing architectural media-techniques and the architecture they represent has been traced along the timeline of the transition from the print to electronic culture. How these transitions have manifested itself in the architectural discipline has been studied with a focus on critical periods such as the Internet Boom and the consecutive surge of electronic media and data opulence, the introduction of digital technologies, computational and morphogenetic design in architecture, as well as ideas and concepts based on nonlinearity and the breakdown of the determinism in sciences.

A fundamental argument of the thesis study is that one such breaking point of a new approach to design shaped by the cultural, technological, socio-political, and economic currents of the era has been the first digital turn in architecture. It is further claimed that this turn has lead to a formal style that reflected the political and philosophical zeitgeist that considered architecture as the extension of its dynamic relations consisting of networks, forces, fields, and, therefore, as the by-product of its milieu. This kind of conception entails the idea of architecture becoming contingent upon its external relations, and the following relationist metadiscourse that grants no autonomy to the architectural discipline has been critiqued in the study from a flat ontological view on architecture and its contingencies as discrete entities. These reciprocal changes in architecture's media-techniques parallel to the changing trends in architectural theory can be chronologically studied through the phases of architecture's formal vocabulary. It has been suggested that the quantitative approach to data and the contemporary ways of processing reality in its disjointed and

fragmentary state have brought about a new aesthetics of voxelization. It can be stated that architecture's formal transition from modernism's platonic solids to curves and splines, and later to a fragmented approach resonates with the contemporary architectural theories concerning a flat ontological discourse. This phenomenon of the phases in architecture's formal lexicon is illustrated by Gilles Retsin's diagram of digital curves.

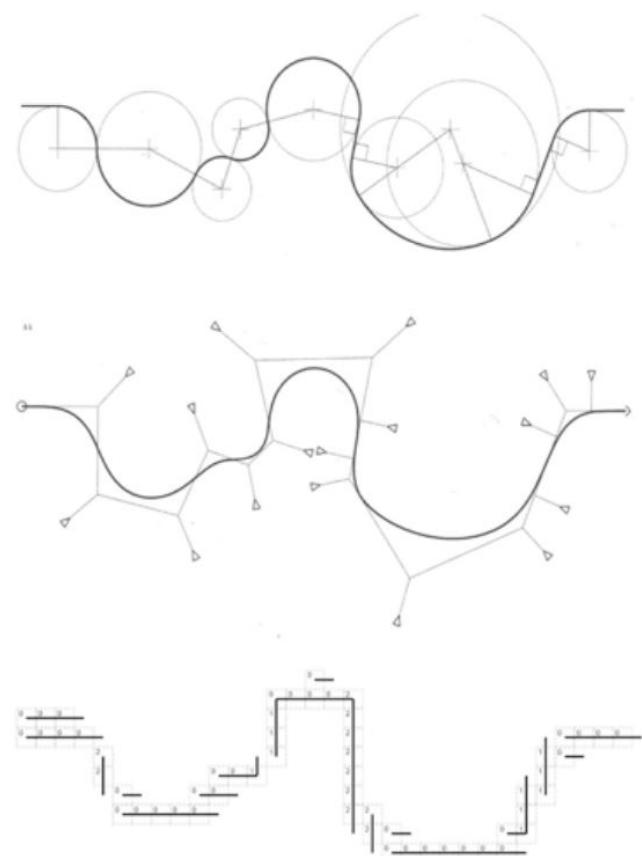


Figure 5.1. Gilles Retsin, Digital curves (after Greg Lynn), 2016

Greg Lynn's 1999 diagram (top) compares a Modernist assembly of circle fragments to a curvilinear NURBS curve (centre). The NURBS diagram rejects the notion of parts and argues for a complete continuity. Here, a new diagram is added below, based on a discrete, computational notion of assembly, suggesting a parallel with the Modernist notion of assembly, but

with parts that have a digital logic – generic units detached from type, geometry or predefined meaning.¹⁹⁷

Looking further into the impact of emergent technologies from an anthropological and physiological standpoint, it is suggested that the contemporary mechanized processes of conceptualizing, designing, and drawing architecture in digital format have reinscribed the well-ingrained orthographic, hand-mechanical gestures and thus redefined the practice of architecture.¹⁹⁸ With the shift from a printed to an electronic culture in architecture where the technical design skills are operated through digital environments and interfaces, the architect's gestural routines, forms of technical literacy, and know-how have been reorganized by the technical systems that are employed. It is concluded that the standardized architectural practice of orthography and its underlying logic of the historical precedent, along with its conditioned modes of design-thinking, have been challenged and transformed by the changing media of architectural design, leading to a severe break from the age of orthography.¹⁹⁹

Another concept provoked by contemporary technologies of media that provided the backbone of the discussion in this study is the paradigm shift from verbal to visual to spatial media, which has led to deviation of digital media technologies from word processing to image and finally towards 3-D processing.²⁰⁰ The ramification of this concept in architecture is multifold, and from a media-technical perspective, the convenience and ease of image and spatial manipulation provided by modern processing power have transformed the architectural media and design, and therefore how architecture and its meaning is produced, advertised, disseminated, and socially consumed. Such media-centered practices based on the intensity and speed of materializing and rationalizing architectural ideas and concepts in specific forms have led to the shift of architecture's meaning from the qualities intrinsic to the design

¹⁹⁷ Gilles Retsin, "Bits and Pieces: Digital Assemblies: From Craft to Automation," *Architectural Design* 89, no. 2 (2019), 45.

¹⁹⁸ John May, *Signal. Image. Architecture.*, 69.

¹⁹⁹ Ibid., 70.

²⁰⁰ Carpo, *The Second Digital Turn*, 99.

to the production and distribution of its image.²⁰¹ Thus, through a close inspection of the instances in the architectural media's history, this study aimed at tracing the architectural production's change of ascribed meaning as instances of reproduction and identicity changed the design and making of architecture.

With the rapid digitalization of media technologies for reproduction, which initiates the emergence of a new kind of copy culture, it is argued that the conventions on the nature of reproductions and the concept of material authenticity within the architectural domain can be redefined. It is proposed that architectural reproductions are essential for the original to survive beyond the conditions of its material presence since all prospective architecture originates from the architecture's past and the profession of architecture as a cumulative form of knowledge relies on the making of copies in terms of drawings, blueprints, scaled models, molds, and replicas as techniques inherently based on past norms of symbolic expression.²⁰² Based on this argument structured on the fundamental role of copies in the production and dissemination of architecture, a potential perspective to Benjamin's concept of aura and related argument on the originals' 'loss of aura' has been brought into the discussion. In that order, the aura has been reconsidered as a migratory, temporally fluid concept that can manifest itself on the surface of changing mediums through a succession of copies. From this perspective, it is proposed that the authenticity of the architectural object can be preserved along its trajectory through time and space by the remanifestation of the nature of its material relations.

Now that the 3-D processing of spatial data has been more convenient than ever with the recent conflation of new technologies for capturing space directly in three dimensions, it is of the same ease and agility to produce and process a digital scan of a building as its electronic image. Thus, digital scans can capture much more information than any perspectival image, which has been a canonical tool for data

²⁰¹ Colomina and Ockman, eds. *Architecture reproduction*, 23.

²⁰² John May, *Signal. Image. Architecture.*, 69.

compression for centuries.²⁰³ As discussed earlier, there is a new culture of the copy defined by the shift in digital reproduction technologies, as reproductions can now be perceived not solely as inferior representations of originals lacking 'aura' but as entities in their own right since they bring out aspects of the original and instill new values of perception. Moreover, copies have become much higher in resolution and more identical to the originals with the advance of digital reproduction technologies, thus capturing details that are imperceptible to the human eye, which results in the formation and building up of 'authentic' information regarding material objects on a forensic scale. Through the study of the multiple motives for reproduction in the field of architecture, it is suggested that digital reconstruction technologies promise – other than long-term preservation – a more profound understanding and inspection of works of architecture as they help reveal the stratified history of buildings and enable new insights into the entities they record. The technique of photogrammetry enables detailed and multi-layered readings of spaces that came to be primarily represented by the orthographic projection, which gives primacy to form over the chromatics and other qualities such as texture, ornamentation, and patina pertinent to architecture. These fundamental aspects that acquired a liminal status within architectural narratives over time require further analysis for an extensive inspection of the interplay between the two complementary concepts of *disegno* and *colore* that are essential to the making of the architecture.

In writing about and envisaging the potentials of reproduction, or any other means of technique in general, it is of critical importance to ask the question 'why' to bring the matters in hand to a fuller perspective. On this note, the influential social theorist Prof. David Harvey at his Harvard Senior Loeb Scholar lecture emphasizes the need for framing and answering the right questions today in social sciences as: "From the 1970s onwards, there has been a gradual erosion. Less and less do people ask the

²⁰³ Carpo, *The Second Digital Turn*, 101.

question, why? They ask the question, how?"²⁰⁴ Regarding this evaluation on the state of social sciences and humanities, a parallel argument can be drawn for the discipline of architectural theory. With this perspective in mind in carrying out this thesis study, essential questions have been raised not only to shed light on how the compelling forces and actors marked certain instances in the historical trajectory of architectural reproduction but also to enlighten the changing motives and impetus for the reproduction of copies in various media in the architectural domain.

²⁰⁴ David Harvey, *Harvard Senior Loeb Scholar Lecture* (July 10, 2020), https://www.youtube.com/watch?v=pm_UgX--ef8&t=1291s.

REFERENCES

- Al-Badri, Nora, and Jan Nikolai Nelles, eds. Nefertiti Hack, 2015.
<http://nefertitihack.alloversky.com/>.
- Allahyari, Morehshin. "On Re-Figuration, Digital Colonialism, and Monstrosity." *UCLA Regents Lecture*. Lecture presented at the UCLA Regents Lecture, July 10, 2020. <https://www.youtube.com/watch?v=VyPXTp6wSgs&t=1115s>.
- Bahrani, Zainab, Zeynep Çelik, and Edhem Eldem. "Introduction: Archaeology and Empire." Essay. In *Scramble for the Past: A Story of Archaeology in the Ottoman Empire, 1753-1914*. Istanbul: SALT, 2011.
- Baudrillard, Jean. Introduction. In *Jean Baudrillard: Selected Writings*, edited by Mark Poster. Stanford, CA: Stanford University Press, 2001.
- . *Simulacra and Simulation*. Translated by Sheila Glaser. Ann Arbor: University of Michigan Press, 2018.
- Benjamin, Walter. *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media*. Edited by Michael W. Jennings, Brigid Doherty, and Thomas Y. Levin. London: The Belknap Press of Harvard Univ. Press, 2008.
- Bois, Yve-Alain, Denis Hollier, Rosalind Krauss, and Hubert Damisch. "A Conversation with Hubert Damisch." *October* 85 (1998): 3-17. Accessed March 21, 2020. doi:10.2307/779179
- Bruno, Giuliana. *Surface: Matters of Aesthetics, Materiality, and Media*. Chicago, IL: University of Chicago Press, 2016.
- Burry, Mark. *Scripting Cultures: Architectural Design and Programming*. Chichester, UK: Wiley, 2011.
- Cache, Bernard, and Patrick Beaucé. "Towards a Non Standard Mode of Production." Essay. In *Objectile: Patrick Beaucé + Bernard Cache: Fast-Wood: a Brouillon Project*, edited by Wolfgang Fiel, 26–39. Wien: Springer, 2007.
- Cache, Bernard, and Mario Carpo. "Introduction." Essay. In *Architecture Words 6: Projectiles*. London: AA Publications, 2010.
- Cameron, Fiona, and Sarah Kenderdine. *Theorizing Digital Cultural Heritage: a Critical Discourse*. Cambridge, MA: MIT Press, 2010.

- Carpo, Mario. "Breaking the Curve: Big Data and Design." *Artforum International*, February 1, 2014. <https://www.artforum.com/print/201402/breaking-the-curve-big-data-and-design-45013>.
- . *Perspective, Projections, and Design: Technologies of Architectural Representation*. London: Routledge, 2008.
- . *The Alphabet and the Algorithm*. Cambridge, MA: MIT Press, 2011.
- . "The Postmodern Cult of Monuments." *Future Anterior: Journal of Historic Preservation, History, Theory, and Criticism* 4, no. 2 (2007): 50-60. Accessed August 26, 2020. <http://www.jstor.org/stable/25835012>.
- . *The Second Digital Turn: Design beyond Intelligence*. Cambridge, MA: The MIT Press, 2017.
- , ed. *The Digital Turn in Architecture 1990-2012*. Chichester: Wiley, 2012.
- Collins, George R. "Antonio Gaudi: Structure and Form." *Perspecta*, no. 8 (1963): 63-90.
- Colomina, Beatriz, and Joan Ockman, eds. *Architectureproduction*. New York, NY: Princeton Architectural Press, 1988.
- Cormier, Brendan, ed. *Copy Culture: Sharing in the Age of Digital Reproduction*. London: V&A Publishing, 2018.
- Crary, Jonathan. *Suspensions of Perception: Attention, Spectacle, and Modern Culture*. Cambridge, MA: MIT Press, 2001.
- Di Giuseppantonio Di Franco, Paola, Fabrizio Galeazzi, and Valentina Vassallo, eds. "Why Authenticity Still Matters Today." Introduction. In *Authenticity and Cultural Heritage in the Age of 3D Digital Reproductions*, 1–9. Cambridge: McDonald Institute for Archaeological Research, 2018.
- Evans, Robin. *The Projective Cast: Architecture and Its Three Geometries*. Cambridge, MA: MIT Press, 2000.
- . *Translations from Drawing to Building*. Cambridge, MA: MIT Press, 1997.
- Gannon, Todd, Graham Harman, David Ruy, and Tom Wiscombe. "The Object Turn: A Conversation." *Log*, no. 33 (2015), 73-94.

- Goldate, Steven. "The Cyberflaneur: Spaces and Places on the Internet." Essay. In *Art Monthly Australia*, no. 91.
- Green, Richard M. "Euclidean Space, Cartesian Space, Arrows and Vectors." Colorado: Colorado University, Mathematics Department, n.d.
- Hansel, Michael, Achim Menges, and Michael Weinstock. "Morphogenesis and Emergence." Essay. In *The Digital Turn in Architecture 1992-2012*, edited by Mario Carpo. Chichester: Wiley, 2012.
- Harman, Graham. *Bells and Whistles: More Speculative Realism*. Winchester: Zero Books, 2013.
- . "A Note on the Life and Thought of Bruno Latour." Foreword. In *Bruno Latour Reassembling the Political*. London: Pluto Press, 2014.
- . *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things*. Chicago: Open Court, 2005.
- . *The Quadruple Object*. Alresford: Zero Books, 2011.
- . *Towards Speculative Realism: Essays and Lectures*. Ropley: O Books, 2010.
- Harvey, David. Lecture. *Harvard Senior Loeb Scholar Lecture*. Presented at the Harvard Senior Loeb Scholar Lecture, July 10, 2020.
https://www.youtube.com/watch?v=pm_UgX--ef8&t=1291s
- Hovestadt, Ludger. "Elements of Digital Architecture." Essay. In *Coding as Literacy Metalithikum IV*, edited by Bühlmann Vera, Ludger Hovestadt, and Vahid Moosavi. Basel: Birkhäuser Verlag GmbH, 2015.
- Hobson, Benedict. "The City of the Future 'Will Be Both Physical and Digital.'" Dezeen, October 26, 2014. <https://www.dezeen.com/2014/10/26/movie-city-future-both-physical-digital-scanlab-william-trossell/>.
- İnci, Erdal, Çağrı Taşkın, and Serkan Kaptan, eds. "El Orfelinato." oddviz collective. Accessed August 26, 2020. <https://www.oddviz.com/work/el-orfelinato>.
- Joselit, David. *After Art*. Princeton, NJ: Princeton University Press, 2013.
- Kolarevic, Branko. "Mass-Customization + Non-Standard Modes of (Re)Production." Essay. In *ACSA 101: New Constellations, New Ecologies: Proceedings of the 101st Annual Meeting of the Association of Collegiate*

Schools of Architecture (ACSA), edited by Ila Berman and Edward Mitchell, 400–405. Washington, D.C., DC: ACSA Press, 2013.

Kwinter, Sanford. "Soft Systems." Essay. In *Culture Lab 1*, edited by Brian Boigon. New York: Princeton Architectural Press, 1993.

Landa, Manuel De. *Intensive Science and Virtual Philosophy*. London: Bloomsbury, 2013.

Latour, Bruno, and Albena Yaneva. "Give Me a Gun and I Will Make All Buildings Move: An ANT's View of Architecture." Essay. In *Explorations in Architecture: Teaching, Design, Research*, edited by Reto Geiser, 80–89. Basel: Birkhauser, 2008.

Latour, Bruno, and Adam Lowe. "The Migration of the Aura, or How to Explore the Original through Its Facsimiles." Essay. In *Switching Codes: Thinking through Digital Technology in the Humanities and the Arts*, edited by Thomas Bartscherer and Roderick Coover, 275–97. Chicago, IL: University of Chicago Press, 2012.

Leach, Neil. "The Culture of the Copy." *Architectural Design* 86, no. 5 (2016): 126–33. <https://doi.org/10.1002/ad.2098>.

Manovich, Lev. *The Language of New Media*. Cambridge, MA: The MIT Press, 2005.

Marinčić, Nikola. "An Overview: Architecture and Computation." Essay. In *Computational Models in Architecture - Towards Communication in CAAD Spectral Characterisation and Modelling with Conjugate Symbolic Domains*. Basel: Birkhäuser, 2019.

May, John. *Signal. Image. Architecture*. New York (N.Y.): Columbia Books on Architecture and the City, 2019.

McLuhan, Marshall. *Understanding Media: The Extensions of Man*. Cambridge, MA: The MIT Press, 1994.

Maxwell, Mhairi. ACCORD, November 12, 2015.
<https://accordproject.wordpress.com/>.

Mitchell, William John. *The Reconfigured Eye: Visual Truth in the Post-Photographic Era*. Cambridge, MA: MIT Press, 2001.

Moe, Kiel. "Nonlinear Perspective." *Log* no. 47 (2019): 118-130.

Morel, Philippe. "The Origins of Discretism: Thinking Unthinkable Architecture." Edited by Gilles Retsin. *Architectural Design* 89, no. 2 (2019): 38–45. <https://doi.org/10.1002/ad.2410>.

Otero-Pailos, Jorge. "In Notre Dame, We Find a Heritage That Invites Us to Breathe and Reflect," April 26, 2019. <https://www.theartnewspaper.com/comment/a-proustian-call-to-arms-on-notre-dame>.

Presner, Todd Samuel, David Shepard, and Yoh Kawano. *Hypercities: Thick Mapping in the Digital Humanities*. Cambridge, MA: Harvard University Press, 2014.

Retsin, Gilles. "Bits and Pieces: Digital Assemblies: From Craft to Automation." *Architectural Design* 89, no. 2 (2019): 38–45. <https://doi.org/10.1002/ad.2410>.

_____. "Discrete Architecture in the Age of Automation." *Architectural Design* 89, no. 2 (2019): 6–13. <https://doi.org/10.1002/ad.2406>.

Roberts, Bryony. "Expanding Modes of Practice," *Log*, no. 48 (2020): 9–14.

Ruy, David. "Returning to (Strange) Objects." *Tarp Architecture Manual*, Spring (2012): 38–42. Accessed June 29, 2020. <http://www.ruyklein.com/essays.htm>

Shklovsky, Victor. "Art as Technique." Essay. In *Theory of Prose*, edited by Gerald Burns, translated by Benjamin Sher. Dalkey Archive Press, 1991.

Sekula, Allan. "On the Invention of Photographic Meaning." Essay. In *Thinking Photography*, edited by Victor Burgin, 84–109. London: Palgrave Macmillan, 1982.

Shaw, Jonathan. "The Humanities, Digitized." Harvard Magazine, June 20, 2014. <https://www.harvardmagazine.com/2012/05/the-humanities-digitized>.

Stiegler, Bernard. *Technics and Time*. Stanford, CA: Stanford University Press, 1998.

The New Museum, ed. "Morehshin Allahyari: Physical Tactics for Digital Colonialism." Morehshin Allahyari: Physical Tactics for Digital Colonialism :: New Museum, 2019. <https://www.newmuseum.org/exhibitions/view/morehshin-allahyari-physical-tactics-for-digital-colonialism>.

Thylstrup, Nanna Bonde. *The Politics of Mass Digitization*. Cambridge, MA: The MIT Press, 2019.

Vobis, Yasmin, and Aaron Forrest. "Other Methods." *Perspecta*, no. 52 (2019): 118-126.

Wiscombe, Tom. "Discreteness, or Towards a Flat Ontology of Architecture." *Project* no.3, Spring (2014): 34-43. Accessed June 29, 2020.
<https://tomwiscombe.com/TOWARDS-A-FLAT-ONTOLOGY-OF-ARCHITECTURE>