PART AND WHOLE:
A MEREOLOGICAL FRAMEWORK FOR ARCHITECTURAL FORM

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SERAY TÜRKAY COŞKUN

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submitted by **SERAY TÜRKAY COŞKUN** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Architecture Department, Middle East Technical University** by,

Prof. Dr. Gülbin Dural Ünver _____
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. T. Elvan Altan _____
Head of Department, **Architecture Dept., METU**

Prof. Dr. Ayşen Savaş _____
Supervisor, **Architecture Dept., METU**

Examining Committee Members:

Assoc. Prof. Dr. İnci Basa _____
Department of Architecture, METU

Prof. Dr. Ayşen Savaş _____
Department of Architecture, METU

Prof. Dr. Selahattin Önür _____
Department of Architecture, Atılım University

Prof. Dr. Berin Gür _____
Department of Architecture, TED University

Assoc. Prof. Dr. Namık Günay Erkal _____
Department of Architecture, TED University

Date: 08.09.2017

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: Seray Türkay Coşkun

Signature:

ABSTRACT

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Türkay Coşkun, Seray
Ph.D. Department of Architecture
Supervisor: Prof. Dr. Ayşen Savaş

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This dissertation constructs a mereological framework for architectural form. Starting with the assumption that architectural form is a "disciplinary product" within which epistemological tendencies, historical styles, design approaches, theoretical discourses, material practices, modes of representation and production, and aesthetic judgments have been accumulated, this study assesses architectural form as "a field for cultivating architectural knowledge." As the disciplinarity of architecture has start to diverge from its conventions and representations, the epistemic content of form remains unaddressed besides the rigorous attempts to formalize the processes of its making and the emerging admiration of its elusiveness. The study observes an epistemological niche that is pregnant with theories regarding the assessment of architectural form and claims that the theoretical and operational uses of parts and wholes are critical for the assessment of architectural form as well as the processes and acts of their making.

To formalize an epistemological framework for the assessment of form in contemporary architecture, this study introduces "mereology," the theory of parthood relations, to reconceptualize "part" and "whole" as tools of cultivating and

disseminating knowledge. Acknowledging part and whole as crucial for understanding and constructing epistemological and methodological approaches to architectural form, the study unfolds theories and practices of part and whole in respect to the ontological premises of “foundedness” and “flatness.” It discloses the mereological underpinnings of architectural form following the philosophical questionings, ontological definitions and theoretical operationalities of part and whole and distinguishes two paradigms: “founded form” and “flat form.” Founded form requires an ontological dependency between part and whole and structures their relationality as the very condition of their beings, whereas flat form does not seek for a dependency or relationality between part and whole and accepts both as circumstantial and contextual concepts that are not defined or characterized by the condition of “being part” or “being whole” and thus independently coexist and resonate without suppressing one another. Although both paradigms acknowledge part and whole, founded form and flat form propose mereologically divergent approaches without a tendency to oppose or refute one another.

Keywords: mereology, architectural form, part, parthood, whole, founded form, flat form.

ÖZ

PARÇA VE BÜTÜN:
MİMARİ BİÇİM ÜZERİNE PARÇA-BİLİMSEL BİR ÇERÇEVE

Türkay Coşkun, Seray
Doktora, Mimarlık Bölümü
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Bu tez, mimari biçim üzerine parça-bilimsel bir çerçeve oluşturmaktadır. Mimari biçimin, bilgi kuramsal eğilimlerin, tarihsel üslupların, tasarım yaklaşımlarının, kuramsal söylemlerin, materyal uygulamalarının, temsil ve üretim biçimlerinin ve estetik yargıların biriktiği bir "disiplin ürünü" olduğu varsayımından yola çıkarak ilerleyen bu çalışma mimari biçimi "mimari bilgiyi yetiştirmek için bir alan" olarak değerlendirir. Mimarlık disiplini geleneklerinden ve temsillerinden uzaklaştıkça biçimin bilgi kuramsal içeriği, yapım süreçlerini kurgulama ve doğrulamaya odaklanan girişimlerin ve "formun" gittikçe bulanıklaşmasının doğurduğu hayranlığın yanında göz ardı edilen bir meseleye dönüşmektedir. Çalışma, mimari biçimin değerlendirilmesiyle ilgili kuramlara gebe "epistemolojik" bir niş gözlemler ve parça ve bütünün, mimari formu anlamak ve üretmek için kuramsal ve operasyonel araçlar olarak ele alınması gerektiğini savunur.

Bu çalışma, günümüz mimarlığına özgü biçimlerin anlaşılabilmesi ve değerlendirilebilmesini mümkün kılacak bilgi kuramsal çerçeveyi biçimlendirmek için "parça" ve "bütün" kavramlarını "parça-bilim" üzerinden kuramsallaştırır. Parça ve bütünün mimari formu farklı şekillerde anlama ve üretmeyi amaçlayan epistemolojik ve yöntemsel yaklaşımların temelini oluşturduğunu savunan çalışma,

bu yaklaşımların parça ve bütüne dair kuram ve pratiklerini “temellendirilmişlik” ve “düzlük” kavramlarının ontolojik önermeleri üzerinden ele alır. Parça ve bütün kavramlarının felsefi sorgulamaları, varoluşsal tanımlamaları ve kuramsal işlerlikleri üzerinden mimari formun parça-bilimsel dayanaklarını inceleyerek iki farklı paradigma tanımlar: “temellendirilmiş biçim” ve “düz biçim.” Temellendirilmiş biçim, parça ve bütün arasında bir ontolojik bağımlılığa gereksinim duyar ve parça ile bütün arasındaki ilişkileri kendi varoluşlarının şartı olarak yapılandırır; düz biçim ise parça ile bütün arasında bir bağımlılık veya ilişki arayışına girmez ve parça ve bütünü birbirinden bağımsız olarak, bir diğerini bastırmadan bir arada var olabilen kavramlar kabul eder. Her iki paradigma da parça ve bütün kavramlarını kabul etse de, temellendirişmiş form ve yassı form birbirlerine karşı koyma ya da çürütme eğilimi olmaksızın farklı parça-bilimsel yaklaşımlar ortaya koyar.

Anahtar kelimeler: “parça-bilim,” mimari biçim, parça, parçalık, bütün, temellendirilmiş biçim, düz biçim.

To Esatcan,

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CHAPTER 1

INTRODUCTION

This study aims at formalizing an epistemological framework to discuss and assess "form" in contemporary architectural theory. Form is approached as a representation, an abstraction of theory. In other words, form, or rather architectural form, is interpreted as a field where definitions of the discipline, histories of styles, approaches to design, critical processes of production, and theories of aesthetics have accumulated. Starting with the assumption that architectural form is a "disciplinary product" within which historical, epistemological and methodological approaches in architectural design are embedded and thus become visible, this study conducts a research into architectural form as a field for cultivating knowledge. The research focuses on the concepts of "part" and "whole" and adopts these concepts as apparatus of design, analysis and criticism. By acknowledging the ontological dependencies, historical associations, contextual misreadings, inconsistent oppositions, and shifting meanings accommodated in the duality of part | whole, this study interrogates how these concepts epistemologically and methodologically function in the comprehension and production of architectural form.

Referring back to the assumption that architectural form is a disciplinary product, architectural design, in return, is a disciplinary act. The understanding of design as an intellectual act in architecture and as the legitimate field of action of the architect has been achieved by the institutionalization of drawing. Therefore, drawing should be acknowledged as a "disciplinary tool" through which architecture was able to define, produce and disseminate knowledge. Drawing and design are historically critical in the disciplinary formation of architecture, of which the epistemological and

methodological tendencies are inscribed on its disciplinary products. The discipline[1] of architecture, formed and developed heavily around the augmented dependence between drawing and design, has been challenged by digital technologies and computational design within the last few decades. Architecture as a discipline has always been tenacious to extra-disciplinary references and has never been able to achieve a sturdy foundation. Nevertheless, detaching it from its representations caused a fundamental deflection in architectural design and thus in its products, namely architectural forms, and in the production of architectural knowledge. There emerged an "epistemological niche" for architecture to question its conventions and assumptions as well as to cultivate a textual field accommodating fresh theories.

Historicity of the discipline of architecture evolved around the engagement of drawing and design is acknowledged regarding its changing definitions that continuously refresh its conventions and representations. Drawing has been historically the primary disciplinary tool and epistemological priority has always been on drawings. Although drawing has been criticized and outdated in current practices, architecture struggles to define digital environments and computational design instruments as disciplinary tools. They are expanding and reformulating their field of experience and application, yet architecture is still in research. How digital environments provide a variety of modeling, calculating, testing, controlling etc. software and predominantly how computation in/as design contribute to architectural knowledge that is peculiar to the discipline is not explicit. The reason is particularly the lack of theory to assess forms that are pushed into the background because of the obsession concentrated on designing processes of design. Despite the diversity of research and recent discourse on the highly formalized and intricately articulated processes of design, the critical interpretation and the aesthetic judgment of the

[1] The understanding of discipline is based on the definition of Stanford Anderson as "a growing body of knowledge unique to this field; it cannot be reduced to the constructs of other fields" in "On Criticism," Places, vol.4, no.1, 1987: 7.

outcomes remain unaddressed. The processes of formation, accepted as the ultimate design act, is responsible for defining the conditions of the product, which controversially leads to an indiscernibility of the process and its products. In the wake of this ambiguity, form is referred solely as an extent of the "on-demand object" and theories for assessing this "contingency", namely the form itself, are yet to be mature.

The epistemological niche that settles in-between architecture and its forms expects to be cultivated by theories questioning the relevancy of "cool"[2] forms and exploring the epistemic content of forms passed over in favor of processes that lead to them. It is the claim of this study that the theoretical and operational uses of part and whole are critical for the assessment of architectural form as well as the processes and acts of their making. The study offers an inquiry into to epistemological and methodological approaches to architectural form by focusing on the concepts of "part" and "whole" and aims at developing a ground theory for its assessment in contemporary architecture. The inquiry will unfold that despite all the deflections from conventional practices and assumptions of architectural design, the currency of the concepts of part and whole allows for the construction of epistemological framework for architectural form.

To achieve a consistency in the definitions of the very notions of the part and the whole, "mereology" provides the theoretical basis. Mereology is a field of philosophy that studies the parts and particularly the conditions of being part, the relationality between parts and the relationality of part and whole. Briefly, it is the

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[2] Sylvia Lavin coined the term "cool" in architectural discourse. She attempts to construct a polemical understanding of coolness in recent architecture that has something to do with a lack of need for justification. Although this study does not aim at reaching a justification of forms, the idea of a form that "simply exists" is critically degrading for acknowledging architectural form and its epistemic content. Sylvia Lavin. "How Architecture Stopped Being the 97-Pound Weakling and Became Cool," The State of Architecture at the Beginning of the 21st Century. Eds. Bernard Tschumi and Irene Cheng. New York: The Monacelli Press, 2003: 46-47.

theory of parthood relations. Mereology assumes no ontological restrictions in the field of parthood, the whole can be as concrete as the parts and/or the parts can be as abstract as the whole. Moreover, it does not aim at a fixation of the notion of parthood, the relations can be formal, material, spatial or temporal and so on. Mereology seeks for the characterizations of part, definitions of the relation(s) and identifying relational properties of the whole. This study aims at formalizing a mereological approach to architectural form by reconceptualizing part and whole as analytical and noematical tools of architectural thinking and theoretical and operational tools of architectural making. The intended "architectural mereology" does not necessitate a part to have a material existence, a conventional definition in the field of architecture, or a structural function in the formation of an architectural whole but rather provides an opportunity to redefine the concepts of part and whole in architecture and to discover their theoretical and operational competences in developing epistemological and methodological approaches to architectural form.

Briefly, architectural form is the object of study; the part and the whole are the tools of research; and mereology is the theory that formalizes the epistemological framework of this study. Architectural form as the object of study is addressed with its representations in a variety that encompasses the introduction of the word "form" in the vocabulary of architecture; the textual field accumulated through the struggles of defining and redefining architectural form; and the visual field expanded by the aggregations of drawings, images, diagrams, buildings, and so on. The words of "part" and "whole" are preserved throughout the text as they establish the tools of research and the indication of "part-whole relations" is consciously avoided to prevent the assumption that the structural order between the two is absolute, constant and timeless. The use of element, component, segment, fragment, piece etc. instead of part and the use of composition, organization, system, complex, unity etc. instead of whole are avoided since they embody critical tendencies in the formation of architectural vocabularies. When required, the aforementioned terms will be referred as specific historical and contextual interpretations of the concepts of "part" and

"whole". The consistency in the use of the words "part" and "whole" is critical to instrumentalize these concepts as the tools of research. The concepts are mereological; part and whole become architecturally operational through the processes of architectural design and disclose the methodological and epistemological approaches to architectural form. This study suggests a particular understanding of architectural form by reconsidering it as a disciplinary product historically, theoretically, conceptually, and materially molded by the urges and challenges to define the concepts of part and whole and their relationality. In this regard, mereology has the capacity to expand the vocabulary of architectural form to *cultivate* theories toward its assessment.

The study instrumentalizes the concepts of part and whole as theoretical and operational tools of research as well as design. Based on the philosophical definitions and questionings emerged within and through the field of mereology, a mereological approach will be founded on the reconceptualization of part and whole. To interrogate how these concepts epistemologically and methodologically function in the conception and production of architectural form, an inquiry into theories and practices of part and whole will be provided.

Aiming at formalizing an "architectural mereology," this study distinguishes two paradigms for acknowledging architectural form in respect to the divergence, not opposition, in the mereological stance: (1) "founded form" and (2) "flat form." Both form-paradigms acknowledge the concepts of part and whole, yet diverge in their ontological instruction and relation. While "founded form" signifies the ontological dependency between part and whole and asserts that the very definitions of the concepts of part and whole are founded on that dependency, "flat form" does not seek any dependencies between the two or assign ontological priorities.

The textual body of the study starts with a contextualization of architecture's disciplinarity and its changing formations as a design-based discipline. The

following chapter provides a brief account on the historical formation of the discipline of architecture "after" drawing. The implication of *"after" drawing* is two-fold; it includes both the "after" of its introduction and the "after" of its suspension. The chapter assesses the critical association between drawing and design as the core formation of architecture's disciplinary character and addresses the problems occurring in different scales and environments after the relationship between drawing and design is suspended by the introduction of digital media and computation technologies. It illustrates the changes in the discipline of architecture by a critical decomposition of architectural design into its processes, surfaces, acts, figures, objects, and vocabularies. The chapter serves as a contextual background upon which the epistemological niche anticipating the theories for the assessment of architectural form can be recognized in different fragments of the discipline.

Chapter 3 is the core part of the study by which an epistemological framework is constructed on the ontological premises and philosophical underpinnings of "mereology". As mereology is marginal to architecture, the first half of the chapter introduces "mereology" with an inquiry of its history in philosophy and fields of influence to acknowledge it as a significant course of understanding and questioning the concepts of part and whole. Extending form the initial formations of its theoretical framework to its metaphysical re-formulations, mereology theorizes the concepts of "part" and "whole" with their ontological intricacies and discrepancies. The second half acknowledges architectural form as a disciplinary product and aims at formalizing an "architectural mereology" by reconceptualizing the "part" and "whole" not solely as analytical and noematical tools of assessment, but also as theoretical and operational tools of design for architectural knowing. The chapter concludes by suggesting the paradigms of "founded form" and "flat form," through and within which architectural mereology will be *cultivated*.

Chapters 4 and 5 constitute the main body of the work, respectively devoted to the paradigms of "founded form" and "flat form." The chapters provide inquires of

architectural form by focusing on the evolution of and the changes in theories and practices of part and whole in architecture, which grow into formations of epistemological and methodological approaches in architectural design. Based on the epistemological framework constructed in chapter 3, the paradigms of “founded form” and “flat form” are distinguished by the divergence in their mereological attitudes toward the ontological definitions and theoretical operationalities of part and whole. While chapter 4 simultaneously decomposes and recomposes “founded form” through a survey of architectural form conducted by the mereological constituents of the notion of “foundedness,” chapter 5 discloses “flat form” through the methodological approaches and operational processes that enable its “strange mereology.”

Chapter 6 recapitulates the mereological framework that is constructed throughout the study and discusses the limitations and the difficulties of conducting a research at the epistemological interposition of two fields that were previously peripheral. The chapter concludes with the implications for future research by contemplating on “founded form” and “flat form” both as discursive models for re-contextualizing architectural theory and criticism and as experimental and creative models to be employed in design education for architectural learning and knowing.

CHAPTER 2

"AFTER" DRAWING

Stanford Anderson defines architectural discipline as "a growing body of knowledge unique to this field; it cannot be reduced to the constructs of other fields."[3] He interprets discipline as an "open and liberating environment"[4] that does not possess fixed boundaries and timeless methods. To differentiate discipline from profession, Anderson points to a distinction in their products:

> The physical artifact, typically a building, as the product of the profession absolutely requires a synthesis whether well or badly performed; the products of the discipline take many forms and possess their own integrity but emphasize a given aspect of architecture, establishing resources for an architectural synthesis rather than taking that step.[5]

To acknowledge architectural form as a disciplinary product, an inquiry into the disciplinary formation of architecture is provided through a critical reading of architectural design "after" drawing. The institutionalization of drawing is assessed as a critical moment in history toward the disciplinarity of architecture. Enabling the conception of design as an intellectual act and as the very practice of the architect, drawing has transformed architecture from being an activity of crafts into a creative production. Design and drawing have been fundamental in the disciplinary formations of architecture by setting its conventions and continuously refreshing its representations. In this study, while design is assessed as a disciplinary act, drawing is assessed as a disciplinary tool, which has been powerful in the visual, historical,

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[3] Stanford Anderson. "On Criticism," 1987: 7.

[4] Stanford Anderson. "The Profession and Discipline of Architecture: Practice and Education," The Discipline of Architecture. Eds. Andrzej Piotrowski and Julia Williams Robinson. Minneapolis: University of Minnesota Press, 2001: 292-305.

[5] Ibid. 295.

and theoretical definitions of its products, namely the architectural forms. However, architecture has started to depart from its representations by pushing the conception of design beyond its disciplinary boundaries. The effects of digital media and computation technologies are multi-dimensional in terms of the disciplinary transformation of architecture, of which the theoretical implications on the assessment of architectural form are the main focus of this study.

2.1 Architecture and Its Disciplinary Formation: Drawing and Design

It is a challenging task to situate architecture epistemologically due to the multiplicity of its historical definitions.[6] Its conceptions, figures and elements have been drastically changing throughout the history suggesting that it is also open to further interpretations in the future. Regarding the variability of the historical definitions of architecture, this study starts with the assumption that architecture and its disciplinary formation has been triggered by its conception as "*disegno*".[7]

Architectural drawings seen as means to an end in the tradition of architecture have been challenged by the idea that architecture always exceeds its representations. The priority of the building over the drawing has been broken with the Italian Renaissance, which established drawing as the primary constituent of architectural practice and fundamentally altered the definition of architecture. By the

[6] Stephen Parcell defines four of them in Western Architecture: architecture as *technē* in ancient Greece, as a mechanical art in medieval Europe, as an art of *disegno* in Renaissance Italy, and as a fine art in eighteenth century Europe. Four Historical Definitions of Architecture. Montreal: McGill-Queen's University Press, 2012.

[7] This reading benefits from Jonathan Hill's texts on the history of design research. See Jonathan Hill. "Design Research: the First 500 Years," in Design Research in Architecture. Ed. Murray Fraser, London: Ashgate, 2013:15-34; Jonathan Hill. "Designs on History," Journal of Architectural Education, vol.67, no.2, 2013: 258-263; Jonathan Hill. "Drawing Research," Journal of Architecture, vol.11, no.3, 2006: 329-333; Jonathan Hill. "Haunting the Shadow – Immaterial Architecture," Journal of Architecture, vol. 8, no.2, 2003: 165-179.

institutionalization of drawing, the architect acquired an intellectual and artistic status. In contrast to a painter who produces a unique painting without referring to an object outside the canvas, the architect distanced himself from reality and approached to the world of ideas by the utilization of architectural drawing. The complexity of drawing unfolded the intellectual and artistic activity that the architect actually performs as a designer and it also emphasized the architect's mastery of the collaborative building process. Jonathan Hill explains the fundamental change in the perception of drawing and in the status of architect in respect to the appreciation of the immaterial processes embedded in drawing during the Italian Renaissance:

> The command of drawing – not building – unlocked the status of architect, establishing the principle that architecture results not from the accumulated knowledge of a team of anonymous craftsmen working together on a construction site but the artistic creation of an individual architect in command of drawing who designs a building in a studio. Asserting their intellectual status, architects made drawings with just a few delicate lines and imagined buildings that were equally immaterial. Whether in the studio or on site, they tended to see not matter and mass but proportion and line.[8]

The introduction of drawing as the architect's major activity was not solely an instrumental change in the practice of architecture. Jonathan Hill argues that the word "design" comes from the Italian word "*disegno*" which literally means drawing. However, the term *disegno* suggests "both the drawing of a line and the drawing forth of an idea."[9] Hill confirms, "informed by neo-Platonist theories common in the Italian Renaissance, *disegno* implied a direct link between an idea and a thing."[10] Since the introduction of this word, the perception of drawing has fundamentally changed and the profession of architecture has evolved from being an activity of crafts into an activity of design performed through the act of drawing.

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[8] Jonathan Hill. "Design Research: the First 500 Years," 2013: 15.

[9] Ibid.

[10] Jonathan Hill. "Haunting the Shadow – Immaterial Architecture," 2003: 165.

It was the conceptualization of design through the institutionalization of drawing, which made architecture a discipline and acquired its current definition. Drawing gained an epistemological priority by working as a projection into time and space beyond displaying prescriptions for buildings yet to be constructed. Historical and theoretical analyses in architecture have been established on the discussions of drawing as the primary referent in the production of knowledge.

Drawing as a mode of representation re-defined the position of architect as well as the practices of architecture as a discipline. It is possible to claim that the concept of architect as a creative intellectual has born with the change in the perception of architectural drawing. As the architect and the architectural drawing have become interdependent, the definition of architecture has shifted from being an activity of construction by collective labor into an individual artistic creation of an architect in command of drawing. The architect re-formed as a designer through the agency of architectural drawing. The architect as acknowledged today was established with the Italian Renaissance, and particularly through Leon Battista Alberti's *De re aedificatoria* (On the Art of Building in Ten Books), which was written around 1450 and first published in 1485. Alberti presented a leading inquiry into the figure of architect as a creative intellectual. A new understanding of design and drawing has been constructed and since the Italian Renaissance, the history of drawing became interwoven with the history of design as with their meanings. The definition of the Renaissance architect has become influential in France after the turn of sixteenth century and matured by Inigo Jones in the early seventeenth century in Britain.

Drawing, beyond all power it gained, enabled architecture to be acknowledged as a discipline based on the premises of visuality and design by forging the formation of architectural education as well. Seeking for the origins of full-time architectural schooling, Peter Collins claims that "present concept of architectural education unquestionably had its roots in the system, which originated in Paris in 1671 as part

of Louis XIV's establishment of the *Académie Royale d'Architecture*."[11] During the eighteenth century, with the efforts of Jacques-François Blondel, it established the initial principles for full-time architectural education. After the revolution it merged with the *Écoles des Beaux-Arts*, which was founded by Cardinal Mazarin in 1648.[12] Since the early eighteenth century, the pedagogical approach that was developed in the Academy has been referred to as the Beaux-Arts system. Drawing was at the core of architectural education. It was the tool of "survey." Resting on the precedents and surveying into their bodies, learning and designing was based on the act of drawing.

Architectural practice had to render itself as a particular creative act distinct from the visual arts because drawing could not be recognized solely as an artwork in itself. It needed to refer to an object outside itself, namely the building, and even to govern the production processes of the object designed on paper. Therefore, architectural drawing had to be considered not purely as an artistic creation but also as a rational and technical construction in itself. In *"The Rendering of the Interior in Architectural Drawings of the Renaissance"*[13] (1956), Wolfgang Lotz demonstrated the processes that architects, previously trained as painters or sculptors, have experienced in the representation of buildings. He was the first who underlined the founding of the orthographic drawing as a "convention" in architecture was the fundamental accomplishment of Renaissance architects. Lotz interpreted the orthographic drawings as being "more professional but less visual".[14]

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[11] Peter Collins, "The Eighteenth Century Origins of Our System of Full-Time Architectural Schooling," Journal of Architectural Education, Vol. 36, No. 1, Beginnings, November 1979: 2.

[12] Ibid.

[13] Wolfgang Lotz, "*Das Raumbild in der Architekturzeichnung der italienischen Renaissance*", *Mitteilungen des Kunsthistorischen Instituts in Florenz*, 1956, 7, 193-226. Republished in Wolfgang Lotz. "The Rendering of the Interior in Architectural Drawings of the Renaissance," Studies in Italian Renaissance Architecture. Cambridge Mass.: The MIT Press, 1977: 1-65.

[14] Ibid. 32.

Knowing the strength and the weaknesses of "line" in architectural drawings, Alberti criticized the prevailing practice of perspective imposed on the Italian architects to represent the building. Alberti discriminated the dispute between perspective drawings through which painters should imitate the vision as accurately as possible and orthographic drawings by which measurements of the building should be conveyed precisely to builders. In *De Pictura* (1435), Alberti regulated the construction of perspective but alerted architects against the use of perspectival drawings due to their lack of precision in conducting and instructing the processes of architectural design and production.

Alberti's prescriptions for architectural drawings in his treatise (1435), have provided the basis for his conceptualizations of architectural design in his comprehensive work on the art of building in 1452. In *De re aedificatoria*, Alberti defines the "line" as the prime constituent of architecture. He argues that architecture is comprises two parts, *lineamenta* and *structura* and makes *lineamenta* the subject of his first book in *De Re Aedificatoria* (1452).[15] Joseph Rykwert, Neil Leach and Robert Tovernor translate *lineamenta* as "lineaments" which encompasses "lines", "linear characteristics", and so by implication "design."[16] For Alberti, *lineamenta* and *structura* are interdependent, yet *lineamenta* necessarily precedes *structura* and derives from the mind. On the other hand, *structura* derives from material, and thus from nature, and is mediated by the skilled craftsman. This fundamental distinction between building and design formed the basis of his entire architectural theory. With this separation, architectural drawing has become an essential element in architectural design and production and the position of the architect has been reformulated as a distinct figure with intellectual labor. Consequently, architect acquired an unprecedented "authorial" status. Alberti could establish the notion of

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[15] Leon Battista Alberti, Book I, "The Lineaments" in On the Art of Building in Ten Books. Translated by Joseph Rykwert, Cambridge, Mass.: MIT Press, 1988:7.

[16] Ibid. "Glossary," 422-423.

"authorship" by assuming that the building and its representation in drawing, namely its design, are identical. However, as Mario Carpo remarks,

> [A] building and its design can only be *notationally* identical: their identicality depends on a notational system that determines how to translate one into the other. When this condition of *notational identicality* is satisfied, the author of the drawing becomes the author of the building. [17]

The primary medium that will preserve this notational identicality was the orthographic drawing. For Alberti, accuracy of measurements, proportions and relations was fundamental in architectural design. Orthographic set was not only a methodological tool to preserve the accuracy of representation through a number of interlocked views and cuts through the building but also a critical agent that maintains the integrity of the architect and his architectural works. The strength of the orthographic drawing was in its construction as a system that first separates the object of representation into its critical parts and then achieves a complete understanding by a display of these dependent parts. The collection of these critical parts has come to be known as the orthographic set. It is the claim of this study that the orthographic set is a mereological whole.[18] It operates mereologically in different levels. While elevations aim at capturing the very extents of the object by recognizing it as a series of views from different sides, plans and sections provide cuts through the object and thus produce "parts" that are meant to be appreciated with their ontological peculiarity and relationality. In this respect, plans, sections and elevations employ a methodology of defining parts, which conceptualize the object as a whole represented through the relationality of its parts. The orthographic set was actually guiding the designer or the architect by suggesting a form of "logic" to be applied in the process of design.

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[17] Mario Carpo. The Alphabet and the Algorithm, Cambridge, Mass.: The MIT Press, 2011: 23 [Italics original].

[18] Seray Türkay. "The Orthographic Set: Making Architecture Visible," unpublished Master's Thesis, Middle East Technical University, 2011.

This study acknowledges the orthographic drawing as a mereological methodology that has been powerful in the definitions of architectural form and in the representations of architecture.[19] Though the technique of orthographic projection emanated as a pragmatic tool to overcome the distance between design and construction, it is embraced as a "scientific approach" within the culture of vision and pedagogically instrumentalized in the formation of architectural education. The orthographic drawing has symbolized the processes of "rational thinking" in architectural design and led to the emergence of a "stylistic manifesto" – which is widely known today as Modern Architecture.

Drawing, including all different modes and techniques it acquired, constitutes a repository of architectural thinking and provides a visual survey of architectural design. Among all the registers through which architecture is produced, drawing has been the key element as a methodology of architectural analysis and production, a tool for learning and knowing, a source for accumulation and dissemination of knowledge, and a work of architecture in its own right. In this study, drawing is acknowledged as a "disciplinary tool" in architecture.

2.2 Architectural Design After Drawing

Design and its critical engagement with drawing allowed architecture to be thought and forged its disciplinary formation. It has been cultivated by drawing as a field for knowing. Design is a "disciplinary act" in architecture and it sustains its authority on the definitions of architecture. Design has started to depart from its long-term fellow drawing and stretched the boundaries of the discipline to embrace the emergent tools and technologies of the information age. Within the last few decades, the peculiar tenacity of the architecture has started to condense around the practices of design under the influence of digital media and computational technologies.

[19] Ibid.

Beyond its practical appeals and evolving discourse, the digital turn can be read in continuance with the emergence of the studies in design research. The construction of digital technologies has fostered the development of problem solving methods, which characterized much of the endeavors carried out in this field in 1960s and 1970s as part of "design methods movement", computation remained as an instrumental tool in design research and was hardly recognized as a generative tool of design until 2000s. With the arrival of the twenty-first century, re-conceptualization of the use of digital technologies in design process extended and also complicated the scope of the studies and the universalistic approaches of positivist paradigm that aims at acquiring knowledge of design by its "scientification." [20] Digital media and computational tools proposed further epistemological frameworks for design by questioning its conventional definitions, deflecting the nature of its problems, expanding its fields of reference and application, and distancing it from its representations.

Architectural design has gone beyond being an interrogation within the practices of architects and dissolved into the emerging field of "design research". The studies focusing particularly on "design" resulted in the separation of previously interdependent and even united practices of drawing and design. The distance between design and drawing has increased, as design has been re-considered as an

[20] The term "scientification" refers to the idea of design as replicating science by isolating the designer from the design problem and by establishing a "method" independent of the designer, in other words, by mimicking the relationship of the scientist and the objective world that was based on the critical distance preserved by the "method". What is intended was the "objectification of design" by following a "method", in other words, the objective of research was guiding the design process. Under the influence of the objectivist/positivist epistemology, the privileged research trend of 1960s and 1970s was based on the very assumption that design was a "problem" and thus it had to be formulated as a process of "rational problem solving activity". The major implication for design in this new scenario was that it started to be categorized as a step-by-step procedure within certain hierarchical structures. The work conducted by Christopher Alexander represented one of the earliest models of design where an underlying structural correspondence between the pattern of the problem and the process of design was scientifically established. See, Christopher Alexander, Notes on the Synthesis of Form. Cambridge: Harvard University Press, 1964; Herbert A. Simon. The Sciences of the Artificial, Cambridge, MA: MIT Press, 1969.

independent realm of investigation and academic research. The long-established relationality of representation and materialization has collapsed by the intensified concentration on "design" in the discipline of architecture. When design has been removed from the equation, drawing has become irrelevant to architecture and thus, architecture has become ignorant to its representations. Epistemological priority was no longer on drawings but rather on "design" itself as an autonomous entity. Adrian Forty explains the epistemological background of this shift as follows:

> The turning of "design" from being a category within architecture into an activity of its own was substantially assisted by arguments of philosophers. Just as Plato and neo-Platonism enabled Renaissance architects to distinguish between an object and its "design", the philosophy of Kant encouraged people to think of "design" as a pure property in its own right.[21]

Perceiving the changes in the nature of design is a necessary condition to acknowledge its implications on the discipline of architecture and to develop a theoretical framework to assess its products. The effects of digital technologies and computation are observable in multiple scales and environments of design including its processes, surfaces, acts, figures, objects, and vocabularies.

2.2.1 Processes

Negating any visual appeal or any aesthetic preference of form, algorithms, scripts and codes aimed at understanding external content through information processing that works with structuring "relationships". Although a code maintains its inherent relational logic, its outputs which can find expression in various virtual, visual and material environments were capable of changing. Yet, the "identicality"[22] between the code and its infinitely many possible outcomes is sustained. Carpo illustrates the

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[21] Adrian Forty. "Design," Words and Buildings: A Vocabulary of Modern Architecture, New York: Thames & Hudson, 2000: 138.

[22] Mario Carpo. The Alphabet and the Algorithm, 2011: 4.

changing paradigms of identification in relation to three different ways of making things by using monetary examples:

> The signature, the banknote, and the credit card: when objects are handmade, as a signature is, variability in the processes of production generates differences and similarities between copies, and identification is based on visual resemblance; when objects are machine-made, as a banknote is, mass-produced, exactly repeatable mechanical imprints generate standardized products, and identification is based on visual identicality; when objects are digitally made, as are the latest machine-readable or chip-based credit cards, identification is based on the recognition of hidden patterns, on computational algorithms, or on other nonvisual features.[23]

In the latest generation of making things, the loss of visuality is inherent and the "referential identicality" manifests the dissolution of the material object into a composition of numerical symbols and equations. Referential identicality means that the same set and structure of data are used for the generation, virtualization and fabrication of the "design" and thus all the processes are directly connected. In other words, the transition from design to fabrication is immediate and requires no additional information between these processes. To illustrate, a 3D digital model does not stand as a representation of an object yet to be fabricated but it is rather an "utterance," so does its material fabrication, of the digital encoding that actually contains and designates the very definition of that object. Regardless of the material and visual expressions that it may yield into, the digital data proceeds with an immediacy and an uninterrupted continuity through its utterances, which can be assessed as the "literalisation of the architectural design processes."[24] Mark Linder claims that "[r]ather than translations form drawing to building, we now move

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[23] Ibid.

[24] Eran Neuman. "Data Reshaped: Literalism in the Age of Digital Design and Architectural Fabrication". Footprint / Dynamics of Data-Driven Design. Eds. Henriette Bier, and Terry Knight. Delft Architecture Theory Journal, Vol.15. 2014: 46.

directly, even literally, from modeling to fabrication, potentially without translation."[25]

There is another critical aspect about the notion of "process" besides literalisation. Regardless of the digital media that is used or involved with, traces of operations are hardly visible on the products. The commands of "undo", "back" and "erase" are highly powerful within the processes of digital making, which results in redundant back and forth operations. The tension between the ease of digital undoing and the impossibility of the physical act of unmaking is continuously augmented in digital media as "the act of undoing does not directly reflect the act of doing."[26] Digital media and computation technologies does not only foster an obscurity of the process by literalisation but also by impending the interaction between process and user as well as suspending the relation between processes and outcomes. Analysis conducted by Autodesk Research aim at revealing the frequency of commands used. According to the database of over 60 million commands issued by anonymized users, while "Erase" is the most frequently used command in AutoCAD, "Undo Scene Operation" and "Delete Objects" are at the top of list in Autodesk 3dsMax.[27]

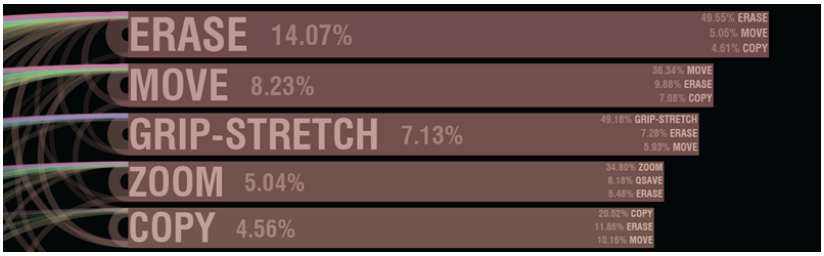

Figure 1. The top 5 most frequently used AutoCAD commands.
[https://www.autodeskresearch.com/projects/command-usage-arc]

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[25] Mark Linder. "Drawing, literally," Architecture As a Craft. Ed. Michiel Riedijk, TU Delft, 2011: 35-51. For Linder's conceptualization of "literal" in art and architecture also see, Mark Linder. Nothing Less than Literal: Architecture after Minimalism. Cambridge, Mass.: MIT Press, 2007.

[26] Thomas Balaban and Jennifer Thorogood. "Undo" in Drawing Futures, eds. Laura Allen and Luke Caspar Pearson, London: The Bartlett School of Architecture, 2016: 40-43.

[27] <https://www.autodeskresearch.com/projects/command-usage-arc> [Last accessed in January 10, 2016].

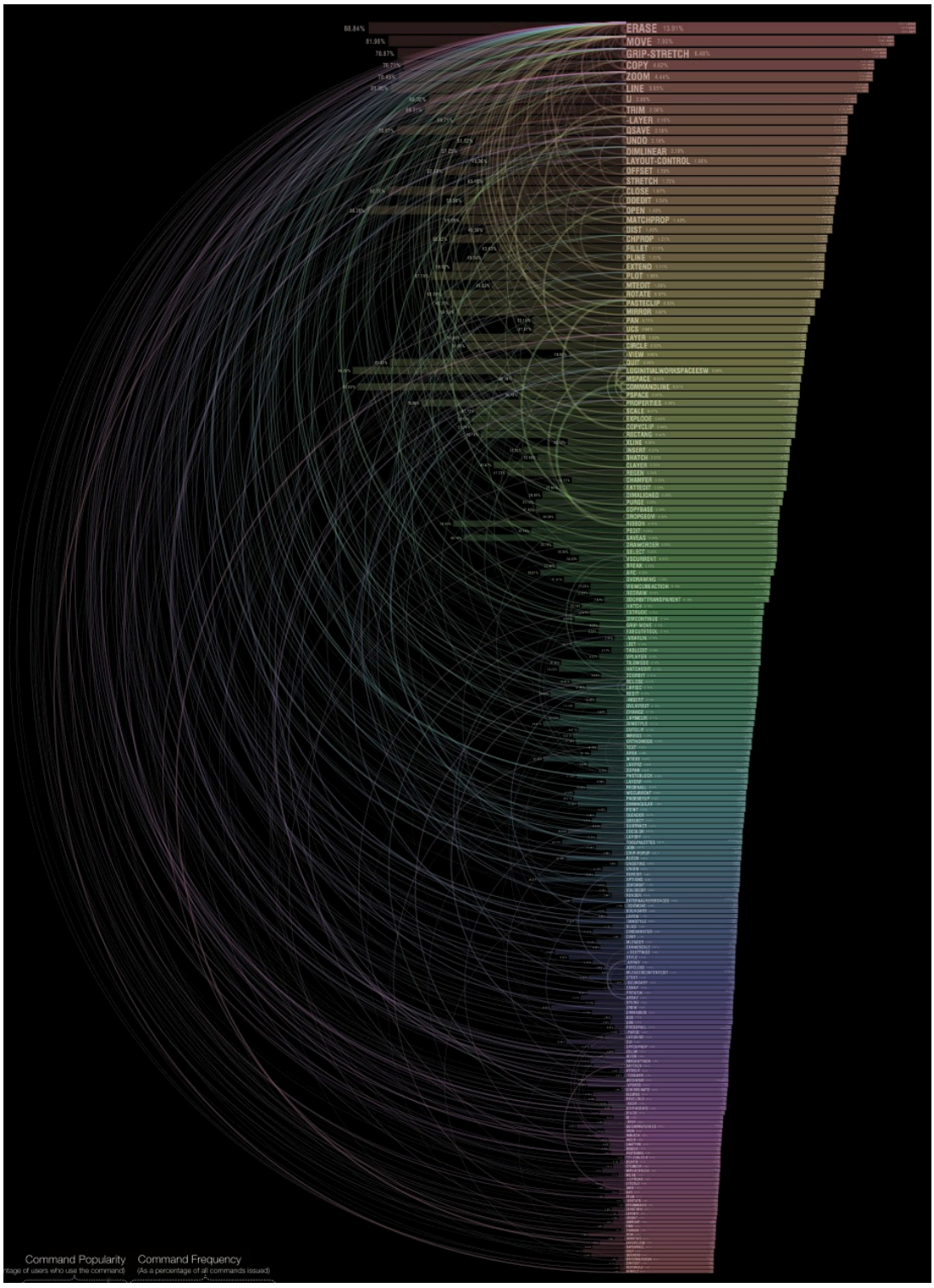

Figure 2. Arc diagram for top 200 AutoCAD commands, by Autodesk Research.
[https://www.autodeskresearch.com/projects/command-usage-arc]

2.2.2 Surfaces

The literalisation of the processes of architectural production gives rise to the emerging procedures in digital design and fabrication, which are unfamiliar to the conventional processes of architectural design.[28] Although they suppress the translational/projective spaces[29] of representation, the immediacy embedded in the literalism implies that the integrity of the information is maintained without any demand of visual similarity or representational identicality:

> Digital media enables processes of data conversion and computation enables the transliteration of data that result in the encoding of the same data in different formats and the creation of variation.[30]

The immediacy of computation and of digital literalism affects design methodology to concentrate on the ways in which architecture performs and operates, and requires architects to focus on the processes that generate architectural form rather than conceiving design as a struggle of perfecting architectural form through its representations. As the "surfaces" of design that the architect interacts diversifies, the competences of the architect as a designer radically changes to include learning and controlling acts that are unforeseen within the discipline of architecture. Previously celebrated processes of architectural drawing are not only replaced by virtual modeling and scripting but also expanded with mind controlled systems, gestural forms, interactive millings, robotic fabrications, material indeterminacies and so on.

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[28] Eran Neuman. "Data Reshaped," 2014: 43-57.

[29] Robin Evans conceptualized architectural projections as translational spaces of representation. See, Robin Evans. "Architectural Projection," Architecture and Its Image: Four Centuries of Architectural Representation: Works from the Collection of the Canadian Centre for Architecture. Eve Blau; Edward Kaufman; Robin Evans et al. Montreal: *Centre Canadien d'Architecture*/Canadian Centre for Architecture ; Cambridge, Mass.: Distributed by the MIT Press, 1989: 19-35; Robin Evans. "Translations from Drawing to Building." Translations from Drawing to Building and Other Essays. Cambridge, Mass.: The MIT Press, 1997: 153-193; Robin Evans. The Projective Cast: Architecture and Its Three Geometries. Cambridge, Mass.: The MIT Press, 1995.

[30] Eran Neuman, "Data Reshaped," 2014: 50.

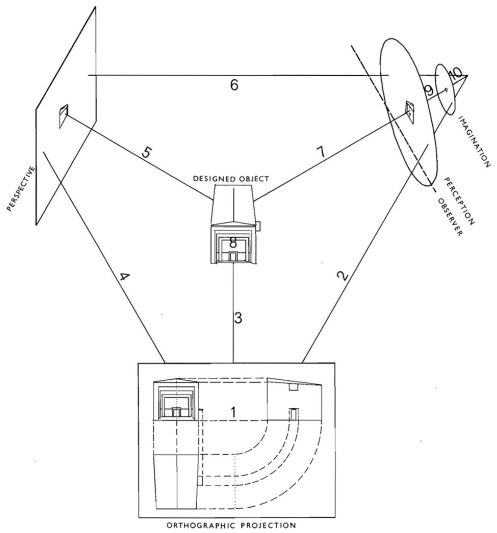

Figure 3. Translational/projective spaces by Robin Evans.
[Robin Evans. The Projective Cast, 1995.]

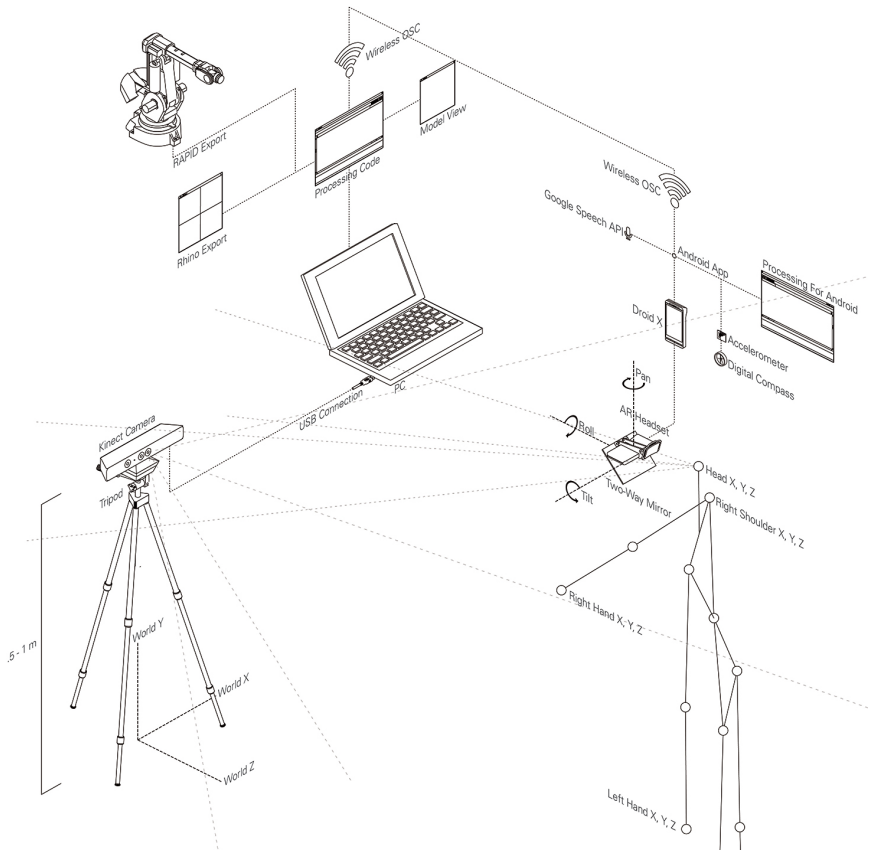

Figure 4. Data flow in "Augmented Teality and the Fabrication of Gestural Form," Greyshed.
[http://greyshed.com/work/gesturalarchitecture/]

2.2.3 Acts

With the advent of digital media and computational design, conventional processes of translation from idea to drawing and then drawing to building are abandoned and architect as a designer found himself in confrontation with the act of coding. Scripts, codes and algorithms established a claim on the control of the design processes and commenced a marginal understanding of the design object. As processes of design and data conversion becomes uninterrupted, intervals within which design has been conducted through a variety of visual interpretations have lost with the successive processes of production and with the range of actors involved. As a result, the act of coding acquired a privileged status as the very act of design and imbricated all different acts of thinking, visualizing, testing, and manufacturing into a single act of numerical instruction. While architect's moves, postures, gestures, and mimics transform to cope with the digital environment, the figures he is working with in the processes of design diversify as well.

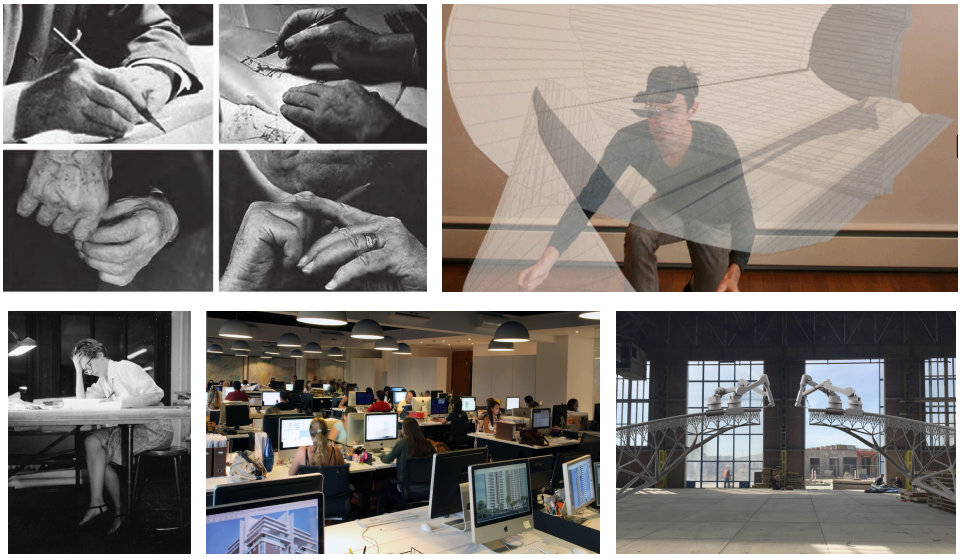

Figure 5. Changes in the acts of design.
Top-left: The architect's presence, hands of Frank Lloyd Wright, Le Corbusier, Mies Van Der Rohe and Alvar Aalto, postcard by Souto de Moura, Christmas 2011; *top-right:* Gestural architecture by Greyshed; *bottom-left*: "Citizen Lambert: Joan of Architecture" directed by Teri Wehn-Damisch; *bottom-rigt:* Joris Laarman, 3d-print bridge visualization.

2.2.4 Figures

As mentioned above, the architect acquired an "authorial" status in design by the institutionalization of the drawing. Mario Carpo claims that the Albertian paradigm of intellectual authorship is based on a system of "notational identicality":

> [A] building and its design can only be *notationally* identical: their identicality depends on a notational system that determines how to translate one into the other. When this condition of *notational identicality* is satisfied, the author of the drawing becomes the author of the building, and the architect can claim some form of ownership over a building…[31]

The figure of the architect and its historical definitions has been critical in the formation of architecture as a design based discipline. Although the architect has been exclusive in the design process of the authorial paradigm, a building requires specific actors to be realized. Towards the turn of the century, not only the figure of the architect as an exclusive author of design has been challenged by digitization but also his co-workers become versatile and digital.

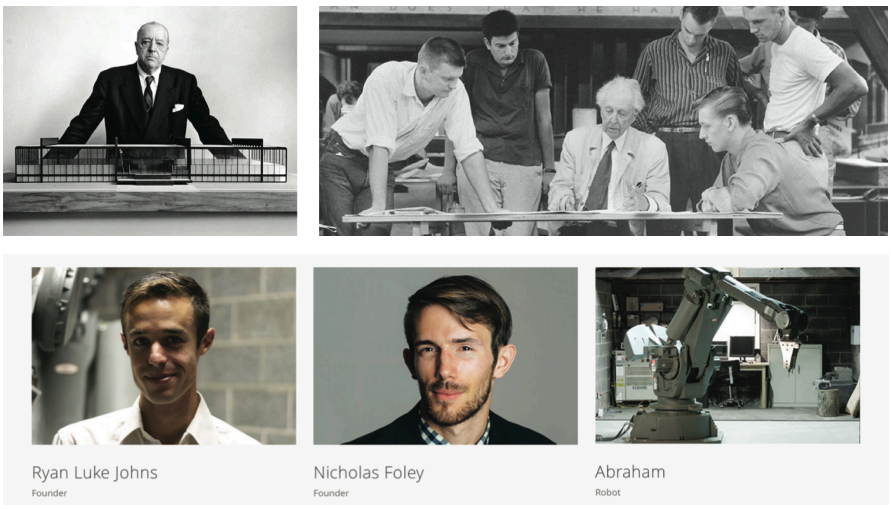

Figure 6. Architect as an author figure vs. design-research office profile in digital age.
Top-left: Mies van der Rohe with a model of Crown Hall at IIT, Chicago; *top-right:* Frank Lloyd Wright with his assistants at the studio on the Taliesin Estate; *bottom:* Greyshed firm profile.

[31] Mario Carpo, Alphabet and the Algorithm, 2011: 23.

2.2.5 Objects

In latest generation of making things, "the loss of visuality" is inherent and it leads to the consequent disappearance of the physical object itself. Digital processes and computation enforces an acute abstraction of the design object, which critically overrides it as a function. One to one correspondence between digital scripts and the "on-demand" physical object, referred as "digital literalism" by Linder and "referential identicality" by Carpo, leads to the indiscernibility of design process and its products. As the emphasis shifs from design object as an end product to a computational process that is capable of generating multiple outcomes immediately in different formats and environments, long-established haecceity[32] of the design object lingers between its codifications and representations that are unusually *a posteriori*.

In *The Fold: Leibniz and the Baroque* (1988), Gilles Deleuze stated that Leibniz's mathematics of "continuity" presented a radical account on the "object" and fundamentally altered its definition.[33] As Carpo explains, "differential calculus does not describe objects but their laws of change – their infinite, infinitesimal variations."[34] Its adoption in architecture as a "theory of continuity" radically shifted the long-established identity of the object as a unique product and destroyed its individuality. The terminology required to define the new generation of object(s), namely the digital variability, has been determined by Bernard Cache.[35] He coined

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[32] Hacceity means the status of being an individual or a particular nature; what makes something to be an ultimate reality different from any other. Haecceity denotes the discrete qualities, properties or characteristics of a thing, which make it a particular thing, and it is translated as "thisness."

[33] Gilles Deleuze. The Fold: Leibniz and the Baroque. Trans. Tom Conley, Minneapolis: University of Minnesota Press, 1993.

[34] Mario Carpo. "Ten Years of Folding," in Folding In Architecture, ed. Greg Lynn. Chichester, West Sussex ; Hoboken, NJ : Wiley-Academy, 2004: 16.

[35] Bernard Cache, Earth Moves: The Furnishing of Territories. Trans. Anne Boyman, ed. Michael Speaks, Cambridge, Mass.: MIT Press, 1995.

the term "*objectile,*"[36] – "a function that virtually contains an infinite number of objects."[37] In other words, *objectile* was not an object but an algorithm that defines a family of objects that are functionally equal, visually similar yet parametrically different.

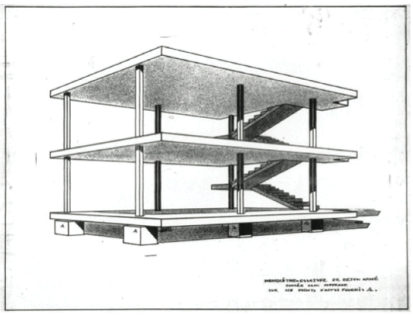

Figure 7. Seeking for origins: Laugier's Primitive Hut.
[Frontispiece, Marc-Antoine Laugier, *Essai sur l'Architecture,* 2nd ed. 1755.]

Figure 8. Inventing oriniginals: Le Corbusier's Dom-ino House.
[Fondation Le Corbusier.]

Figure 9. Constructing self-originating systems: Greg Lynn's Embryologic Houses.
[CCA, "Origins of the Digital," Greg Lynn, Embryological House: Size "A" eggs, 1999; <http://www.cca.qc.ca/en/issues/4/origins-of-the-digital/5/embryological-house> Last accessed in January 9th, 2017]

Abstraction, or rather, naturalization[38] of object, or rather abstraction of an object of design, into a function, which is simply a system that receives inputs to produce outputs, is a critical interruption to the definition and to the nature of architectural

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[36] Ibid. In "Ten Years of Folding," Carpo notes that "Deleuze mentions Bernard Cache with regard to both the mathematical definition of the fold and the concept of the objectile (which, however, he does not attribute to his gifted student)" and both notions are initially developed by Cache in *Earth Moves*. See, Deleuze, The Fold, 1993: 20.

[37] Mario Carpo. "Ten Years of Folding," 2004: 16.

[38] Naturalized epistemology is based on the assumption that knowledge is a natural phenomenon and it employs an understanding of knowledge generation as information processing. In other words, knowledge is a result of the structuring input data by an interactive computational process that is able to respond the changes of its environment.

design. Computation embedded multiplicity and mutability to the computed object and disconnected its existence from its representations. Digital media and computation technologies presented a new paradigm to architectural design by removing the underlying principles of visuality and perception, upon which the assessment of architectural forms have been grounded. While architecture shifts the ideals from designing objects for "seeking for origins" to "inventing originals" and then currently into "constructing self-originating systems," the question of how "forms", which result from these computational scripts, and arguably, no longer peculiar to architectural design, will be assessed awaits to be answered. It is the aim of this study to seek for epistemological possibilities to formulate this problem and construct a framework, a ground to theorize its implications.

2.2.6 Vocabularies

Architecture and its disciplinarity heavily depend on the historical formation of critical vocabularies. Words and their theoretically, historically and contextually associated fellows form critical vocabularies through the changing idealizations of architecture to reflect epistemological tendencies, stylistic manifestos, discursive regimes, means of production, aesthetic appeals and so on. Architecture has always been tenacious to extra-disciplinary references.[39] Consequently, its critical vocabularies cannot be assessed as architecturally pure or genuine. Architecture, oscillating between arts and science, has been improving various strategies to define its relevancy and place following the shifts in paradigms. Analogies, metaphors, borrowings, translations and many other ways of importing and processes of interpretation of "words" have been employed in the formation of critical vocabularies. With the introduction of computers, digital media, information technologies, and computational design processes into the fields of architectural

[39] Zeynep Mennan. "Theory on Borderlines: A Collective Experience and a Free Market," Shifting Borders, Negociating Places: Cultural Studies and the Mutation of Value(s), eds., B. Adkins, D. Bennato et.al., Rome: Bordighera Press, 2006: 65-85.

research and practices, while architecture struggles to maintain its links with the accumulated body of vocabularies, it is also exhilarated by the proliferation of verbal and textual expressions found in this unfamiliar field.

Architecture expands its lexical field to include predominantly the terminologies of digital media, computer sciences, programming languages, software development, etc. and imports concepts from biology and evolution theories. Surrounded by highly technical yet alien words of information systems, advanced concepts of natural sciences and uncanny theories of philosophy, architecture does not resist rejections of its past (non-standard, non-linear), conceptual borrowings (becoming/emergence, fold, assemblage), lexical fabrications (objectile, parametricism, voxelization) and hybridizations (cyberspace, biomimicry, topo-tectonics, smart-geometry) as well as the proliferation of immediate abbreviations (CAD, BIM, AEC, AGU, CAS, FEM, IPO, F2F, NURBS)[40]. In the wake of this lexical abundance, the need for a theoretical framework to formalize a critical vocabulary for architecture is urgent.

[40] CAD – Computer Aided Design (or occasionally Drafting); BIM – Building Information Modeling; AEC – Architecture Engineering Construction; AGU – Advanced Geometry Unit; CAS – Complex Adaptive Systems; FEM – Finite-Element Method, IPO – Input-Processing Output; F2F – File to Factory; NURBS – Non-Uniform Rational B-Spline Surfaces.

CHAPTER 3

PART AND WHOLE:
FORMALIZING AN ARCHITECTURAL MEREOLOGY

Regarding the changes in the disciplinarity of architecture that were illustrated by the decomposition of architectural design into its processes, surfaces, acts, figures, objects, and critical vocabularies, this study claims that as architecture has started to diverge from its representations, the epistemic content of forms remain unaddressed besides the rigorous attempts to formalize its processes and the emerging admiration of the multiplicity and the elusiveness of its objects. Based on the assumption that architectural form is a disciplinary product that has been historically, theoretically, conceptually, and materially molded by the urges and challenges to define the concepts of part and whole and their relationality, this study introduces "mereology" – the theory of parts and wholes – as the philosophical course of understanding form in contemporary architecture.

This chapter establishes the groundwork for constructing a mereological framework for architectural form. With a reading of the history in philosophy, the formulation of theories intertwined with the concepts of ontology and metaphysics, and the fields of influence, mereology, which otherwise marginal to architecture, becomes crucial for theorizing "part" and "whole." After building up the knowledge of part and whole as mereological concepts distinguished by the ontological underpinnings and philosophical questionings of their definitions and relationality, the study initiates the project of formalizing an "architectural mereology" by reconceptualizing part and whole as analytical, operational and theoretical tools of cultivating architectural form as a disciplinary product.

3.1 Mereology

The term mereology is derived from the Greek word "*μερος" (meros)*, which means part. Mereology is basically the study of parts. It aims at providing a theory to define parthood conditions as a way of ordering. Mereology seeks for the identifications of parts and definitions of relations to understand wholes in respect to the processes and structures that precede their formations. It particularly focuses on the notion of "part" and the conditions of "parthood" to unfold the conception of the "whole". Mereology implies no ontological restrictions in the definitions of parts and wholes meaning that the whole can be as concrete as the parts and/or the parts can be as abstract as the whole. Although specific axiomatic definitions[41] of mereology have been defined as core principles to formalize "parthood" for partial ordering, the study of mereology is highly complex and the fields of its application are diverse, which continue to expand its theoretical framework.

This study embraces an understanding of mereology as a ground theory upon which further theoretical approaches can be cultivated through concepts, notions and principles that will nourish its readings and applications. In this regard, the disciplinary tools and products of architecture are approached with a mereological perspective and an instrumentalization of the concepts of "part" and "whole" as epistemological and methodological tools is enabled to survey architectural forms.

3.1.1 Fields of Influence and History in Philosophy

Mereology is a branch of philosophy with applications and theorizations in a number of fields including logic, metaphysics, ontology, mathematics, and linguistics. While its roots can be traced back to Presocratics and later on to Plato, particularly

[41] There are three core principles to formalize the conditions and relations of parthood as partial ordering: (1) Reflexivity entails everything is part of itself; (2) transitivity entails any part of a thing is itself part of that thing; and (3) anti-symmetry entails two distinct things cannot be part of each other.

Parmenides, and to Aristotle, especially *Metaphysics*, mereology also occupies a prominent role in contemporary practices of computer sciences as a methodological approach in the definition of concepts and developing relation systems in programming paradigms, such as object-oriented programming, as well as in studies of artificial intelligence.

Regarding the fundamental accounts on the history of mereological theories, the work of Franz Brentano can be assessed as the primary source of reference. Brentano aimed at a thorough understanding of "part" by analyzing its properties, relations and constructions to illustrate what holds fast the "whole". He did not use the term mereology but rather provided a formal theory of parthood from a twofold perspective – ontological and psychological. Brentano's methodological attempts to construct a foundational theory of parts and wholes can be observed beyond his ontology or his psychology. His philosophical influence was exclusively disseminated through the notes of his lecture courses and the works of his students from which the impact of his ideas mainly become visible.[42] The extents of the scope of studies and applications of Brentano's theories on parts and wholes through their relationality can be seen through the works of Carl Stumpf's "*Tone Psychology*" (1883-1890), Christian Ehrenfels' "*Gestalt Qualities*" (1890), Edmund Husserl's "*Logical Investigations*" (1901), Kazimierz Twardowski's "*On Content and Object of Presentations*" (1894), and Alexius Meinong's "*Theory of Object*" (1904).[43] The works developed in ontology and mereology in the Lvov-Warsaw School, founded by Twardowski, were influenced by Brentano's ontology. Stanisław Leśniewski, who coined the term "mereology" in 1927 and presented a formal theory of part-relations from which contemporary formulations of mereology and set theory has been developed, was a student of Twardowski. Leśniewski's *Foundations of the*

[42] Guillaume Fréchette. "Introduction: Brentano's Impact," Themes from Brentano. Eds. Dennis Fisette and Guillaume Fréchette. Amsterdam; New York: Rodopi, 2013: 9.

[43] Ibid. 9-10.

General Theory of Sets (1916) and his *Foundations of Mathematics* (1927–1931) with *The Calculus of Individuals* (1940) by Henry S. Leonard and Nelson Goodman are recognized widely as the basis for the theories developed on parthood in ontology.[44] Brentano's influence was evident in the works of Gestalt psychologists from the schools of Berlin and Graz, as well as the Prague linguistic circle.[45] His philosophical impact continued to include Husserlian and Heideggerian phenomenology and the works of many other philosophers embodying the philosophical perspectives of Husserl and Heidegger such as Sartre, Merlau-Ponty and Lévinas. Among the works mentioned, Husserl's third investigation *"On the Theory of Wholes and Parts"*[46] is acknowledged as a leading and thorough formulation of a theory based on the definitions and relations of mereological concepts of part and whole.

3.1.2 Part and Whole: Defining Mereological Concepts and Relationality

As indicated, mereology is the theory of parts and wholes with the situations that initiate their relationality. Yet, it is possible to claim that epistemological priority is on the "part" assessed both as a mereological entity and as a mereological tool. Mereology has a particular focus on part to decipher how it acts in the formation of wholes. Therefore, the whole is assessed as a body of relations to be surveyed

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[44] Both Leśniewski and Leonard and Goodman established a mereological definition of part relation as an antisymmetric, reflexive and transitive binary relation between parts and wholes. See, Stanisław Leśniewski. Collected Works. Eds. S.J. Surma, J.T. Srzednicki, D.I. Barnett, and V.F. Rickey, trans. D.I. Barnett, Dordrecht: Kluwer, 1992; and Henry S. Leonard and Nelson Goodman. "The Calculus of Individuals", Journal of Symbolic Logic, 5, 1940: 45-55.

[45] Guillaume Fréchette. "Ontology and Metaphysics," Themes from Brentano, 2013: 190-191.

[46] Although Husserl's work is acknowledged as the first attempt to formulate a theory of mereology, the word "mereology is absent in his writings. He rather uses the expression "the theory of wholes and parts". Edmund Husserl. "Investigation III – On the Theory of Wholes and Parts," Logical Investigations, vol.II. Trans. J.N. Findlay. London: Routledge, 2001:1-45.

through its parts. Although the concept of part is usually subsumed under the concept of whole, the definition of part actually precedes the definition of whole.

To acknowledge how mereological concepts of part and whole have been constructed, Brentano's definitions and development of these concepts in Husserl's theory are critical in the formation of a mereological vocabulary as well as in the formulation of contra theories. Although formal theory of extensional mereology, formulated by Leśniewski, are often referred in bibliographies of mereological studies, this study particularly adopts the mereological vocabulary of Husserl and develops with his concepts and definitions. The theory of Leśniewski, known as "Classical Extensional Mereology,"[47] proceeds with the assumption that "an extensional whole exists only when all the constituent parts exist." Accordingly, the principle of extensionality entails that the wholes with the same parts are identical. In other words, extensional mereology treats parts as members and wholes as a collection or sum of these members so that it does not recognize any distinctions between mere sums and composed or unified wholes. In this regard, while extensional mereology provides a formal theory systematizing mereological concepts and their relations, it does not address to the notion of "the unity of the whole" or discuss the differences in the identification of parts and of the type of connections formed in-between parts to compose the whole. As opposed to the ontological, functional and conceptual ignorance of extensional mereology, Husserl's theory employs an ontological approach to parts and wholes and unfolds a metaphysics of the relations that formed within parts to achieve an integrity and unity of whole. He does not only define the mereological concepts of part and whole but also advances a philosophical account on "wholeness" in respect to the notion of "parthood." This study dwells on the theoretical framework offered by Husserl from which the vocabulary of mereology is cultivated. Before the analysis of his terms and concepts,

[47] Leśniewski, "Foundations of the General Theory of Sets," 1992: 129-173. Also see, Peter Simons' reviews of extensional mereology in Parts: A Study in Ontology. Oxford: Clarendon, 1987.

Brentano's identifications of parts are significant to achieve a comprehensive understanding of Husserlian mereology.

Brentano aims at revealing the inner structure of wholes, the ways in which things and their parts, and parts of these parts, come together in order to obtain structured wholes. Arguing "wholes are things which need to *have* parts,"[48] he claims that "[e]very multiplicity [*Mehrheit*] of things is a thing and every part of an individual thing is a thing."[49] What Brentano refers as a multiplicity can be "composed of bodies, or of minds, or of a mind together with a body."[50] His approach does not imply any ontological restriction on the nature of parts, according to which parts can be physical, logical or metaphysical.[51] Physical parts are self-descriptively indicates concrete or quantitative parts of an organized body whereas metaphysical parts refer to the "parts of substances, of places, of time, of thinking"[52] and thus include physical parts that only correspond to the parts of corporeal substances. Brentano defines logical parts as "conceptually independent" from the whole that they define. He claims that they are the "logos" of a thing, meaning that "logical parts are parts of a definition."[53] Accordingly, definition of a whole follow a logical order that hierarchically individualizes that whole by the unity of its logical parts.

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[48] Franz Brentano. The Theory of Categories. Trans. Roderick M. Chisholm and Norbert Guterman. The Hague: Martinus Nijhoff Publishers, 1981: 10.

[49] Ibid. 19.

[50] Ibid. 10.

[51] Franz Brentano. "Parts of Being," in Lectures on Metaphysics. Würzburg, 1867 as referred in Wilhelm Baumgartner. "Franz Brentano's Mereology," Themes From Brentano, 2013: 233-236.

[52] Ibid. 235.

[53] Ibid. 234.

Proceeding from the identification of the different nature of parts, Brentano develops a further and more comprehensive classification of parts in respect to how they are recognized and thus become "elements of consciousness"[54] to understand the ways in which a multitude of parts becomes a unity, a whole. He distinguishes two types of parts – separable and distinctional[55]:

> [O]ne may be able to distinguish parts that are actually separable from one another, until one reaches parts where [...] separation can no longer take place. [...] However, even these ultimate actually separate parts, in some sense, can be said to have further parts. [...] To differentiate these from others, we may refer to them as distinctional [*distinktionelle*] parts.[56]

Regarding Brentano's statements of separable and distinctional parts, it is possible to claim that the parts that are separable are also distinguishable in thought whereas the reverse is not possible or only possible with an ontological damage or destruction of the whole. These different natures of parthood are actually theorized on the basis of the notion of "ontological dependency". To illustrate, while separable parts are "ontologically independent" of the wholes which they compose, distinctional parts are "ontologically dependent" upon the wholes which they define. In analyzing parts as basic constituents and the conditions of their relationality, Brentano does not instrumentalize logic where, in extensional mereology[57], it analogically treats parts as members, wholes as sets that are merely the sum of these elements. He rather employs an ontological theory of part and whole. His mereology is actually enhanced

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[54] Franz Brentano. Descriptive Psychology. London: Routledge, 1995: 13-30.

[55] Ibid. Brentano further articulates different classes of separable and distinctional parts. While separability can be mutual or one-sided, distinctional parts can be identified by distinction in proper sense or by modifying distinction. He further distinguishes two classes of strictly distinctional parts one of which is defined as the class of mutually pervading parts whereas the other is the class of logical parts.

[56] Ibid.16.

[57] The properties of parthood described by classical extensional mereology are very similar to those of subsethood in set theory.

by different relations of ontological dependence that define the ways in which parts are unified as a whole.

The notion of "dependency" is situated at the core of Husserl's theory of parts and wholes. His theory is constructed upon the reciprocal formulation of parts and the wholes they form. Husserl defines the relations of "parthood" in reference to its implications on the notion of "wholeness". His "theory of wholes and parts" starts with the assumption that "[e]very object is either actually or possibly a part, i.e. there are actual or possible wholes that include it."[58] Yet, Husserl notes that every object does not necessarily need to have parts – an observation which enables him to distinguish objects as complex or simple. The criterion of qualification to distinguish complex and simple objects is very straightforward: having parts or not having parts. Husserl refers to the etymology of the word complexity, which suggests "a plurality of disjointed parts in the wholes," so that objects that "cannot be cut up into a plurality of parts" are called simple.[59] Based on the notion of disjointedness and separability, he defines a fundamental distinction between "independent" and "non-independent" parts. Husserl introduces a comprehensive interpretation of the word part as a "content" which can be "distinguished 'in' an object, or, objectively phrased, that is 'present' in it."[60] Part, thus, is not necessarily an object but it can be further considered as an "abstract content" as well. Husserl unfolds his conceptualization of part as follows:

> Everything is a part that is an object's real possession, not only in the sense of being a real thing, but also in the sense of being something really in something, that truly helps to make it up: an object in itself, considered in abstraction from all contexts to which it is tied, is likewise a part.[61]

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[58] Edmund Husserl. "On the Theory of Wholes and Parts," 2001: 4.

[59] Ibid.

[60] Ibid. 5

[61] Ibid.

In Husserl's theory, the part goes beyond a mere material fragment and actually becomes a property of the whole, which is fundamental in understanding the notion of "unity". With the interpretation of part both as an object and as a content that is "present" in a whole, part is acknowledged both analytically and noematically. The distinction among the parts that are "present" in a whole is defined by the quality of being independent or non-independent. Respectively, Husserl identifies independent parts as "pieces," whereas non-independent pieces are called "moments". Pieces, or independent parts, are separable, or rather, "separable presentable" from the wholes and from other parts that they coexist within that very whole. The separability of independent parts does not necessarily mean that this kind of parts can be literally dismantled from the wholes of which they are parts or from other independent parts. Independent parts, or pieces, are not necessarily fully detached or disjoined from each other but they can reflect relative dependencies in the sense that they can be "mutually-put-together *pieces*." [62] In other words, it is possible to speak of independent parts as long as these parts, by their very nature, "permit their separated presentation."[63] A piece, or a non-independent content, is a part that

> [C]an exist without a whole in which it exists; it can exist by itself, not associated with anything else, and will not then be a part. Change in, or complete annihilation of associations, does not here affect the part's own, peculiarly qualified content, and does not eliminate its existence: only its relations fall away, the fact that it is a part.[64]

Regarding the statement above, independent parts may, but not need to, associate with other parts or enter into wholes. On the contrary, Husserl claims that moments, or non-independent parts, are not separable from one other and from the whole within which they are contained. They are parts that cannot be separately presentable as they permeate each other. Moments are parts that blend through the whole within

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[62] Ibid. [Italics original].

[63] Ibid. 6.

[64] Ibid. 20.

which they are contained and cannot be distinguished without distinguishing the whole and all the other moments that the whole possesses. Non-independent contents are "parts which only exist as parts, that cannot be thought of as existing by themselves."[65] To illustrate the distinction between independent and non-independent parts, Husserl states that:

> A head can certainly be presented apart from the person that has it. A color, *form* etc., is not presentable in this fashion, it needs a substrate, in which it can be exclusively noticed, but from which it cannot be taken out. But the head also, considered, e.g. visually, can only be noticed by itself since it is unavoidably given as an element in a total visual field.[66]

The non-independent moments are hardly recognizable as parts in common apprehension of objects, or of their parts, but Husserl emphasizes that they must be acknowledged as parts as they are noematically critical in an understanding of a whole. While independent parts with the relationships in-between them defined by degrees of independencies, or relative dependencies, enable an "analytical" understanding of the wholes they enter in, non-independent parts, and their relations, become noematical tools that allow "philosophical distinctions to be made, the distinctions that leave objects intact physically but broken up phenomenologically or metaphysically"[67]. However, it should also be acknowledged that although moments are assessed non-independent parts they are not solely dependent on other moments or recognized just through those moments contained in the whole but they are also dependent on the very existence of pieces and cannot be "separately noticed unless all the concrete contents [independent parts], in which they are contained, have been stressed as wholes"[68].

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[65] Ibid. 12.

[66] Ibid. 13. [Emphasis on *form* added.]

[67] Robert Sokolowski. "The Logic of Parts and Wholes in Husserl's Investigations." Philosophy and Phenomenological Research, vol. 28, no. 4, June 1968: 541.

[68] Edmund Husserl, "On the Theory of Wholes and Parts," 2001: 14.

Deriving from the distinctions between independent and non-independent parts, there observed fundamental differences among the "*a priori* relationships between Whole and Part, among the Parts of one and the same whole."[69] Not all the parts of a whole relate to the whole in the same manner and not all the parts of a whole are related with each other in the same way. To formalize the differences in relationships present among different parts of a whole and among the parts of different wholes, Husserl introduces the concept of "foundation". The concept of foundation does not only serves to determine, or rather, identify the nature of the relationship within parts and of parts to their whole, but also defines the very identity of the whole. Husserl articulates degrees of foundation such that parts, both independent and non-independent, can be mediately or immediately founded on one another or on the whole that they are contained.[70] There is also another possibility, which is the absence of a relation of foundedness and it is obviously only possible with independent parts. Such a whole, which according to Husserl not to be called a whole, is defined as an "aggregate"[71] which is a mere coexistence of any parts, or contents. The objects "only held together in thought" as they are intrinsically unrelated and disconnected. Without any foundational relations among its parts, the formation of an aggregate is arbitrary and governed by external coercion. On the other hand, there are wholes founded on the necessity and legality of the relationships between its parts. The idea of founding sustains internal coherence and carries the idea of "unity". Husserl claims that "[u]nity is conferred on the 'moments' in the 'pieces,' as also on the 'moments' of unity and the 'pieces,' by the foundational relations." [72] He acknowledges founded wholes as law-bound constructions that are based on the "moment(s) of unity". The moment of unity binds

[69] Ibid. 27.

[70] Ibid. 30.

[71] Ibid. 38.

[72] Ibid. 37.

all the parts of the whole, yet "the demands of our definition [of wholeness] are satisfied, without the presence of a peculiar moment founded on all parts together."[73] Forms of unity may vary for every whole and moments of unity are identifiable at different scales such as in the relationships within groups or pairs of parts. Therefore a founded whole is causal whereas an aggregate is contingent.

The influence of Brentano's ontological dependency, which allows him to distinguish separable and distinctional parts, becomes visible through Husserl's definitions of moments and pieces. While a particular concentration on the notion of part is prominent in Brentano's approach, Husserl develops a more comprehensive framework theorized through a network of definitions, propositions and rules governing different forms of relationships. He advances the concept of part not only to physically decompose wholes but also to dissect them philosophically. Based on this far-reaching treatment of part Husserl forges formal categories of wholes and catalogues the multiplicity of relationships. The notion of "foundedness" finds itself a place at the heart of his theory of wholes and parts with the appreciation of whole as a founded unity.

3.1.3 Redefining Part and Whole: Multiplicities and Mereological Discrepancies

If one seeks to find a radical account on mereology in philosophy beyond Husserl, and thus beyond its foundationalist definitions, then the key concept to expand the understanding of parts and wholes is "multiplicity."[74] The introduction of the concept

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[73] Ibid. 35.

[74] Husserl and Bergson have developed the philosophical understanding of multiplicity on the basis of its mathematical description provided by Reimann. See, Edmund Husserl. Formal and Transcendental Logic. Trans. Dorion Cairns. The Hague: Martinus Nijhoff, 1978; Henri Bergson. Time and Free Will: An Essay on the Immediate Data of Consciousness. Trans. F.L. Pogson. New York, Cosima Classics, 2008 (originally published in 1910); and Gilles Deleuze. Bergsonism. Trans. Hugh Tomlinson and Barbara Habberjam. New York: Zone Books, 1966.

of multiplicity has fundamentally affected the epistemological approaches to the notions of part and whole as their ontological characterizations and mereological definitions. Multiplicity is an outstanding concept in the philosophy of Gilles Deleuze, which is particularly explicit in and widely known through his works with Félix Guattari.

Deleuze and Guattari rely on a logic of multiplicity and metaphysics of parts and wholes to formalize their ontology. While they offer a deflection of foundationalist mereology, they conspicuously use a mereological vocabulary and refer to the concepts of traditional mereology. The famous concept of "multiplicity" elaborated vastly in *Capitalism and Schizophrenia* to critically re-define parts and wholes; the notion of "fragments" as the dominant theme to controvert the foundationalist part and the chapter dedicated to "The Whole and Its Parts" in Anti-*Oedipus*[75]; the conceptualization of "line" as part and the proliferation of the definitions of Deleuzian wholes as "plane of consistency," "assemblage," "rhizome," "body without organs" and strangely as "composition" in *A Thousand Plateaus*[76]; the cinematographic whole in *Cinema 1*[77]; and the model of "fold" to theorize the whole in continuous becoming and involution in *The Fold – Leibniz and the Baroque*[78] can be listed as the most prominent examples from Deleuzian corpus that deploy mereological concepts and terms.

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[75] Gilles Deleuze and Félix Guattari. Anti-Oedipus: Capitalism and Schizophrenia. Trans. Robert Hurley, Mark Seem and Helen R. Lane, preface by Michel Foucault, introduction by Mark Seem. London: Continuum, 2009.

[76] Gilles Deleuze and Félix Guattari. A Thousand Plateaus: Capitalism and Schizophrenia. Trans. Brian Massumi. London: University of Minnesota Press, 2011.

[77] Gilles Deleuze. Cinema 1: The Movement Image. Trans. Hugh Tomlinson and Barbara Habberjam. Minneapolis: University of Minnesota Press, 1986.

[78] Gilles Deleuze. The Fold – Leibniz and the Baroque. Trans. Tom Conley, Minneapolis: University of Minnesota Press, 1993.

It is clear from the analyses of Deleuze's texts and lexicon that his ontology has parts and wholes. However, the nature of parts and wholes that are no longer founded on one another is hardly comprehensible. This study does not aim at a critical reading of Deleuze's philosophy of multiplicity with respect to its position relative to mereology, yet the interpretations and re-constructions of the concepts of part and whole and the processes of their making and connection expands the mereological framework to "recast" the meaning of these terms to formalize a critical vocabulary and to assess "form" in contemporary architecture.

Deleuze stretches and even deflects the traditional meanings of part and whole to guide his logic of "composition". Starting with the most popular re-definition of whole as "rhizome," it is obvious from the proliferation of expressions that the necessity of introducing new terms and concepts was inevitable to explain and articulate a new theory that will unfound mereology and its concepts. The notions of multiplicity and hetereogeneity are the fundamentals of the bizarre mereology developed through the concepts that intend to replace, and thus escape from, traditional parts and wholes. Deleuze provides infinitely many definitions and instructions on the concept of "rhizome," "assemblage," "plane of consistency," and "body without organs," which are used interchangeably, referentially and interactively. A compendium of these definitions and instructions draws an outline of how the concepts of part and whole are re-constructed in respect to the ways or processes of their making and connections.

> [Assemblages are] neither unities not totalities, but multiplicities […] composed of a set of lines or dimensions which are irreducible to one another.[79]
>
> An assemblage is precisely [the] increase in the dimensions of a multiplicity that necessarily changes in nature as it expands its connections. There are no points

[79] Gilles Deleuze and Claire Parnet. Dialogues. Trans. Hugh Tomlinson and Barbara Habberjam. New York: Columbia University Press, 1987: vi.

or positions in a rhizome, such as those found in a structure, tree, or root. There are only lines.[80]

All multiplicities are flat, in the sense that they fill or occupy all of their dimensions: we will therefore speak *of a plane of consistency* of multiplicities, even though the dimensions of this 'plane' increase with the number of connections that are made on it.[81]

Unlike a structure, which is defined by a set of points and positions, with binary relations between the points and biunivocal relationships between the positions, the rhizome is made only of lines: lines of segmentarity and stratification as its dimensions, and the line of flight or deterritorialisation as the maximum dimension after which the multiplicity undergoes metamorphosis, changes in nature.[82]

The BwO [body without organs] is not opposed to the organs; rather, the BwO and its "true organs," which must be composed and positioned, are opposed to the organism, the organic organization of the organs.[83]

[…] the Whole itself is a product, produced as nothing more than a part alongside its parts, which it neither nullifies not totalizes, though it has an effect on these other parts simply because it establishes aberrant paths of communication between noncommunicating vessels, transverse unities between elements that retain all their differences within their own particular boundaries.[84]

The body without organs is produced as a whole, but in its own particular place within the process of production, alongside the parts that it neither unifies nor totalizes.[85]

The whole not only coexist with all the parts; it is contiguous to them, it exists as a product that is produced apart from them and yet at the same time is related to them.[86]

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[80] Gilles Deleuze and Félix Guattari. A Thousand Plateaus, 2011: 8.

[81] Ibid. 9.

[82] Ibid. 21.

[83] Ibid. 158.

[84] Gilles Deleuze and Félix Guattari. "The Whole and Its Parts," Anti-Oedipus, 2009: 43.

[85] Ibid. 43.

[86] Ibid. 43-44.

As indicated through a compendium of definitions and instructions above, Deleuze's logic of multiplicity is actually based on a metaphysics of part and whole, which resists and rejects to explain the part and whole and their relations as a causality. It is possible to claim that Deleuzian multiplicity and heterogeneity offers a different explicability to the notions of part and whole that escapes traditional mereology and its founded parts and wholes and yet could not totally depart from or drop its primary constituents. Mereological concepts of part, whole and the conditions and processes that define or undefine their relationality, do not only maintain their influence in the texts of Deleuze but they are also at the core of the interpretations of Deleuze as well.[87]

Manuel DeLanda is one of the renowned commentators on Deleuzian philosophy. It is possible to observe that he situates mereology at the heart of his interpretations on Deleuze's ontology, which he precisely explains as "a general theory about the relations between part and wholes."[88] DeLanda assesses Deleuzian assemblage as an alternative theory to the "part-whole relations" based on the assumption that the result accounts to a totality. He assumes that there is a contrast between the approaches of Deleuze and traditional mereology, which resides in the nature of relations set between parts:

> [U]nlike wholes in which parts are linked by relations of interiority (that is, relations which constitute the very identity of the parts) assemblages are made up of parts which are self- subsistent and articulated by relations of exteriority.[89]

DeLanda's sustains the use of the concepts of part and whole in the construction of assemblage theory. However, his approach to the concepts of parts and wholes as

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[87] For a detailed account on the relationship between Deleuze and mereology see, Ioannis Chatzantonis, "Deleuze and Mereology: Multiplicity, Structure and Composition," unpublished Ph.D. diss., University of Dundee, 2010.

[88] Manuel DeLanda. A New Philosophy of Society: Assemblage Theory and Social Complexity. London: Continuum Press, 2009: 9.

[89] Ibid. 18.

mereological "givens" is, arguably, paradoxical both with Deleuzian parts that are never "parts of a whole" and with Deleuzian wholes that are never "wholes constituted of parts". Although DeLanda's interpretations provide a rather explicit reading of Deleuze's philosophy, the consistency with the conventional mereological vocabulary challenges the possibility to acknowledge part and whole, as concepts of a Deleuzian mereology, with their peculiarities in the logic of multiplicity and in assemblage theory. On the other hand, the permanency of the concepts of part and whole offers possibilities to expand their definitions and relations.

The idea of a part that is not defined by being part of a specific whole and the idea of a whole that is peripheral or exists alongside its parts radically deflect the mereological principles and relations that are based on, and thus become intelligible through, the notions of foundedness, unity and dependency. Disregarding the relations of interiority and embracing relations of exteriority necessarily unfounds the conception of part as present in the whole; the identity of the whole being a unity; the nature of relations determined according to the degrees of dependency within parts; and the distinctions among parts based on their immediate or mediate relations to one another and to the whole. According to DeLanda, relations of exteriority contrive "emergent wholes in which the parts retain a relative autonomy, so that they can be detached from one whole and plugged into another one entering into new interactions."[90] As the relations of dependency between parts resolve, the whole is stripped from all the ambitions to become unified and rather approaches to a level of consistency that will sustain the interaction between its parts. In this case, emergent whole can only exist as long as the parts stay together; the whole is not capable of and does not intend to totalize or unify the parts but rather intensifies the connections within. This new formation of wholes is identified as "multiplicities" and in the loss of any immanent relation commanding a structural system of parts, "all multiplicities are *flat.*"[91] DeLanda explains this approach

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[90] Manuel DeLanda. Deleuze: History and Science. New York: Atropos, 2010: 4.

[91] Gilles Deleuze and Félix Guattari. A Thousand Plateaus, 2011: 9. [Emphasis on *flat* added.]

based on relations of exteriority, interacting parts and emergent wholes as a "flat ontology"[92] and claims that in flat ontologies there is no difference among wholes, or rather, multiplicities, in terms of the degree of complexity they possess.[93] Yet, he argues that it is possible to speak of "levels of scale" but it does not refer to a change in the ontological status of multiplicities:

> [A] city is clearly larger than a human being but there is no reason to believe that it possesses a higher degree of complexity, or that any of its component parts is more complex than the human brain.[94]

Levi Bryant is one of the contemporary philosophers who advocates flat ontology and argues that the world is composed of objects that exist at a variety of different levels of scale. He claims that flat ontology offers a peculiar approach that enables us to formulate a mereology regarding "collectives and entanglements between a variety of different types of actors, at a variety of different temporal and spatial scales"[95]. By embracing flat ontology, Bryant aims at developing an account on mereology by departing from the vocabulary and the constraints of parts and wholes. Bryant defends an "object-oriented philosophy" and forges a realist ontology, which he calls "onticology." [96] Embracing the term "object" as the primary constituent of his mereology, Bryant claims that the mereology of onticology and object-oriented philosophy is concerned with a particular mereological relation: "the relation between objects where one object is simultaneously a part of another object and an

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[92] Manuel DeLanda. Intensive Science and Virtual Philosophy. New York: Continuum, 2002: 47.

[93] Manuel DeLanda. Deleuze: History and Science. 2010: 9.

[94] Ibid.

[95] Levi Bryant. The Democracy of Objects. Ann Harbor: Open Humanities Press, 2011: 32.

[96] Bryant follows Graham Harman's "object-oriented philosophy," which rejects the idea that objects are the given and argues that objects are withdrawn from all relations, and develops the designation "object-oriented ontology," after which he coins the term "onticology." Bruno Latour and Manuel DeLanda are among the famous onticologists with Gilles Deleuze and Félix Guattari.

independent object in its own right."[97] He introduces the concepts of larger-scale objects and smaller-scales objects among which the relationality, may or may not to be formed, does not necessitate an immanent foundedness and rather defends the autonomy of both.[98] Accordingly, larger-scale objects are independent and autonomous form the smaller-scale objects of which they are formed and smaller-scale objects are not founded on the larger-scale objects of which they compose. Bryant defines his approach as a "strange mereology,"

> [W]here objects can be nested in other objects while nonetheless remaining independent or autonomous of those object within which they are nested. This mereology destroys organic conceptions of both society and the universe, where all substances are thought of as parts of an organic whole.[99]

The "strangeness" of such a mereology stems from the premise that although it is solely concerned with "the relation between objects where one object is simultaneously a part of another object and an independent object in its own right" and thus embraces the view that all objects are independent or autonomous from one another, the mereology of onticology and object-oriented philosophy also assumes that "[o]bjects can enter into exo-relations with one another, but they are not constituted by their relations."[100] In other words "objects are not merely aggregates of other objects, but have an irreducible internal structure of their own."[101]

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[97] Ibid. 214.

[98] Ibid. 31.

[99] Ibid. 152.

[100] Ibid. 214. The term "exo-relations" is used by Bryant to refer "foreign relations," in other words, external relations or relations of exteriority. Bryant here employs an adaptation of Graham Harman's terminology that distinguishes between "domestic relations" and "foreign relations". Domestic relations are that structure the internal being of an object, which Bryant refers to as "endo-relations," while "foreign relations" are relations an object enters into with another object. See, Graham Harman. The Quadruple Object. Winchester, UK: Zero Books, 2011.

[101] Ibid.

Acknowledging the necessity of internal structures, or domestic relations, for a particular object, which will operate the organization of its parts, besides foreign relations into which the object will enter to form objects of larger scales yet preserve its autonomy, "strange mereology" nonetheless asserts that "[p]arts aren't parts for a whole and the whole isn't a whole for parts."[102] The primary idea that onticology maintains is that objects may relate to one another and generate new objects, however, an emergent object does not erase or eliminate the objects that it is composed of and is an autonomous object as well as the objects that it contains.

Part and whole are conceptual models that permeate every philosophical questioning and conduct epistemological courses. Mereology, as the theory of part and whole, elaborates and expands the scope of its study, definitions of its concepts and assumptions in various dimensions. Philosophical and ontological approaches in mereology, or rather, mereological approaches of philosophical and ontological positions covered so far provide a collection of the re-constructions of the concepts of part and whole and the conditions of their relationality.[103] The mereological field defined by these approaches conveys significant insights to unveil the philosophical background of the changes in the concepts of part and whole, which stimulate the development of methodological and epistemological approaches in to architectural form. The ontological variety and the epistemological expanse of part and whole and the instability of their relationality maintain a mereological framework to recast the definitions of part and whole as tools of architectural mereology.

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[102] Ibid. 217.

[103] For more on the theories of part and whole see, Aaron J. Cotnoit and Donald L. M. Baxter eds., Composition as Identity, Oxford: Oxford University Press, 2014; and Shieva Kleinschmidt ed., Mereology and Location, Oxford: Oxford University Press, 2014.

3.2 A Mereological Approach to Architectural Form

It is not easy to delineate the boundaries of form in architecture or achieve a consistent categorization of approaches that aims to formalize it. Form is an indispensable term not only for architecture but also for every other practice of art. Yet, it is controversially assumed to be a timeless, universal architectural concept that exists to indicate the immanent obscurity of architectural objects and recover the redundant obsessions on their visuality. Form, arguably the most seductive word in architectural vocabularies through history, owes its exclusive place to its widely acknowledged yet unfairly reductionist meaning as shape. It occupies a long philosophical history interwoven with the variety of challenges to define what it contains as with what it excludes. The ambiguity embedded in its meaning, as "a property of things as they become visible to our senses" and as "a property of things as they are known to the mind," allowed form to be an uncannily malleable term in architecture.

By looking at its use in philosophy before appropriated by architecture, Adrian Forty seeks for the possible causes behind the interest in form, particularly in Modern Architecture.[104] While Plato, the originator of the very concept of form, argued form as an unknowable, pre-existing idea that is imperceptible to the senses and only knowable to the mind, Aristotle refused the separation of form from matter and assessed form as a pure object of thought, as the "essence," originating from the mind of the artist. As indicated in the previous chapter, Alberti's well-known separation of *linemanta*, as deriving from mind, and *structura*, as deriving from material, has its roots in Platonist idea of form. In *De re aedificatoria*, Alberti claims that:

> Nor do lineaments have anything to do with the material, but they are of such a nature that we may recognize the same lineaments in several different buildings that share one and the same form, that is, when the parts, as well as the siting and

[104] Adrian Forty. "Form," Words and Buildings: A Vocabulary of Modern Architecture. London: Thames&Hudson, 2016 (First published in 2000): 149-172.

> order, correspond with one another in their every line and angle. It is quite possible to project whole forms in the mind without any recourse to the material, by designating and determining a fixed orientation and conjunction for the various lines and angles. Since that is the case, let lineaments be the precise and correct outline, conceived in the mind, made up of lines and angles, and perfected in the learned intellect and imagination.[105]

While Alberti's definition of the lineaments does not fully accord with Platonist form, his approach to the concept of form as a property of mind derives from a philosophical appropriation of the word and provides a theoretical basis for his formalization of design as an intellectual activity that is separated from the material world. Forty remarks that form was not widely used by artists and architects, accept its corresponding meaning as shape, until the end of 19th century and following the Renaissance, most of the discussions on form was held by Germans-speaking countries.[106] The field of philosophical aesthetics has been stratified in-between Kant's aesthetic form as a property of perception, Goethe's genetic form as a property of things and Hegel's ideal form as a property above and beyond things, knowable only to the mind. Forty claims that when architects started to appropriate the concept of form beyond referring shape, different levels of meaning embedded in form have started to be blended and confused.[107]

Besides various interpretations of form in architecture, as an immaterial force unified with matter, as a purified representation of mass, or as the equivalent of space, Forty registers that established tendencies in the use of form are mostly depending on an appropriation of form to argue against for certain matters. As common to the predominant uses of form, specifically within modernism, the intention was not to define what form is, means or includes but rather it was a tool to oppose, exclude and criticize. *Form as resistance to ornament, form as antidote to mass culture, form*

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[105] Leon Battista Alberti. Book I, "The Lineaments," On the Art of Building in Ten Books, 1988 :7.

[106] Adrian Forty. "Form," Words and Buildings, 2016: 153-157.

[107] Ibid.157.

versus social values, form versus functionalism, form versus meaning, form versus 'reality', and *form versus technical or environmental considerations* are the various counteractions into which form has been forced.[108]

Deriving from the multi-layered definition of form as a word with philosophical intricacies and immanent ambiguities, this study does not seek to find another definition of form or to formulate it with another opposition but rather embraces its complex stratification and tries to tear up a layer that focuses on its architectural formalization mediated by the concepts of part and whole. Following framework will intend an "architectural mereology" to survey methodological and epistemological approaches to form particularly through the reconceptualization of part and whole as theoretical and operational tools of architectural design and research.

3.2.1 Architectural Form as a Disciplinary Product

The interwoven histories and meanings of drawing and design have been significant in the disciplinarity of architecture and in the formation of its disciplinary products. In this regard, design is assessed as a disciplinary act through which knowledge peculiar to the discipline is acquired along with the material practices and theoretical approaches, whereas drawing serves as a disciplinary tool, a medium for disciplinary thinking, by which the very act of design is conducted and disciplinary knowledge has been produced and disseminated.

Based on the disciplinary characters of drawing and design, architectural form should be acknowledged as a disciplinary product within which the epistemological tendencies, historical styles, design approaches, theoretical discourses, material practices, modes of representation and production, and aesthetic judgments are embedded and thus becomes visible and intelligible. However, the assessment of

[108] Ibid. 161-172.

form as a disciplinary product does not necessarily refer to any material or visual existence of form as a corporeal entity, the very idea of form, that is peculiar to architecture, can become intelligible through theoretical concepts, analytical definitions, perceptual and intentional readings, noetic or tectonic configurations, contextual or historical criticisms and so on. Architectural form, as a disciplinary product, contrives "objects of architectural thought".

The assumption that design is a disciplinary act of architecture founded on the theories and practices of drawing lingers after the break of this long-established relationship by autonomizing design as a "processual"[109] entity. Acknowledging the distance introduced between drawing and design is fundamental to contemplate the changes in the conception and production of architectural form, which is assessed as a product that accumulates and mediates the disciplinarity of architecture. Introduction of digital media and computational technologies affected the processes, surfaces, acts, figures, objects, and vocabularies of design, the theoretical implications of which become evident in its forms.

To enable a reading of architecture's disciplinarity through its products, this study critically distinguishes "forms" from "objects". The expression of "objects," as indicated in Chapter 2, refers to the destination and/or outcome of design process regardless of its ontic state, meaning that objects can occupy physical, real, or factual existence. However, regarding the philosophical stratification embedded in its meaning, "form," should be acknowledged as a representation, as an abstraction which necessitates an assessment of the object upon which it is founded or through which it is mediated. The epistemic content that the form acquires as a disciplinary

[109] The term "processual," is used by Pia Ednie Brown to refer the status of architecture under the influence of computational design. She refers to the changing, responsive, interactive, and adaptable nature of digital media and computation, which renders design as a process-based formation. See, Pia Ednie Brown. "The Aesthetics of Emergence: Processual Architecture and an Ethico-Aesthetics of Composition." unpublished Ph.D. diss., RMIT University, 2007.

product is governed and sustained by the ambiguity of "form" as a property of things and as a property of mind.

This study observes an epistemological niche that is pregnant with theories regarding the assessment of form. It is the claim of this study that the theoretical and operational uses of parts and wholes are critical for the assessment of architectural forms as well as the processes and acts of their making. Despite all the deflections from conventional practices and assumptions of architectural design, the currency of the concepts of parts and whole allows for the cultivation of a theory with a mereological approach to architectural form.[110]

3.2.2 Reconceptualizing Part and Whole as Tools of Architectural Mereology

Mereological vocabulary constructed by Husserl is essential for the reconceptualization of part and whole as tools of architectural mereology. Acknowledging Husserlian mereology is essential to formalize the fundamentals of architectural mereology and to construct its vocabulary. This study aims at formalizing an architectural mereology as a theoretical framework for the assessment of form and it starts with the concepts of parts and wholes as defined by Husserl. Yet, deriving from the mereological concepts defined by Husserl does not necessitate a full agreement with the assumptions of Husserl's theory of parts and wholes. The notions of presence, foundedness, unity, and dependency are accepted as the key concepts of a mereological approach. These key concepts rather provide a field to be cultivated with further mereological formations. All subsequent or opponent definitions and conceptualizations, such as emergence, flatness, coherency, and

[110] Although the definitions and applications of the concepts of part and whole radically altered by the concepts of digital paradigm, such as emergence, complexity and continuity, the currency of part and whole is actually immanent in the formation of these theories, the premises and influences of which will be elaborated through the concept of "flat form" in Chapter 5.

multiplicity should also be acknowledged as "mereological formations"[111] in reference to the aforementioned key concepts.

The duality of part | whole accommodates ontological dependencies, historical associations, contextual misreadings, inconsistent oppositions, and shifting meanings embedded in the definitions and the conditions of relationality of the concepts of part and whole. However, the expression of "part-whole relations" or "part-to-whole relations" and the very assumption that there is an absolute, constant and timeless, structural order between the two should be avoided to enable the reconceptualization of the concepts of part and whole as "tools of architectural mereology" rather than the "givens" of architectural form. It is critical to acknowledge that part and whole are not autonomous and universal entities. Definitions of part and whole cannot be ontologically restricted; parts and wholes of architectural mereology can be as abstract as the thought of space, the referential notion of datum, the canon of inflection, or as the concept of phenomenal transparency; they can be as concrete as the members of a structural system, the bricks of a wall, or as the complete building.

The relationality of part and whole can be reluctant and contingent as well as essential and foundational. The ontological neutrality of part and whole and the instability of their relationality foster the diversification of epistemological and methodological approaches to architectural form. Part and whole are mereological instruments to achieve an understanding of form as an epistemic entity. It is through the agency of part and whole that architectural form contrives objects of architectural

[111] The indication of "mereological formation" is based on the observation that although the definitions of and the relationality within part and whole as the building blocks of a mereological approach radically deflect, the very concepts of part and whole are prevalent in the vocabulary and in the formalizations of theories beyond foundationalist approaches. Aiming at a critical deflection in the conception of part and whole that will "unfound" their relationality, these approaches still depend on the existence of the concepts of part and whole as well as the concept of relationality to escape their relationality. This issue has been covered previously in this chapter, under the title "Redefining Part and Whole: Multiplicities and Mereological Discrepancies."

thought. The concepts do not only enable the examination of architectural form physically or visually but also facilitate the appropriation and dissection of architectural form philosophically.

Part and whole, as mereological concepts, are not necessarily explicit in/as architectural forms. Parts and wholes are always in a flux regarding the multiplicity and vicissitude of their definitions and relationality. In other words, part and whole, as tools of architectural mereology, are not merely to be found but to be *cultivated* to enable the assessment of form. They should be acknowledged as theoretical and operational instruments of design in architectural making, as well as being analytical and noematical tools of assessment for architectural knowing.

3.2.3 Formalizing Architectural Mereology

Formalizing an "architectural mereology" is a genuine task, as mereology is marginal to architecture. Although theoretical field and philosophical questionings of mereology innately concern architectural form, an epistemological framework for part and whole in architecture remains to be unaddressed. It is possible to find initial studies involved with mereology in recent architectural discourse with a significant divergence in scope and aim. Daniel Köhler's *"The Mereological City: A Reading of the Works of Ludwig Hilberseimer"*[112] can be considered as a reference work in the emerging field at the intersection between design and mereology. As the title indicates, the study "mereologically consider the work of Ludwig Hilberseimer, that is, in the resonance of the determining parts of his projects."[113] Köhler provides a reading into Hilberseimer's design method as an approach to design "parthood relationships" and reveals how this design method always remains in "a state of transition from part to whole" beyond the

[112] Daniel Köhler. The Mereological City: A Reading of the Works of Ludwig Hilberseimer. Bielefeld: Transcript Verlag, 2016.

[113] Ibid. 7.

scales of the house and the settlement.[114] The work introduces the concepts of form and mereology to assess "the schema of architectural design" that is evident in Hilberseimer's work, as "the study is a formal reading."[115] Köhler proposes a mereological reading into the dialectics of the house and the settlement, the figure and the ground, and of the part and the whole. He approaches architectural design as "a mereological composition" in the case of Hilberseimer.

Another reference work where mereology and architecture approach one another is Luciana Parisi's *"Contagious Architecture: Computation, Aesthetics and Space."*[116] The ambitious title of the work excludes mereology, yet it embraces a particular approach entitled "mereotopology" to develop an understanding of algorithms and the programming culture they introduce. Parisi focuses on the logic of computation in the field of digital architecture and aims at revealing the immanent mode of thought in algorithms that is beyond the processing of large amount of data with simple, or definite, set of rules. She argues that "incomputability" as intrinsic to computation and criticizes the topological model that parametricism and digital formalism suggests. Embracing Whitehead's mereotopology as a means to break the "reciprocity between control and events," Parisi suggests a critical reading of digital architecture as "conditioned by non-denumerable infinities or the immanence of incomputable data"[117] and claims that "mereotopological architecture of wholes and parts offers a mathematico-geometric schema of extension, and I used this to present the spatiotemporalities of algorithmic actualities as parts that exist among others."[118]

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[114] Ibid.

[115] Ibid. 11.

[116] Luciana Parisi. Contagious Architecture: Computation, Aesthetics and Space. Cambridge, Mass.: The MIT Press, 2013.

[117] Ibid. 161.

[118] Ibid. 172.

Regarding the limited number and divergent nature of the work that is produced in the field yet to be mature in-between architecture and mereology, this study aims at formalizing an architectural mereology that will provide an epistemological framework for architectural form. Yet, architectural mereology does not aim formalism; it is not a formal analysis or a formal reading. It is directed to the conception and production of architectural form, yet it does not intend to reveal visual rules or structures that a form is based upon or generated through but rather scrutinizes the very logic behind these visual systems or formal expressions – the logic that precede the definitions and relations that characterize its formation. In this regard, architectural mereology focuses on what is beyond visual and formal; it is a philosophical questioning of form.

Architectural form is a disciplinary product within which knowledge of architecture is embedded. Architectural mereology does not intend to excavate what is embedded but rather aims at *cultivating* it. It instrumentalizes the concepts of part and whole to study architectural form; it does not impose the condition of being a whole as compulsory to all architectural forms or does not require an architectural form to contain parts. Reminding that parts and wholes are always in a flux regarding the multiplicity and vicissitude of their definitions and relationality, architectural mereology is limited with neither the products nor the media of design. As parts and wholes, as tools of architectural mereology, cannot be ontologically restricted, architectural form should be considered beyond figures, surfaces and objects to disclose how the theoretical and operational uses of parts and wholes lead to the epistemological and methodological approaches in architectural design. Mereology of architectural form is double-folded: it aims at understanding how parts and wholes are architecturally processed to achieve architectural form and thus affect the formulation of methodological approaches; and how architectural form itself becomes a part or a whole and reflects on the formation of epistemological approaches. Thus, architectural mereology does not only construct an

epistemological framework to assess architectural forms but also provides a methodological approach to design.

Architectural mereology formalized by this study also claims that the definition of the concepts of part and whole are epistemologically critical as it contributes to the lexical, textual, conceptual, and visual field, namely, the "vocabulary" of architectural form. Vocabularies of architectural form are significant – "nomenclature" is not only a practical act of naming but also a critical act of identifying, documenting, presenting, displaying, and translating. In other words, architectural mereology emphasizes that nomenclature should be acknowledged as an epistemological operation.

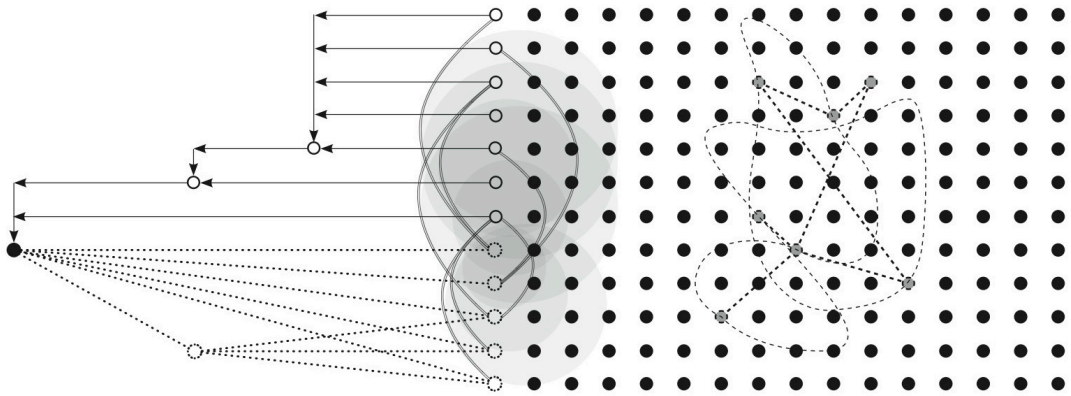

Figure 10. Mereology from foundedness to flatness.
[Produced by the author.]

According to the philosophical course of mereology, "foundedness" and "flatness" become prominent as two meta-concepts that underlie the ontological questionings and epistemological approaches to the concepts of part and whole. Following the distinct, yet non-opposing, mereological models that foundedness and flatness indicate, the study proposes "founded form" and "flat form" as two paradigms underlying epistemological and methodological approaches to architectural form.

The concept of “founded form” develops from the Husserlian notion of foundation as a questioning of relationality that ontologically defines part and whole. Flat form, on the other hand, follows a questioning of the relationality between part and whole that does not intend to impose an ontological dependency between the two. It embraces the independency and autonomy of part and whole, which has been clearly defined by DeLanda as “flat ontology” and proceed into a “strange mereology” as suggested by Bryant.

Founded form and flat form are mereologically divergent models that will be used to construct a mereological framework for architectural form. The mereological peculiarities of these two paradigms will be unfolded through following two chapters constituting the main body of this work in respect to changes in the historical definitions, theoretical approaches and architectural operationalities of the concepts of part and whole.

CHAPTER 4

FOUNDED FORM

Founded form simply means that the conception and production of architectural form is "founded" on part and whole. It does not employ a traditional foundationalist mereology that necessitates parts to be founded on the whole, but it also acknowledges the cases in which the whole is founded on its parts, parts act to found the parts to achieve the whole, and parts and wholes try to avoid foundations, yet depend on the very concept of founding. In this regard, the multiple embodiments of foundedness will be surveyed through the concepts that constitute a founded form, which are namely the foundations, parts, moment of unity, and composition.

4.1 Foundations

Foundations include the systems, rules and principles that does not only guide the operational processes through which the whole and the parts are generated but also provide a theoretical basis to define the concepts of part and whole and regulate their relationality. Although foundations has been mostly considered and studied solely as visual and formal systems and rules, architectural mereology intends to reveal the logic behind foundations to understand how they provide a ground upon which epistemological and methodological approaches to architectural form have been constructed.

4.1.1 Laws of foundation

Foundations are not static conditions upon which a whole is constructed by placing parts, they are rather systems that succeed through a particular logic. The logic provides "laws of foundation" to maintain the consistency and the integrity of the

parts and the whole and the conditions that generate relations within. Laws of foundation assign ontological priorities, either to the parts or the whole and set ontological restrictions accordingly, which in turn results in a systematical construct interlocking a variety of constituents with different operational skills with a set of rules with specific objectives and fields of effect. Briefly, laws of foundation define a logical framework through and within which the "foundedness" is contrived and sustained.

Architecture has dealt with and produced many different approaches to "found" architectural forms. They have been mostly recognized, and also criticized, of being visual or formal, yet what lies behind the visuality and defines the formal expression is a logical framework that enables the form to be founded – founded as a whole, founded as a manifold of parts, founded as a relational structure, founded as a causality or a factuality and so on. Architectural mereology interrogates the logical frameworks by and upon which architectural form is founded. The concepts of part and whole supervise the interrogation through which laws of foundation will be unveiled, as they are the primary constituents of the logical framework that precede founded form.

The principal concern behind the laws of foundation is being whole. The whole may be assumed as ever-present or it can be achieved. In either case, laws of foundation serve to keep consistency, integrity and unity – "wholeness". For the sake of preserving the "wholeness," laws of foundation contemplate ways to organize; the internal structure of the whole, the internal structure of the parts, the relations between parts, and inextricably between the parts of a part, the relations of parts to the whole, and the objectives and fields of authority of these different types of relations. When architectural form has been considered, laws of foundation are not only concerned with the particular form upon which they operate but they rather tend to become "the" law that the architectural form, as a generality, should be founded upon.

The most famous and the most powerful law of foundation through which architectural form has been founded is "order." The word order is not easy to use as it comes with a historical burden of the fact that it was not present in architectural vocabulary and its meanings differ at times it is present. Here, "order" is used without any architectural reference and simply to indicate the act and the status of arrangement, as the epistemological and methodological approaches concerned with laws of foundation to reach and sustain order will be studied through their respective historical and contextual terms. Any consideration of order is founded on the concepts of part and whole because one needs parts to arrange and has to have a reason, an aim or an urge of achieving a whole to arrange.

Law of foundation that is primarily concentrated on order assigns an ontological priority to the whole. In this respect, architectural forms founded on an "order" are always founded on the whole, or rather, on the being of whole. Architectural forms conceived with a classical paradigm strictly obey the laws of foundation with an obligation to "wholeness." Although they can be assessed as visually and formally constraining, they are logically and systematically consistent founded forms. In *Classical Architecture: The Poetics of Order*, Alexander Tzonis and Liane Lefaivre inquire into "how classical architecture is made, how it works as a *formal system*."[119] The main assumption that the classical architecture works as a formal system denotes the fact that it is a "system" which is simply a whole compounded of several parts. The etymology of the word system directly states that it is an arrangement, an organized whole which entails that systems are founded on a logical framework that place together a set of interacting or interdependent elements and rules that regulate their relations. Correspondingly, Tzonis and Lefaivre define their aim "to identify the kind of logic associated with this [classical architecture] system."[120] They employ the

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[119] Alexander Tzonis and Liane Lefaivre. Classical Architecture: The Poetics of Order. Cambridge, Mass.: The MIT Press, 1986: 2 [Italics original].

[120] Ibid.

Vitruvian term "*logos opticos*,"[121] and look into the making of the classical architecture; "the logic of composition" that underlies it as a system "to construct an operational definition"[122] of it. Tzonis and Lefaivre identifies a tripartite system that operates through the making of classical architecture:

> (1) *Taxis* [the framework], which divides architectural works into parts; (2) *genera*, the individual elements that populate the parts as divided by taxis; and (3) *symmetry*, the relations between individual elements.[123]

The system is defined with a set of elements, the relations within these elements and the framework, the foundation, upon which everything is founded. Considering the proposition of "founded form" and the concepts that constitute its "foundedness," taxis is the "foundation," genera is the "parts" and symmetry is the "moment of unity."[124] Taxis means "arrangement, arranging, order" in Greek and suggests a logical framework to define the laws of foundation. Tzonis and Lefaivre state that taxis becomes operational through the notion of dividing. In this regard, "division" is the law of foundation for architectural form. In the making of classical architecture,

> Taxis divides a building into parts and fits into the resulting partitions the architectural elements, producing a coherent work. In other words, taxis constrains the placing of the architectural elements that populate a building by establishing successions of logically organized divisions of space.[125]

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[121] Ibid. See, Vitruvius. *De Architectura*, Book I, Chapter I. Ten Books on Architecture, trans. Morris Hicky Morgan, Cambridge: Harvard University Press, 1914.

[122] Ibid. 4.

[123] Ibid. 6 [Italics original]. In the "Contents," under the first chapter entitled "Rules of Composition," the first sub-chapter is indicated as "Taxis: The Framework."

[124] The foundations will focus only on taxis as a logical framework defining the laws of foundation. As indicated, genera will be covered under the sub-chapter of "Parts" as a particular indication of a group of architectural elements that refers to the "classical orders", namely the five orders designating column types, whereas symmetry will be discussed as a "moment of unity" in the sub-chapter entitled accordingly.

[125] Alexander Tzonis and Liane Lefaivre. Classical Architecture: The Poetics of Order, 1986: 9.

Taxis assigns division as the law of foundation according to which building as a whole will be "logically" organized through its parts. Division is not simply an act or process of partitioning but also an act of defining. Taxis continuously operates through division and it simultaneously defines the whole with its constituent parts. By division not only whole is divided into and defined by parts but also the parts are controlled with their respective relations to the whole. The processes of division and arrangement within taxis are intricate. It is impossible to separate division from arrangement since division includes the act of arrangement as well as arrangement includes the process of division. The parts generated through the act of dividing are simultaneously arranged. Taxis continuously imposes further divisions. To illustrate, division is applied in scales starting from the spatial partitions of a temple to the elementary fragmentations of a column capital. Division defines everything; the basic partitions of the whole, further partitions of these partitions and the elements that will occupy these partitions, the smaller parts of these elements, which in turn will result in a complete system that the relations of each and every part with one another and to the whole is defined and preserved.

What is critical of division as the law of foundation is its "transitivity,"[126] meaning that division starts from whole and transits through parts and then parts of those parts and continues. The authority of being the law of foundation can only be maintained as long as the operation of division is "transitive," as the whole will be founded through this very law of foundation and preserve its consistency and integrity. Transitivity of division does not only continuously generate and define parts of a whole but it critically sustains the being of parts as parts of the whole from which they are generated through division, which is the very definition of parts "founded" on the whole. Taxis defines "a mother formula"[127] to logically organize, in other

[126] "Transitivity" is a concept in mereology that indicates one of the core relations in parthood as a partial ordering. As long as the relation of being part of a whole is sustained, the rule transits from whole to its parts and continues.

[127] Alexander Tzonis and Liane Lefaivre. Classical Architecture: The Poetics of Order, 1986: 24.

words, a law to found the whole and its parts. The law of foundation defines a single operation that divides, distributes, arranges, and thus interlocks the whole system with a logical framework, which sets and defines the relationality of parts and contrives the "wholeness".

Tzonis and Lefaivre indicate that taxis operates through two forms of division, which they call as "schemata:" the grid and the tripartition. Within a mereological approach it does not matter which form of division is employed as the visual and formal results of these forms of division does not entail a difference in the operational application of division. What is essential of these "schemata" is that they are not solely visual and formal operations but rather organizational and relational applications to contrive a logical system. The notion of transitivity is conceptualized and illustrated in reference to two forms of division by Tzonis and Lefaivre:

> In general, taxis, whether in its overall grid schema or tripartition, should be seen as applied *hierarchically* from the whole to the part, one grid or tripartition schema *embedded* in another. In fact, this hierarchical correspondence among divisions in applying taxis schemata from the general to the particular, from the total to the last detail, is also a means through which the norm of noncontradiction is respected. Hence the legend that in a classical work, even if only a tiny fragment survives, one can always reconstruct the whole.[128]

The transitivity of division is reflected by the use of the concepts of "hierarchy" and "embedding." The concept of transitivity as a principle sustained by parthood entails hierarchy as an ordering principle and allows for the operations of embedding. Transitivity of the law of foundation defines the conditions of which the parts can be arranged as well as generating them. Through the transitivity of division, taxis constructs a logical framework for different applications of the law of foundation and identifies relational patterns of parts. According to this framework, transitivity entails different conditions of parthood within and through which parts can be eliminated from, added to, repeated, fused into, and/or

[128] Ibid. 18 [Italics original].

embedded within one another without damaging the integrity of the whole. Figure 11 shows the applications of these conditions and relations of parts sustained by taxis, as illustrated by Tzonis and Lefaivre.

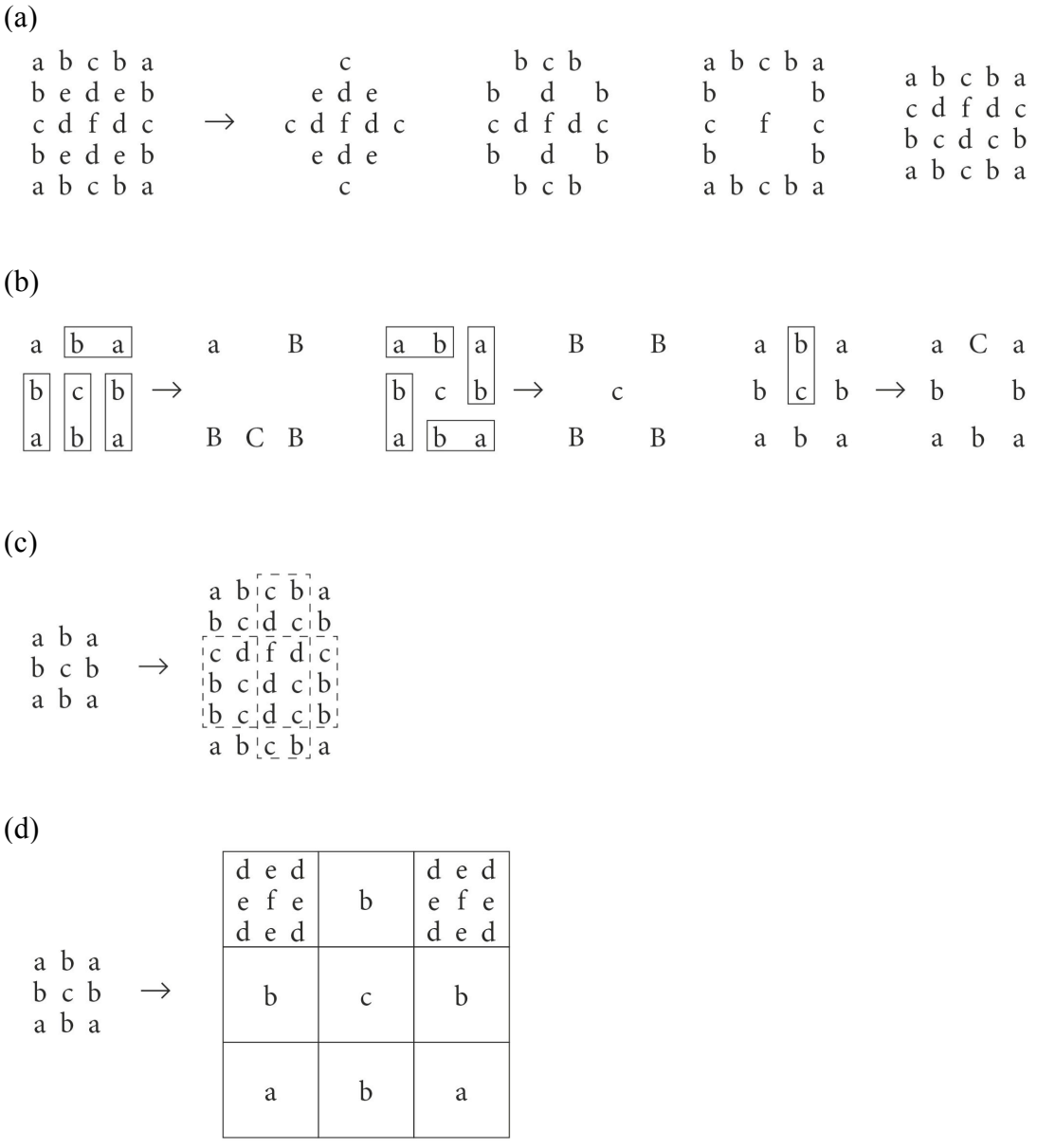

Figure 11. Transitivity of parthood - (a) Elimination of parts; (b) Fusion of parts; (c) Addition and repetition of parts ; (d) Embedding of parts.

[Alexander Tzonis and Liane Lefaivre, Classical Architecture: The Poetics of Order, 1986: 24. Reproduced and emphasis added by the author.]

As illustrated, taxis and the law of division it entails are not simply operational procedures to be followed but rather foundations upon and from which conceptual, relational and organizational structures of an architectural form can be developed. Laws of foundation sustain logical frameworks by operating through all levels and scales of a whole. In the specific case of architectural form, they may result in spatial organizations, structural patterns, proportional harmonies, and so on. Different forms of division – schemata – illustrated by Tzonis and Lefaivre are abstract representations of taxis, which are applicable in a building as well as in an architectural element that is considered in the making of classical architecture.

Leon Battista Alberti used a more literal term to indicate division, which is "*partitio*," translated as "compartition," by Joseph Rykwert, Neil Leach and Robert Tavernor,[129] which treats building as a body that is decomposable to its parts, or rather bodily fragments, which are also individually articulated through *partitio*. Alberti defines partitio as

> Compartition is the process of dividing up the site into yet smaller units, so that the building may be considered as being made up of close-fitting smaller units, joined like members of the whole body.[130]

Compartition as an operation of division is clearly the law of foundation for Alberti. However, the whole conceived by Alberti is rather concrete and refers directly to building as a body that is composed of concrete parts. It would be misleading to assume that Alberti conceived architectural form solely as a building as long as the theoretical division between *lineamenta* and *structura* is acknowledged. Yet, Alberti's morphological analogy of building as a body emphasizes the critical function of division as an act of definition besides its operational nature. Division as

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[129] As indicated in glossary in reference to Leon Battista Alberti. Book I, Chapter 9. On the Art of Building in Ten Books. Translated by Joseph Rykwert, Cambridge, Mass.: MIT Press, 1988: 421.

[130] Ibid. Book I, 8.

a law of foundation is powerful in the definition and the construction of the parts as well as its organizational and relational action on the whole. In the seventh book of *De re aedificatoria*, Alberti defines the parts of a Doric base according to a method that is based on successive processes of division instead of indicating the proportional relations of the parts. He conceives the construction of parts as a process rather than a descriptive act of definition and division is the operation to be employed in this sequential process that he explains:

> The measurements of all the parts are taken from the diameter at the base of the column, according to the rule first established by the Dorians. They made the height of the base half the diameter. The width of the die in either dimension would be no more than one and a half and no less than one an a third times that diameter. The height of the base was then divided into three parts, one of which was taken up by the thickness of the die [A], and the width of the die three times the thickness of the base. The thickness of the remainder of the base, excluding the die, was then divided into quarters, the top one being taken up by the upper torus [B]. Then the distance remaining in the middle, between the torus at the top and the die at the bottom, was divided in half, the bottom being given over to the lower torus [B], the top hollowed out for the scotia sandwiched between the two tori. The scotia consists of a hollow channel and two thin fillets [D] running around the edges of the channel. Each fillet takes up a seventh of the thickness [D]; the remainder is hollowed out.[131]

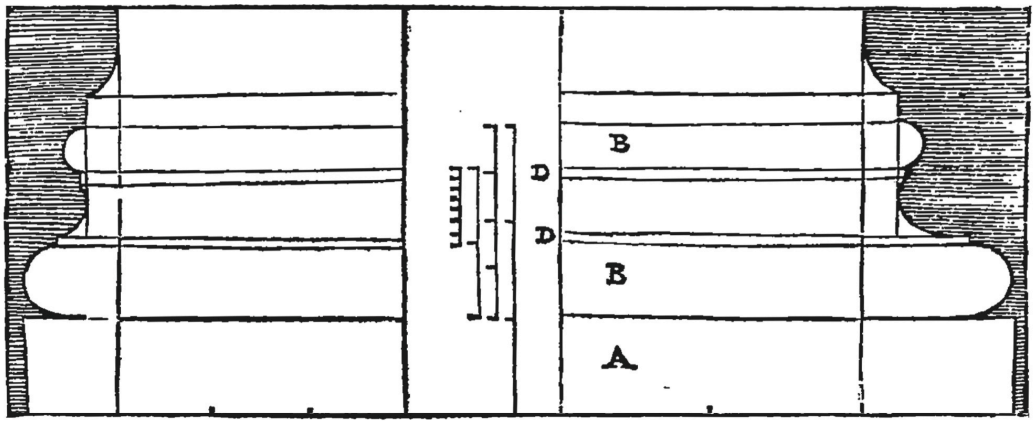

Figure 12. Alberti's Doric base.

A: plinth, B: torus, D: fillets, with scotia between. [Leon Battista Alberti. On the Art of Building, 1988: 202.]

[131] Ibid. Book 7, Chapter 7: 202-203.

Alberti's text may seem confusing at first glance but if the steps in the process of division are separated from one another and applied sequentially, it is observed that at each step a part of a Doric base is acquired and then the rest of the whole is further divided in a given number of parts to achieve the rest of the parts that constructs the Doric base, which is a contextual whole that is actually a part of another whole. To ease the understanding of the procedural construction of the six parts that compose the Doric base, Mario Carpo rephrases Alberti's instructions of division as followed:

> [F]irst, take the diameter of the column at the base, and divide it into two equal parts. This gives the total height of the base. Then, take this segment and subdivide it into three equal parts; the lower third is the plinth. Then take what is left, divide it into four equal parts; the upper quarter is the upper torus. Then take what is left and divide it into two equal parts; the lower half is the lower torus. Then take what is left and divide it into seven parts, and the upper and the lower seventh are the two fillets. What is left is the scotia, sandwiched between the two fillets and tori. Thus the sequence is completed.[132]

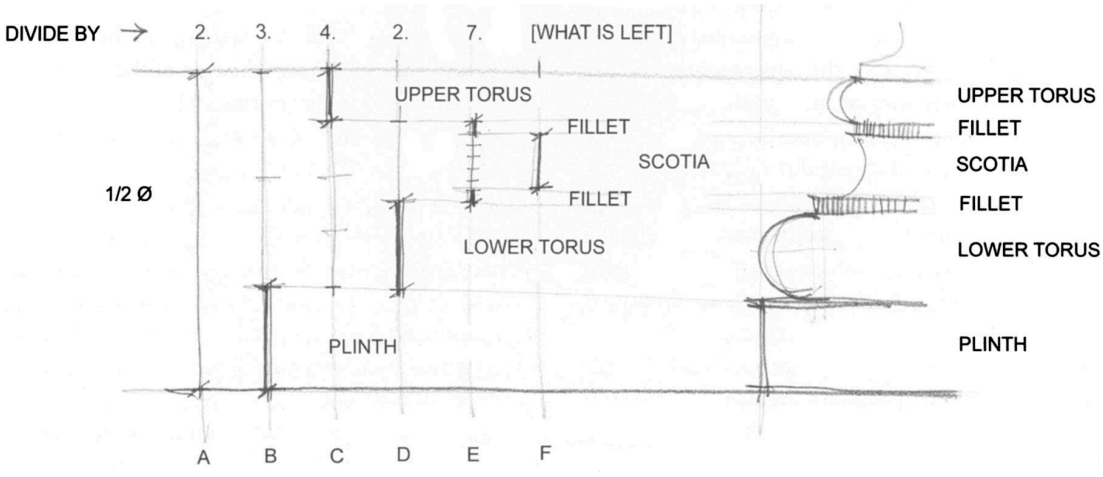

Figure 13. Alberti's instructions for determining the proportions of his Doric base, by Carpo.

[Mario Carpo, "Drawing with Numbers: Geometry and Numeracy in Early Modern Architectural Design," Journal of the Society of Architectural Historians, vol. 62, no. 4, 2003: 449.]

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[132] Mario Carpo. "Drawing with Numbers: Geometry and Numeracy in Early Modern Architectural Design," Journal of the Society of Architectural Historians, vol. 62, no. 4, 2003: 449.

Carpo simplifies the instruction of Alberti as an iterative process, which means that to achieve parts, the operationally identical act of division should be repeated on what is left after a part acquired by division. Carpo focuses on the Alberti's specification of the sizes and proportions by the operation of division as opposed to giving measurements of each part or defining the multiples of each part according to a minimum dimension or module. However, what is essential to this process is not only acquiring relational sizes of each part but attaining the construction and thus the very definition of parts by the law of division. Through the sequential process conducted by the operation of division, each part is founded on the respectively bigger part to which they belong, or rather, from which they have been derived. Alberti's *partitio* applied on a Doric base is a seminal illustration of division as a law of foundation.

To reflect the logical construct that regulates the proportions of the parts of a building, Claude Perrault embraces the term "ordonnance." He remarks that by parts of a building "the rooms that it is composed of, such as the courtyard, vestibule, or hall" should be considered as well as "the parts that are involved in the construction of each room."[133] Perrault dedicates his work to these constructional parts, which are the five column types and the parts that these columns are constructed of. He focuses particularly on the proportional regulation forged by the ordonnance, from which the emphasis on the proportions rather than the shapes of the columns and their parts makes it clear that the ordonnance is more than a visual and formal order and fairly a lawful framework that the parts should be founded upon.[134]

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[133] Claude Perrault. Ordonnance for the Five Kinds of Columns after the Method of the Ancients. Intro. Alberto Pérez-Gómez, trans. Indra Kagis McEwen. Santa Monica, CA: The Getty Center Publications, 1993: 65.

[134] Since the work of Claude Perrault particularly focuses on the columns as architectural parts, his elaborations on the definition of architectural parts and the tripartition that determines the organizational structure of the column parts will be discussed in the sub-chapter entitled "Parts."

Division as a law of foundation did not only enable architectural form to be founded through the foundedness of parts to their whole and the founding of the whole as an organizational system but it also enabled the identifications of architectural form from its logical framework. The logic of dividing and partitioning suggested an implicit method for defining as well as generating. While the variety among the organizational constructs of taxis is achieved by the operation of division, the similarities and commonalities emerged within this variety became intelligible by division and taxis. Simply, what generated and defined different "types" of temples, plans, columns, brick layouts, etc. was taxis; a basic operation of dividing enabled classification and made it possible to speak of "taxonomies" within classical architecture.

4.1.2 Cultivating foundations

Taxis provided a logical framework for architectural form to be founded, which expanded into an epistemological positioning of it. Although it has been claimed that for a mereological approach the logic of the system that organizes the foundational relation of part and whole is essential, the operations, which have been explained so far conceptually, should also become practically applicable through a medium. Drawing provides a field to accommodate the foundations from which architectural forms will be cultivated. Drawing phenomenologically grounds the architectural form, which is logically constructed and epistemologically distinguished.

One of the most striking aspects of architectural drawing is that it is always *partial* – both in the sense that it relates to part more than whole and it favors one part, side, view, vision, position or property more than others. Yet, it is this partiality that renders drawing as a powerful field of architectural thinking and making. This decisive deficiency is actually a purposeful tenacity, which equips drawing with critical and noematical means beyond its clinical and analytical representationality.

The orthographic set emerged as a systematical and methodological approach in architectural thinking and making by instrumentalizing the partiality of drawing. What lies in the core of its formalization and legitimizes the intentional partiality of orthographic set is the assumption that a whole can be understood through its parts. In this respect, the orthographic set should be assessed as the mereological representation of architectural form and each orthographic drawing that it is constituted of should be acknowledged as mereological operations that aim at defining architectural wholes by redefining their parts. The parts of the orthographic set, namely plan, section, elevation, did not remain solely as parts of the drawing but magnified to become the very parts of the architectural form itself. In this regard, orthographic drawing is not a representation mode but rather a disciplinary tool for architecture, with which architectural form has been founded and cultivated.

Orthographic drawing was not the only means to study an architectural whole with its parts, perspectival and parallel, or as Massimo Scolari says "oblique,"[135] drawings have also been used to "represent" the composition of parts into a whole. However, what is critical of orthographic drawing is that it does not only aim at representing but it rather employs an operation of division that conceptually and structurally breaks up the whole. The parts acquired after division are interlocked with a system that founds these parts and their relations with one another, with the conceptual whole they compose and with the actual whole that they have been "divided" out from at the first hand. Orthographic set does not only represent but actually deconstruct and reconstruct the architectural whole. Through the simultaneous acts of dividing and combining, the architectural form is constructed and instructed at the same time.

Division is the very foundation of orthographic drawing and it operates through architectural form in multiple levels. The operation of dividing is a metaphysical act

[135] Massimo Scolari. Oblique Drawing: A History of Anti-Perspective. Cambridge, Mass.: The MIT Press, 2012.

of cutting as well as it is a conceptual act of decomposing. The whole is cut up be known not solely to be represented. The parts, then, are put back together to produce knowledge of the whole. While plan and section serve to dissect the whole to manufacture parts out of it, elevation applies a brutal skinning of the whole and then stitches the patches in a particular way to achieve a superficial pastiche of it. Cutting is the task and means of knowledge as Foucault says; "knowledge is not made for understanding, it is made for cutting." [136] Both individually and collectively, orthographic drawings push the limits of the whole by cutting it in different ways to get parts out of it for the sake of producing knowledge of it. What assures the founding of this peculiar type of knowledge of a whole is the mereological comprehensiveness of the concept of part.

Orthographic drawing is not only a methodological but also an epistemological approach to architectural form. Intending toward an understanding of the whole, it metaphysically operationalize division as a means of knowing through parts and rationalizes the partiality of drawing. Any architectural form can be studied with an orthographic set, yet it does not mean that it will be understood perfectly as a whole with its "orthographic" parts. The partiality of drawing operates in different levels respective to the mereological composition of architectural forms. Referring back to the making of classical architecture according to a logic of composition, orthographic drawing was also a field to construct the logical framework of architectural form and practice the laws of foundation. Taxis was to be performed exclusively through orthographic drawings. First, division has broken the architectural whole apart into its orthographic parts – plan, section, elevation – and then it articulated the whole with further divisions that are applied on these parts. Mereologically what matters is how a part is defined and its relation to the whole; and division, with all attributed meanings and connotations, is a significant concept that enables the formalization of

[136] Michel Foucault. "Nietzsche, Genealogy, History," in Language, Counter-memory, Practice: Selected Essays and Interview. Ed. Donald Bouchard. Ithaca: Cornell University Press, 1977: 140.

an architectural mereology, through which an understanding of founded form is contrived. Yet, it is challenging to devoid the visuality of any architecture. Although neither visual principles nor formal expressions are the focus of architectural mereology, they are pregnant with substantial clues to discover the changes in the conception and production of architectural form in respect to the theories and practices of part and whole. In this respect, different approaches in drawing should be acknowledged beyond their visual peculiarities by focusing on how they accommodate and process the law of division to formalize an approach to architectural form by founding it on the concepts of part and whole.

The operation of division actually suggests an idealization of architectural design that is integrated with the act of drawing. Knowing the strengths and weaknesses of the operation of division, Alberti steered architects away from the use of perspectives and insisted that they had to study *lineaments* and perform *partitio* on orthographic drawings so that the whole is divided and proportioned precisely.[137] Proportion could be recognized as an advanced level in the organization of the whole as it is concerned not only with logical ordering of parts but also loaded with the dimensions and ratios that effect the visual and material construction of the form. For Alberti proportion was the "successful combination of number, measure and form"[138] and it could only be captured in orthographic drawings. Proportion is a mastering of division, which aims at a perfection of the whole by articulating on its logical ordering and mereological composition. By juxtaposing the metaphysical division induced by the orthographic set, the logical division imposed by taxis and the visual, and actually physical, division dictated by proportion, architectural form is cultivated through the foundational relationality between the whole and the parts.

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[137] For three dimensional operationality of *lineamenta* see, Ayşen Savaş. "Linea Mentis: Definition of the Term Façade in Architecture," Terminology Problems in Art History Symposium. Ankara: The British Institute, November 2001: 143-152.

[138] Alberti. On the Art of Building, 1988: 424.

The integrity of the act of designing and drawing has been essential and provided the foundations of architectural learning. The logical and operational processes conducted by division were beyond stylistic codifications. Division united with the act of drawing actually defined the very act of architectural design and initiated the formalization of methodological and epistemological approaches to architectural form. Accordingly design had acquired various expressions including "lineaments," "distribution," and "planning" among which "composition" has acquired a historical and semantic reputation.[139]

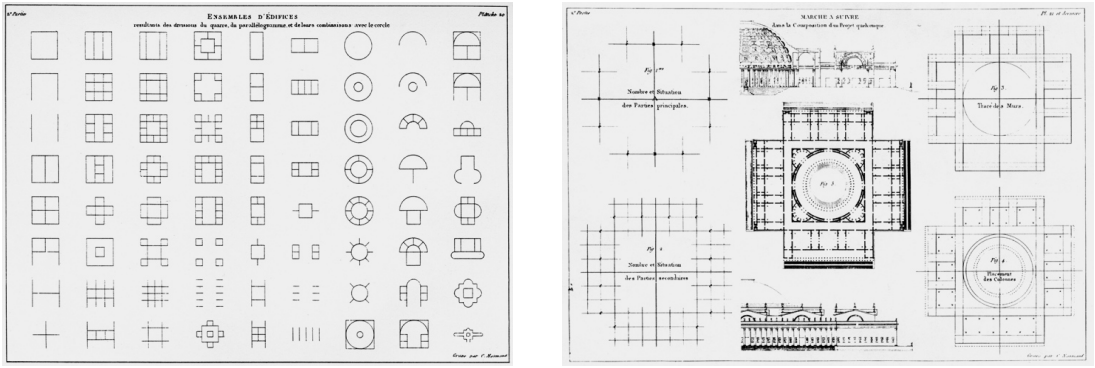

Figure 14. Divisions conducting the stages of composition, Jean-Nicolas-Louis Durand.

Left: Ensembles d'edifices resultants des divisions du squarre, du parallelogramme et de leurs combinaisons avec le cercle / Ensembles of buildings, resulting from the divisions of square, parallelogram, and their combinations with circle. [*Précis des leçons d'architecture données à l'École royale polytechnique*. 1st ed. 1802, vol.2 Plate 20]; *right: Marche à suivre dans la composition d'un projet quelconque* / Procedure to be followed in the composition of any project. [*Précis des leçons d'architecture* 4th ed. 1825, vol. 2, Plate 21]

[139] Composition has a complex history regarding the meanings, interpretations and connotations it has acquired, especially within the French tradition. Though the discourse on composition begins with Jean-Nicolas-Louis-Durand and his well-known work *Précis des leçons d'architecture données à l'École royale polytechnique* (1802), the literary culmination of nineteenth-century composition is widely considered to be Julien Guadet's *Éléments et théorie de l'architecture*, the four-volume compilation of his lectures published between 1901 and 1904. Deriving from its historical and theoretical formulations developed in respect to the concepts of part and whole, composition will be discussed as a mereological construction of the whole as it combines all the notions – foundations, parts, moment unity – underlying the thought of founded form and proceeding toward a methodological and epistemological definition of architectural design.

Orthographic drawing can be assessed historically dominant as a means of architectural design but it is not the absolute field where the concepts and relations of part and whole could be studied or theorized. What is unique for orthographic drawing is its of partiality that foregrounds it as a methodological and epistemological tool in cultivating architectural form by critically oscillating it between part and whole. Orthographic drawing occupies a considerable terrain within the textual field of this study due to its mereological form, yet it would be misleading to assume that orthographic drawing is exclusive for founded form or vice versa. There are other modes of drawing to cultivate founded form as there are forms cultivated through orthographic drawing and nevertheless expand the very concepts of part and whole and reformulate the conditions of relationality – instances from both will be discussed in respect to the notions of foundedness and flatness.

4.1.3 Bending foundations

The logic that underlie the conception and production of architectural form have been discussed over the multidimensional operationality of division, which can be assessed as the ultimate law of foundation to organize and systematize the relationality of part and whole. Taxis, partitio and ordonnance are all formalizations that depend on, derive from, and rationalized by the very idea of division as a methodological and epistemological act operating through the mereological concepts of part and whole. Yet, division cannot be assessed or processed operationally identical to all endeavors of founded form; it should rather be acknowledged as a "foundation" where diverse approaches to architectural from could be practiced and developed along with the questionings of the definition and relationality of part and whole.

Foundations of architectural form have been repeatedly bent under the historical, theoretical, ideological, and philosophical disparities experienced along the

disciplinary formation of architecture. Architectural mereology seeks to locate the implications of these disparities on architectural form by instrumentalizing the concepts of part and whole and intends to cultivate an understanding of it from within. How founded form have been bent to achieve a flatness of it cannot be understood purely as a disposal of foundations. Architectural form has been bent from its foundations under the extravagant discourses on what architecture is or what is its purpose, which was simultaneously based on and derived from the changing definitions of architectural part, the never-ending reformulations of architectural whole, and the anxiety concentrated on their relationality.

What the foundations are concerned with or aim at regulating is directly related to the conception of part and whole. As the responses of what an architectural part is and how an architectural whole should be conceived change, the very formalizations of foundations are bent accordingly. When looked on a single yet a highly powerful term order is considered, the vulnerability of foundations becomes clear. Order is acknowledged probably as the famous of all the foundations. Aristotle's notion of taxis has initiated architecture's embracing of the term order, which was actually meant the beauty of a proportional relationship of parts to the whole for Vitruvius. From Alberti to the late twentieth century, architects have been obsessively worked on the mathematical and geometrical principles that would serve as a system of order for architecture. The analytical and noematical aspects of how these systems are regulated by the logic of part and whole have been mostly overlooked for its visual outcomes. The visuality of architecture cannot be argued, yet what underlies the long-praised geometrical constructions and proportional formulations for the ordering of part and whole could be discussed on the basis of foundedness. Taken purely as a matter of geometrical and mathematical systematization for a visual effect, the idea of order as the foundation of form becomes questionable as the definitions parts to be arranged and the whole that is intended to be achieved change and questioned.

Le Corbusier says, "[t]o create architecture is to put in order. Put what in order? Functions and objects." He claims "[a]rchitecture is the masterly, correct, and magnificent play of masses brought together in light" [140] and he also claims "architecture is circulation."[141] While Louis Kahn states "[d]esign is form-making in order," [142] Louis Sullivan claims [f]orm follows function. Mies van der Rohe emphasizes that "the organic principle of order that makes the parts meaningful and measurable while determining their relationship to the whole"[143] and he also remarks that "[t]he building art begins with the *careful* fitting of two bricks."[144] What is order for architecture, what orders architecture and what architecture orders continuously blends as the conception of order alters with what it concerns. Bricks, functions, masses, spaces, or forms do not conflict with the idea of order or foundation, but confuse what is part and what is whole.

For Alberti the separation of *lineamenta* from *structura* was the foundation of his theory but structure gained a reputation as an abstract content of form, which challenged Albertian paradigm of design. Eventually, structure did not only depart from its materiality but also from its visual and sensual properties and even recognized as a "deep aspect concerned with conceptual relationships which are not sensually perceived; such as frontality, obliqueness, recession, elongation,

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[140] Le Corbusier. Towards a New Architecture. Trans. Frederick Etchells, New York: Dover Publications, 1986: 29.

[141] Le Corbusier. Precisions on the Present State of Architecture and City Planning. Trans. E. S. Aujame, Cambridge, Mass.: The MIT Press, 1991. Originally published in 1930: 47.

[142] Louis Kahn. "Order is," Zodiac no.8, Milan, June 1961: 20; reprinted in Ulrich Conrads (ed), Programmes and Manifestoes on Twentieth Century Architecture, Cambridge, Mass.: The MIT Press, 1971: 169-170.

[143] Fritz Neumeyer. The Artless Word: Mies van der Rohe on the Art of Building. Trans. M.Jarzombeck, Cambridge, Mass.: The MIT Press, 1991: 317.

[144] Ibid. 338.

compression and shear, which are understood in the mind."[145] Peter Eisenman's "deep structure" was not an order but it was surely a foundation of form; a foundation that does not situate but rather instantiate form. It is not a logical framework through which the parts are successively founded on the whole but a collection of indexical procedures that instrumentalize "operational parts," rather than operating on parts and never lets form to settle down. As foundation became a buoyant concept that is not obliged to restrict form and as parts and wholes became eligible to occupy abstract and concrete contents, architectural form has been deflected not only formally but also mereologically. Part embarked on an ontological tyranny over the whole by disposing all the formal, functional and semantic burdens of "being part of a whole" and start to dig out the whole from within. The consistency, integrity and unity of the whole are suspended to steer it from its foundations. Form was now "weak."[146] Although foundations were bent to be broken, they were here and there, yet still there.

Architectural mereology acknowledges foundation as a malleable and vulnerable concept for architecture and architectural form, which is compelled and forged by the changing conceptions of part and whole and the instability of their relationality. Law-bound nature of founding is not timeless and universal but immanently circumstantial and skeptical. The following chapter focuses on the notion of "part" in

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[145] Peter Eisenman. From Object to Relationship II: Giuseppe Terragni Casa Giuliani Frigerio," Perspecta 13/14, 1971: 38-39.

[146] "Weak form" is known as a concept to indicate the instability and contingency of form reticulated with possibilities, discontinuities, fragmentations, superimpositions and so on. "Weak thought," "*pensiero debole*," is initiated by the Italian philosopher Gianni Vattimo in 1980s and Eisenman embraced the notion of "weakness" to achieve a "weak ontology" in questioning and criticizing the foundational relation between part and whole. For him, the only possible way to achieve this was the separation of form and structure. See, Peter Eisenman. "Strong Form, Weak Form," Architecture in Transition: Between Deconstruction and New Modernism. Eds. Peter Noever and Regina Haslinger. Munich: Prestel, 1991: 32-43; Stefano Corbo. From Formalism to Weak Form: The Architecture and Philosophy of Peter Eisenman. Farnham: Ashgate, 2014. Founded form subsumes the notion of weak form. The assumption will be illustrated by the questioning of "part" in deconstructivist architecture as an anti-foundationalist attempt, which cannot invalidate and thus regenerate foundationalism.

the conception and production of architectural form to disclose the intricacies embedded in the foundations to instruct and conduct epistemological and methodological approaches toward founded form.

4.2 Parts

Parts are the principal constituents of a mereological approach. Architectural mereology acknowledges part not as a submissive content of the whole but rather as a formative, operative and decisive content that identifies the very being of whole. Although founded forms are biased with the ontological priority of the whole, the part holds the epistemological primacy.

4.2.1 Architectural Part I: Concrete contents of part

Defining what constitutes architecture has been a compelling task throughout the history. Parts are appreciated as the "elements" that characterize the discipline of architecture. The fundamentals of architecture have been initiated by establishing the basic constituents. The meanings, purposes and significances attributed to architectural parts have changed drastically regarding the abstract and concrete contents that the concept of part inheres. Yet, the concrete and abstract contents do not entail the conditions of dependency in architecture, meaning that, in Husserlian terms, while part as an abstract content may act as a "piece," an independent part that is separately representable from the whole, part as a concrete content may become a "moment," a non-independent part that serves as a founding part of the whole.

One of the challenges in defining what is an architectural part, or rather, what is part for the discipline architecture derives from the long-established notion of part as a concrete content, which resulted in its historical recognition as "architectural element". The term "architectural element" is comprehensive to include both the

abstract and concrete contents of part, but nevertheless it appropriated part as a concrete content and actually meant the "building elements" until the introduction of the concept of space and the reconsideration of part as an abstract content in the late nineteenth century.[147]

The primary referent of parts as architectural elements is "the classical orders," which are indicated as *"espéces"* by Claude Perrault and rephrased as *"genera"* by Tzonis and Lefaivre. The classical orders occupied a central position in all historiographies of architecture and received a reputation growing with its multiple re-formulations and interpretations. Acknowledgement of the classical orders was fundamental for classical paradigm as they established the epistemic core of architectural form. It is not the aim of this study to discuss the formulations and proportional rules of the classical order but rather to unfold the notion of founded form by studying their mereological formation and status as architectural parts. As parts of wholes that are founded forms, the classical orders are founded forms as well, regarding their own mereological formation. Perrault claims that:

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[147] Adrian Forty claims that Gottfried Semper is responsible for the introduction of "space" as the principle theme of modern architecture. See, Gottfried Semper. *Der Stil in den technischen und tektonischen Künsten oder Praktische Ästhetik,* 2vols (1860, 1863) Style in the Technical and Tectonic Arts; or, Practical Aesthetics. Intro. Harry F. Mallgrave, trans. and Michael Robinson, Los Angeles, CA: Getty Publications, 2004.

The conception of composition as an act and process of architectural design has contributed to the apprehension of part as an abstract content. J.N.L. Durand has confronted with the challenge of separating the abstract and concrete contents of part in his theory of composition developed through *Précis des leçons*. His *les éléments des édifices* (elements of buildings) indicated as a consistent group of parts, his elements oscillate between two points of view: (1) forms and proportion, (2) materials and construction.

Julien Guadet, after a century later than Durand, distinguished "elements of architecture" and "elements of composition." His "elements of architecture" were actually building elements, such as walls and domes, but his conception of "elements of composition," although restrictive in the sense that it correspond to the combination of "elements of architecture" such as rooms and lobbies, contributed to the development of part as an abstract yet constitutive and regulative element of architecture. See, Julien Guadet. *Éléments et théorie de l'architecture* (1901-1904).

> [T]he architectural order is what is regulated by the ordonnance when it prescribes the proportions for entire columns and determines the shape of certain parts in accordance with their different proportions.[148]

What is clear from Perrault's statement is that an architectural order is a separately presentable part of architecture, which is founded on the relationality of the parts that it contains. In other words, the mereological formation of the classical orders [from here on will be mentioned as the orders] is established on the conditions of parthood. Although the orders are differentiated visually and formally by the changes in the proportions of the parts constituting the column as a whole, they are mereologically identical forms. In all orders, the foundedness of the whole – an entire column according to Perrault – is sustained through parthood. Perrault explains the formation of parts, or, the partition of entire columns as followed:

> The entire columns of each order are made up of three main parts: the pedestal, the column, and the entablature. Furthermore, each of these parts is itself made up of three parts. The pedestal has its base, its dado or drum, and its cornice; the column has its base, its shaft or stalk, and its capital; and the entablature is made up of the architrave, the frieze, and the cornice.[149]

Reminding the logical framework of taxis, the transitivity of division operates through the parts by applying tripartition to entire column first and then to its three main parts. The partition does not only logically operate and organize the orders, but also mereologically identify the parts by their relations within and to the whole. The partition also determines the very definition of parts; for a founded form division is definition and vice versa. With a further layer of division, which specifies the proportions, architectural orders are differentiated formally but not mereologically. It should be noted that Perrault concentrated on an epistemology of form rather than its aesthetics. Intending to go beyond the obsession with proportions to maintain beauty, Perrault rejected proportions as a formulation of ratios conducting an absolute

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[148] Claude Perrault. Ordonnance for the Five Kinds of Columns, 1993: 65.

[149] Ibid. 70.

system to keep the parts of the elements and of the building intact. Based on the assumption that there were no absolute proportions, he started to question the imitation of nature and the augmented correspondence between proportions and beauty.[150] Perrault presented a comparative study of the classical treatises in the Ordonnance and unveiled the lack of correspondence between the ratios presented by various authors in their outstanding works:

> [A]ll those who have written about architecture contradict one another, with the result that in the ruins of ancient buildings and among the great number of architects who have dealt with the proportions of the orders, one can find agreement neither between any two buildings nor between any two authors, since none has followed the same rules.[151]

TABLE OF ENTABLATURES

Tuscan		Doric		Ionic		Corinthian		Composite	
minutes		minutes		minutes		minutes		minutes	
Vitruvius 15		Colosseum 26	more	Temple of Fortuna Virilis 18		Temple of Peace 8		Arch of the Lions 34	more
Scamozzi 11		Scamozzi 27		Vignola 18	more	Portico of Septimius 12		Serlio 30	
Vignola 15		Vitruvius 15		Theater of Marcellus 25		Delorme 19	more	Vignola 30	
Palladio 16	less	Bullant 15		Colosseum 26		Temple of Nerva 24		Arch of Septimius 19	
Serlio 3		Serlio 13	less	Palladio 11		Three Columns 36		Arch of Titus 19	less
		Palladio 12		Serlio 13		Facade of Nero 47		Temple of Bacchus 2	
		Vignola 10		Scamozzi 15	less	Scamozzi 0		Palladio 0	
		Barbaro 8		Delorme 16		Palladio 6		Scamozzi 3	
		Theater of Marcellus 7		Vitruvius 19		Vignola 12			
		Delorme 5		Bullant 35		Serlio 14	less		
						Vitruvius 19			
						Temple of the Sibyl 21			

Figure 15. Table of entablatures showing the lack of correspondence in ratios, Claude Perrault.
[Claude Perrault. Ordonnance for the Five Kinds of Columns after the Method of the Ancients. Intro. Alberto Pérez-Gómez, trans. Indra Kagis McEwen. Santa Monica, CA: The Getty Center Publications, 1993: 73]

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[150] Although Perrault did not break the orders, he introduced a separation of the conceptual and perceptual aspects of architectural form, which led the way to the constitution of a new formal vocabulary based on geometric solids by Étienne-Louis Boullée.

[151] Claude Perrault. Ordonnance for the Five Kinds of Columns, 1993: 48.

TABLE OF COLUMN LENGTHS

	Mean Modules		Mean Height: Mean Modules	Mean Height: Small Modules
Tuscan	Vitruvius	14	14⅔	22
	Trajan's Column	16		
	Palladio	14		
	Scamozzi	15		
	Serlio	12		
	Vignola	14		
Doric	Vitruvius in Temples	14	16	24
	Vitruvius in Temple Porticoes	15		
	Colosseum	19		
	Theater of Marcellus	15⅔		
	Scamozzi	17		
	Vignola	16		
Ionic	Colosseum	19–2	17⅓	26
	Theater of Marcellus	17⅔		
	Palladio	18		
	Serlio	16		
	Vitruvius	17		
Corinthian	Portico of the Pantheon	19–16	18⅔	28
	Temple of Vesta	19–9		
	Temple of the Sibyl	16–16		
	Temple of Peace	19–2		
	Three Columns of the Campo Vaccino	20–6		
	Temple of Faustina	19		
	Basilica of Antoninus	20		
	Portico of Septimius	19–8		
	Arch of Constantine	17–7		
	Colosseum	17–17		
	Vitruvius	19		
	Serlio	18		
Composite	Arch of Titus	20	20	30
	Temple of Bacchus	19⅓		
	Scamozzi	19½		
	Arch of Septimius	19–9		

TABLE OF PEDESTAL HEIGHTS

				Mean Height: Mean Module	Mean Height: Small Module
		Modules	Minutes		
Tuscan	Palladio	3	0	4	6
	Scamozzi	3	12		
	Vignola	5	0		
	Serlio	4	15		
Doric	Palladio	4	5	4–20 minutes	7
	Scamozzi	4	8		
	Vignola	5	4		
	Serlio	6	0		
Ionic	Temple of Fortuna Virilis	7	12	5–10	8
	Theater of Marcellus	3	8		
	Colosseum	4	22		
	Palladio	5	4		
	Scamozzi	5	0		
	Vignola	6	0		
	Serlio	6	0		
Corinthian	Altars of the Pantheon	7	28	6	9
	Colosseum	4	2		
	Palladio	5	1		
	Scamozzi	6	11		
	Vignola	7	0		
	Serlio	6	15		
Composite	Arch of the Goldsmiths	7	8	6–20	10
	Palladio	6	7		
	Scamozzi	6	2		
	Vignola	7	0		
	Serlio	7	4		

Figure 16. Tables of column lengths and pedestal heights showing the lack of correspondence in ratios, Claude Perrault.

[Claude Perrault. Ordonnance for the Five Kinds of Columns, 1993: 76, 79]

According to Perrault's meticulous work, *espéces* were actually instable and unreliable. The *espéces*, species, of columns shared a mereological form, but to be acknowledged as *espéces*, proportional articulation of their mereological form is essential and should be systematized rather than taken for granted as the cause of beauty. Tzonis and Lefaivre' remarks that they use the word *genus* to express "the idea of typified, predetermining relations that bind together the members of certain groups."[152] Regarding their common mereological formation, *genus* stands as a more appropriate term to classify the orders under founded form.

[152] Alexander Tzonis and Liane Lefaivre. Classical Architecture: The Poetics of Order, 1986: 35.

Any inquiry into part that conceives it as an architectural element reveals that part holds an epistemological priority in the production of knowledge of architectural form. Parts are not only studied in respect to the architectural orders as elements firmly restricted under proportions before Perrault, but they are also analyzed according to their constructional as well as compositional possibilities. The notion of *disegno* immanent in the Renaissance idea led to an emphasis on the visual studies pursuing a systematization of architecture. The illustrated treatises of Sebastiano Serlio and Andrea Palladio are acknowledged as the origins of the notion of type and typology in the sense that both sought for the possibility of transmitting a universal idea of form by means of particular and individual representations of it. *Tutte l'opere d'architettura, et prospettiva* (1537-51) and *I quattro libri dell'architectura* (1570) were compendiums of architectural elements and their applications in the formation of architectural wholes, or rather, designs. Yet, the two are radically different in their approaches to the concepts of part and whole, which reflected on the formalizations of their visual representations.

In *Tutte l'opere*, Serlio employs a pragmatic approach to systematize architectural knowledge by graphical means. Particularly in *Libro Terzo* (1540), the third book that contains his work on antiquity, he studies the relationality of part and whole in a constructional matter and focuses on exploring all the possible ways in which parts can be assembled by cutting out fragments from the wholes and then decomposing them further into their constructional parts. Serlio's illustrations of these fragments are actually represented as "cut-outs," they embody the cracks on their edges. The parts are coded on the fragments and presented with drawings in a larger scale. Serlio does not contextualize, rationalize or organize these parts with a consistent form of representation and he uses orthographic and perspective drawings together. Both the fragments and the parts are represented as "independent pieces," which float on the surface of the sheet. Neither parts nor the fragments of buildings are represented in relation to one another, parts from a fragment usually appear on a different page and the drawings of parts are "pieced-together" on the page rather than arranged.

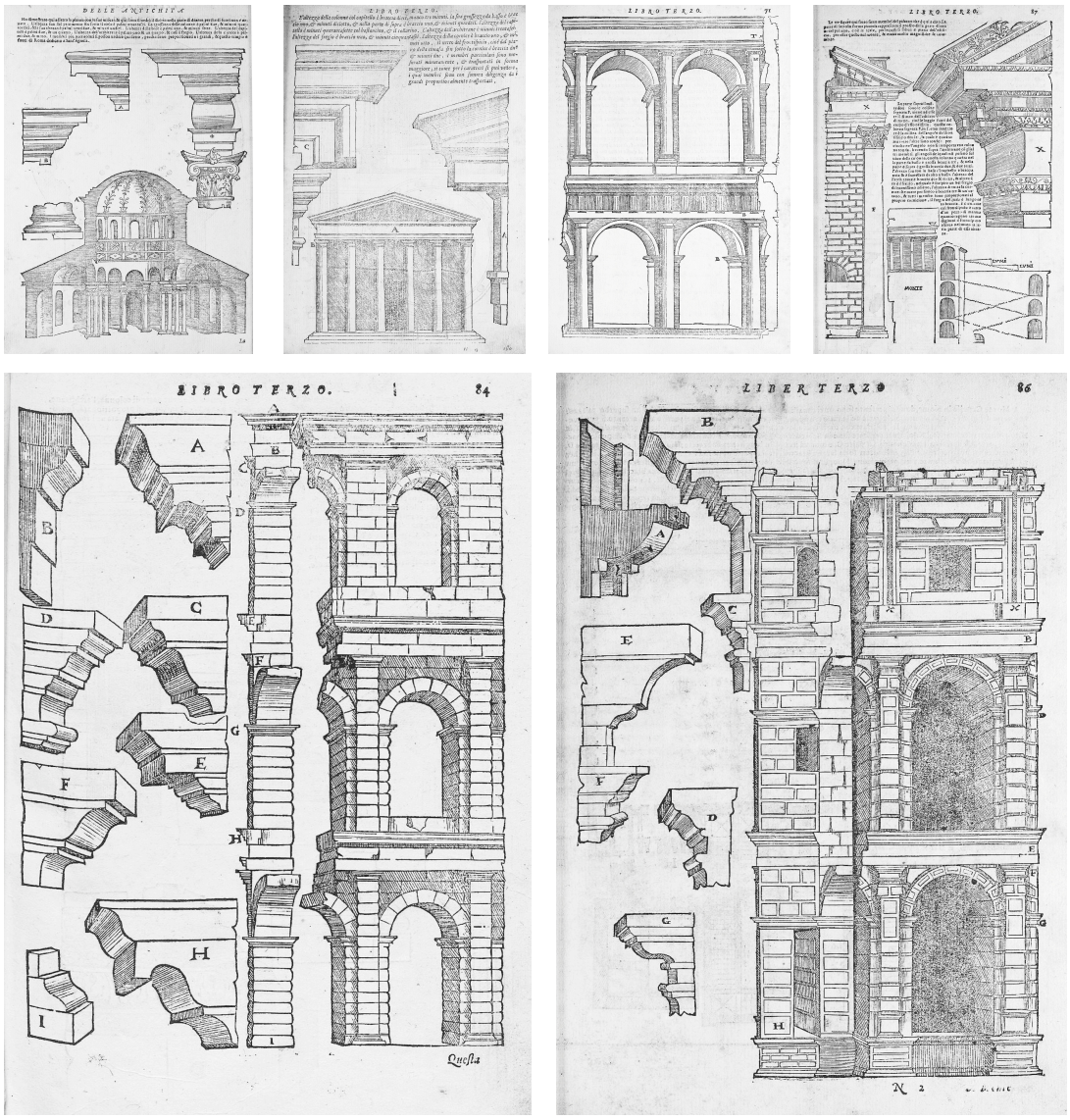

Figure 17. Excerpts from *Tutte l'opere d'architettura, et prospettiva,* Serlio.
[Sebastiano Serlio. *Tutte l'opere d'architettura*, *Libro Terzo*, 1584: 58, 60, 71, 84, 86, 87.]

Mereologically, Serlio embraces an understanding of parthood as a constructional relationship, which is related with and defined according the material body of the whole. He just draws to depict what is actually there by following and image-based method for the composition of architectural designs; parts are material constituents of the whole and they physically construct it. The graphic documentation of ancient monuments is an essential part of his work toward a systematization of architectural

components. Carpo assesses Serlio's constructional repertoire as a "closed world of a catalog of ready-made parts."[153] He claims that:

> The Serlian orders are architectural microdesigns, ready for use but with some assembly required. The user must select, combine, and construct the parts. The scale of the project is just about the only variable not dictated by the system. For the rest, there should be no difference between an image printed in the treatise, its copy in an architectural design, and the three-dimensional form of the resulting structure.[154]

The influence of Serlio's books was evident in Palladio's *Quattro Libri*, regarding the eagerness in classification and systematization intertwined with illustrations. Diverging from Serlio's fragmentations that treat building parts as independent pieces, Palladio considered parts and assembled parts in relation to their context. He represents them as "close-ups" to indicate that illustrated parts are not independent pieces but rather parts of a larger whole. Palladio also adopts a frame to circumscribe his drawings to emphasize the partiality of drawing as well as parts as opposed to Serlio's parts and fragments that float within the page. What is essential for defining fundamental principles for architecture is the "relations," which suggest an immanent order through which parts can be assembled into wholes. However, for Palladio, relations were more than paths to be followed toward the whole, parts and wholes inscribed by the relations should be considered beyond the materiality and particularity of their constitution and manifest an "ideal."

Discovering the power of drawing as a generative and formative tool besides its analytical, depictive and descriptive nature, Palladio utilized orthogonal projection as a means of formulating parts and wholes geometrically, which breeds schematic

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[153] Mario Carpo. Architecture in the Age of Printing: Orality, Writing, Typography and Printed Images in the History of Architectural Theory. Cambridge, Mass.: The MIT Press, 2001: 51.

[154] Ibid. 49.

and diagrammatic representations of their relationality.[155] Palladio's architectural parts were compositional as well as constructional and they were embedded with traces that could reveal foundational relations beyond their particular wholes. He intended to express that there are "ideals" founded on principles that transcend his own buildings.

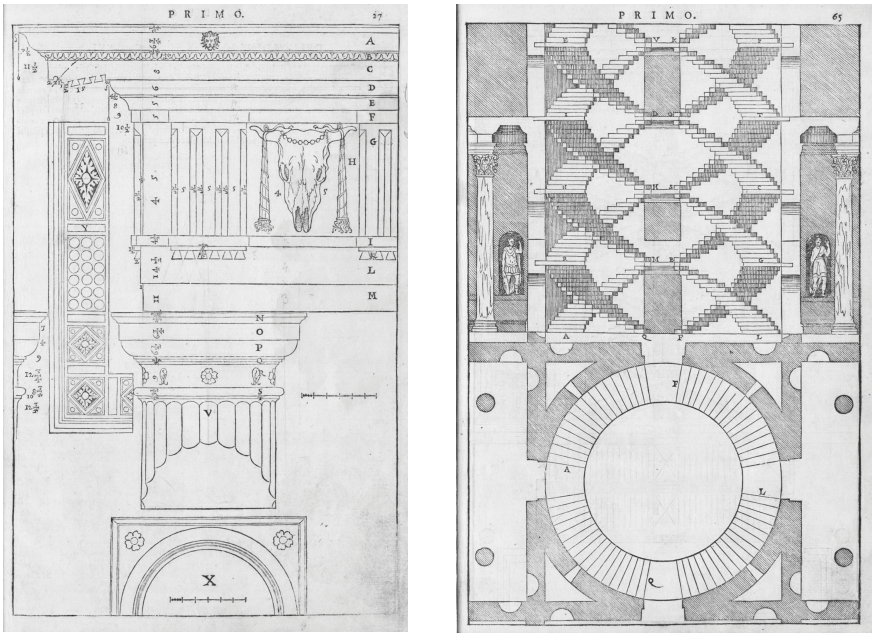

Figure 18. Excerpts from *I quattro libri dell'architectura,* Palladio
[Andrea Palladio. *I quattro libri dell'architectura, Libro Primo,* 1570: 27, 65]

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[155] Rudolf Wittkower concluded that Palladian villas are "derived from a single geometric formula." Architectural Principles in the Age of Humanism, New York: Van Nostrad Academy Editions: St. Martin Press, 1973: 68.

With the introduction of digital technologies and computation in architectural design, Palladio's relational principles and geometric formulas have received a further attention in computational design research. Various studies have been developed to re-cast Palladio's system in terms of algorithms and shape grammars. The strategies were simply based on an understanding of reverse-engineering, which attempts to extract a step-by-step procedure to imitate Palladian designs. Rules of division were the fundamental operations to be executed by the algorithms. See, George Hersey and Richard Freedman. Possible Palladian Villas: (Plus a Few Instructively Possible Ones), Cambridge, Mass.: 1992; George Stiny and William Mitchell, "The Palladian Grammar," Environment and Planning B, vol.5, 1978: 5-18; Lawrence Sass, "Reconstructing Palladio's Villas: An Analysis of Palladio's Villa Design and Construction Process," unpublished Ph.D. diss. Massachusetts Institute of Technology, 2000.

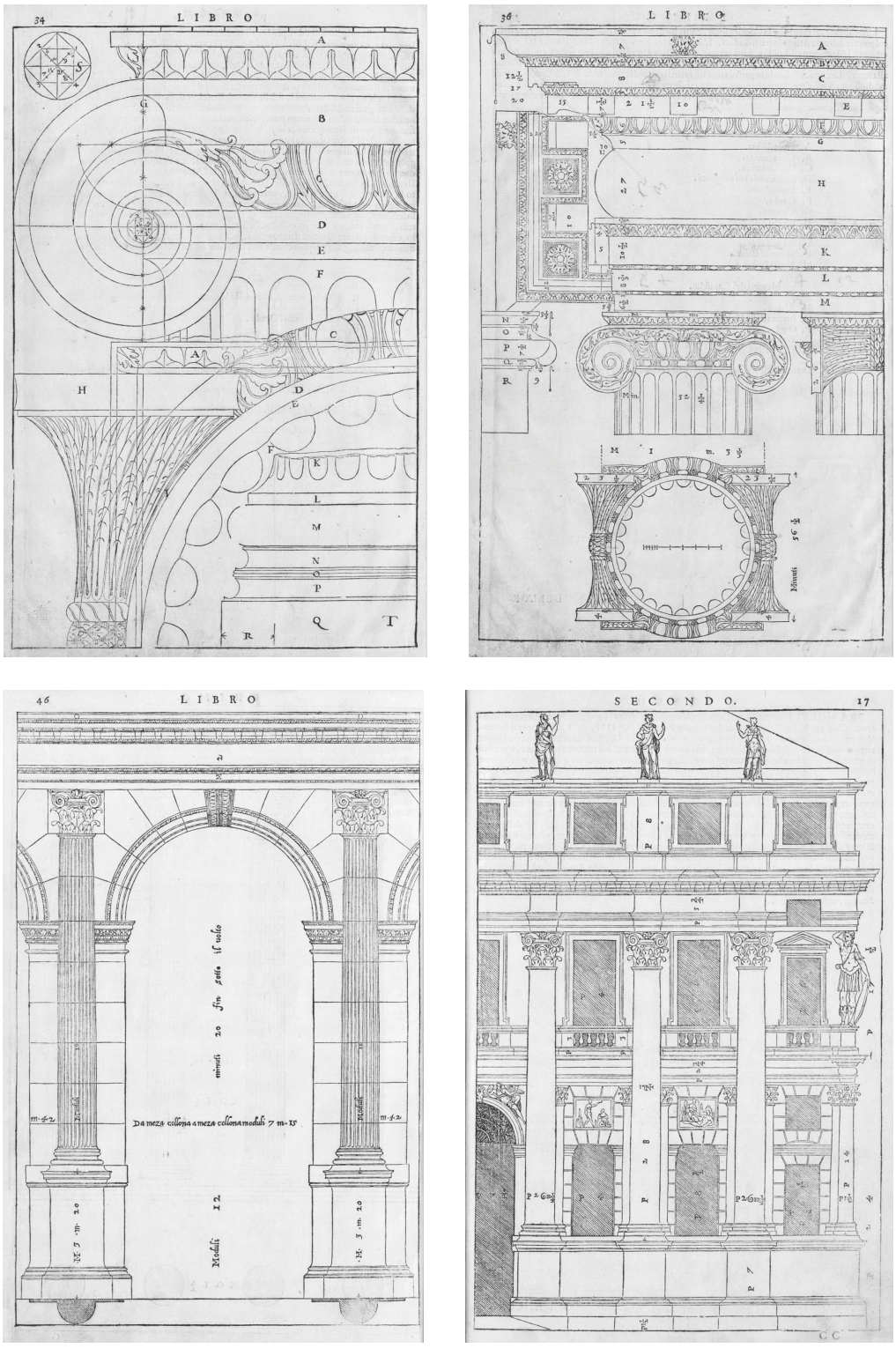

Figure 19. Excerpts from *I quattro libri dell'architectura,* Palladio.
[Andrea Palladio. *I quattro libri dell'architectura,* 1570, *Libro Primo:* 34, 36, 46; *Libro Secondo:* 17.]

Idea of part as a material constituent of the whole finds itself a striking place in Viollet-le-Duc's theory. His approach was founded on the notion of "structure" prevailing among the nineteenth-century rationalist architects through an analogy with the bodily construction of a living organism. Antoine Picon claims that "the French word structure was first used to designate the internal organization of the body and its various organs before it was applied to buildings."[156] For Viollet-le-Duc, a monument was a body having an immanent life of its own. The building embodied a metabolism, which was a combination of organs working together and to understand its making and working, Viollet-le-Duc employed almost an "anatomical" methodology to dismantle it. According to this view, an organ could exist only in relation to the whole and it could only be understood by its, particularly "functional," place in the system.

Viollet-le-Duc's approach was influenced by Georges Cuvier's scientific method (1769-1832) and the anatomical drawings contained in the seminal work of Marc Jean Bourgery's *Traité complet de l'anatomie de l'homme* published in 1831. Martin Bressani claims that "*Traité complet* is generally recognized as a work that, more than any other treatise of the nineteenth century, studies drawing's capacity to represent exactly the human body in its intimate assembly as a whole."[157] Viollet-le-Duc was fascinated with the illustrations of Nicolas Henri Jacob (1782-1871) in *Traité complet* and utilized drawing as a means to take possession of architectural form, to know it by physically decomposing it. One of the most significant drawings of *Dictionnaire raisonné* was the exploded perspective of the springing point of the arch, which takes up a full-page in "Construction" (see Figure 21). By means of exploded perspective, Viollet-le-Duc visually re-animates the process through which

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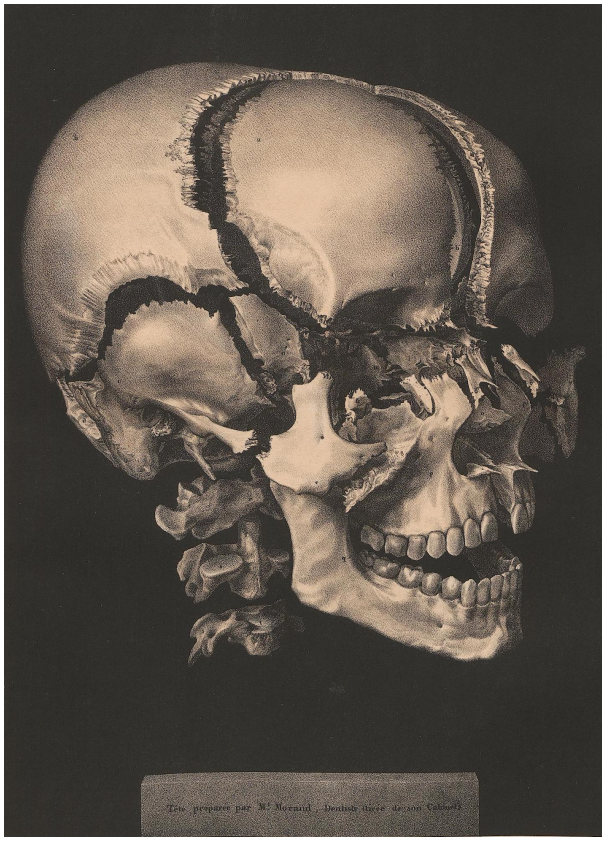
[156] Antoine Picon. "Architecture, Science, Technology, and the Virtual Realm." Architecture and the Sciences: Exchanging Metaphors. Eds. Antoine Picon and Alessandra Ponte, New York: Princeton Press, 2003: 294.

[157] Martin Bressani. "Viollet-le-Duc's Optic" Architecture and the Sciences: Exchanging Metaphors. Eds. Antoine Picon and Alessandra Ponte, New York: Princeton Press, 2003: 126.

the parts constructing are arch are assembled. This drawing can be assessed as a tribute to the lithograph of the exploded skull illustrated by Jacob for *Traité complet* (see Figure 20). When both drawings are viewed side by side, by virtue of drawing, each part's mode of articulation becomes intelligible by the immediate parts it is related as well as its place within the whole into which it is assembled - whether it is a skull or an arch.



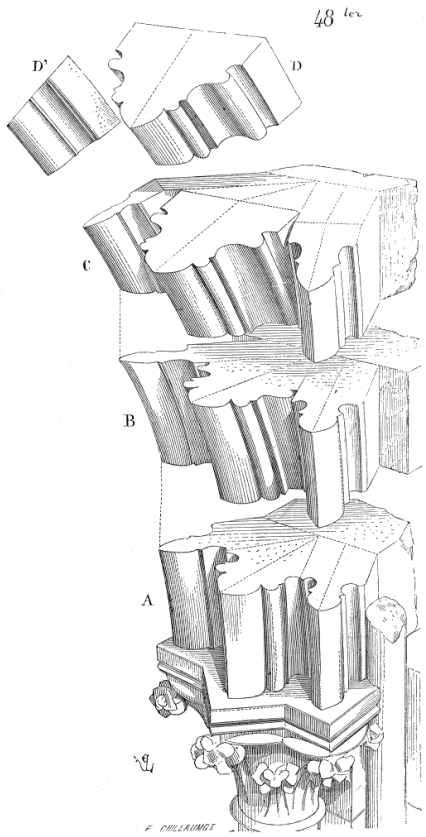


Figure 20. Exploded perspective of a skull, lithograph by Nicolas Henri Jacob from *Traité complet de l'anatomie de l'homme,* Jean Bourgery.

[Jean Bourgery. *Traité complet de l'anatomie de l'homme,* Plate 30.]

Figure 21. Exploded perspective of a springing arch from *Dictionnaire raisonné,* Viollet-le-Duc.

[Viollet-le-Duc. "Construction," *Dictionnaire raisonné.*]

Viollet-le-Duc's drawings are not a "passive reproduction of reality"[158] but rather active operations that simulate the construction of the arch by its decomposed parts. Methodologically and intentionally differing from the orthographic drawings of Palladio and fragmented perspectives of Serlio, he utilizes perspective drawings in an analytical manner. Appreciating the methodological and analytical sensitivity in the drawings of Viollet-le-Duc, Bressani claims that:

> Though drawn mostly in perspective, they are almost never of picturesque views of the monuments. Instead, they present a minute, a myopic scanning of the fabric; the eye is brought into various hidden corners, shown partial views in which layers are peeled away in order to study the inner workings.[159]

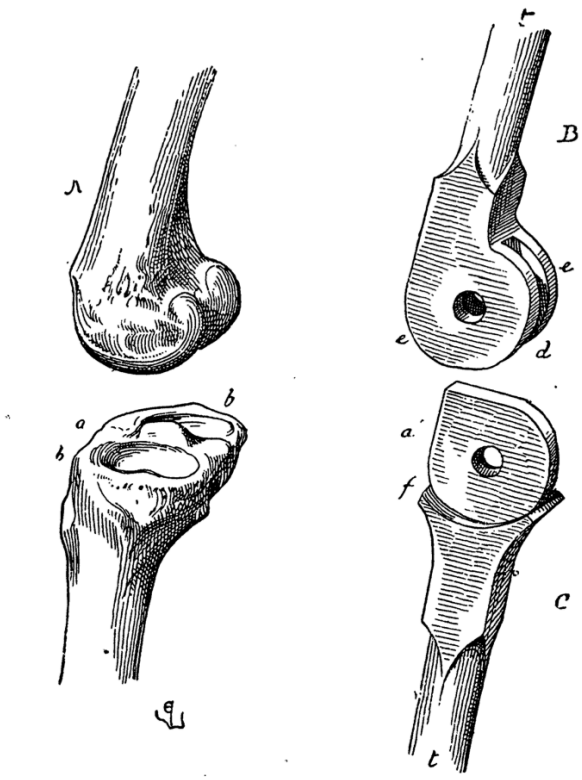


Figure 22. Application of bones to engineering, Viollet-le-Duc.
[Viollet-le-Duc. *Mémoires d'un dessinateur*, 1879]

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[158] Ibid. 122.

[159] Ibid.

Through a "clinical gaze,"[160] Viollet-le-Duc analyzes whole as a structural system as an ensemble of parts acting together. However, the analogy between architecture and biology is far-fetched considering the almost identical application of the articulation of bones to engineering (see Figure 22). He wrote in the entry "Style" of his *Dictionnaire raisonné de l'architecture* (1854):

> The architecture of the Middle Ages proceeds with the type of logical order we discover in the works of nature. Therefore, just as from the leaf of a plant one can deduce the entire plant, from the bone of an animal the entire animal, seeing a single profile is sufficient to deduce the architectural member to which it belongs, and from the member to reconstruct the monument.[161]

What is significant for Viollet-le-Duc's architecture is that part acquires an "active" role in the constitution of the whole. In this regard, parthood is an innately "functional" condition for Viollet-le-Duc, which specifies not only the material constitution, physical construction and mereological formation of the whole but also the way in which it works as a structural system.

The concept of part as a concrete content is at the core of all the endeavors where architecture is theorized by its elements. Although part conceived as a concrete content is commonly recognized in the form of "architectural element," what founds parthood has changed according to principles and practices of composition as with the definition of the whole. Part, both as an architectural form and as a theoretical and operational tool to study architectural form, has been founded on and defined by its organizational, compositional, constructional, material, structural, and functional positions it occupied within the whole.

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[160] Michel Foucault. The Birth of the Clinic. New York: Vintage Books, 1975: 124-146.

[161] Eugène Emmanuel Viollet-le-Duc. "Style," The Foundations of Architecture: Selections from the *Dictionnaire raisonné*, Intro. Barry Bergoll, trans. Kenneth D. Whitehead. New York: George Braziller, 1990: 231-263.

4.2.2 Architectural Part II: Abstract contents of part

Perrault's questioning of the proportions as the foundation of architectural form has led to the emergence of new theories on architecture in the last decades of eighteenth century. Introducing a fundamental split between the conception and perception of architectural form, his theory called for a change in the formal vocabulary of architecture. Architects such as Etienne-Louis Boullée and Claude-Nicolas Ledoux abandoned the compositional techniques and aesthetical concerns of classical tradition and sought for a new theoretical foundation to identify elementary components of architectural practice. Emphasizing the significance of sensations created by architectural forms, both contributed to the construction of a new formal vocabulary that is based on clear-cut geometries and elementary shapes for the sake of achieving volumes of regularity and order and forms with clarity and purity.[162]

The urge for defining elements through which architecture to be founded did not simply a derive from a formal concern. Architecture was again a combination of elements but, as Picon asks, "[i]f elements were not ultimate laws or substance, what then was their true characterization?"[163] Elements were to be considered not as numb parts of the prescribed and constructed whole but rather approached as productive components processing toward a creative whole. Picon claims that:

> In eighteenth-century philosophical culture, the identification of elements and the understanding of the way they combined bore a name. Analysis was the

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[162] See Etienne-Louis Boullée, "*Architecture, Essai sur l'art* / Architecture, Essay on Art," in Boullée & Visionary Architecture. Ed. Helen Rosenau, New York: Harmony Books, 1976: 82-116; Claude-Nicolas Ledoux, *L'architecture considérée sous le rapport de l'art, des moeurs et de la législation*.(1804), Paris: Fernand de Nobele, 1961; Emil Kauffman, Three Revolutionary Architects: Boullée, Ledoux and Lequeu, Philadelphia: 1952; Anthony Vidler, Claude-Nicolas Ledoux: Architecture and Social Reform at the End of the Ancien Régime. Cambridge, Mass.: 1990.

[163] Antoine Picon. "Architecture, Science, and Technology," The Architecture of Science. Eds. Peter Galison, Emily Thompson. Cambridge, Mass.: The MIT Press, 1999: 319.

> method that consisted in the identification of elements, followed by the study of their various combinations.[164]

Analysis was acknowledged as a decomposition of a whole and the arranging of its parts in such a way that both the generative possibilities of the whole and the productive capacities of the parts become intelligible.[165] Analytical method was actually an epistemological tool to extract abstract knowledge. The notion of analytical decomposition was the principal condition for a rational recomposition. Following the premises of eighteenth century philosophy, a demand for a rational, and suggestively useful, architecture arose out of the obsession for control and regulation.

Modernism implied a "scientization" of the practice and architecture has started to borrow and adopt terms, such as "structure," "circulation" and "function," from sciences. These "scientific metaphors"[166] invoked a significant change in the perception of the whole and intrinsically implied a deflection in the definition of architectural parts. Architectural part was no longer solely a concrete entity; it could be conceived as an abstract content as well. Intertwined with the flamboyant terms of science and technology, architectural vocabulary has been modernized not only lexically but also formally. However, for architecture, it is possible to suggest

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[164] Ibid.

[165] Manfredo Tafuri conceptualized the study of history as a critical analysis, as an "explosive" method – a "doubling." He claims that: "At the origin of a critical act, there lies a process of destroying, of dissolving, of disintegrating a given structure. Without such a disintegration of the object under analysis, no further rewriting of the object is possible. And it is self evident that no criticism exists that does not retrace the process that has given birth to the work and that does not redistribute the elements of the work into a different order, if so no other purpose than to construct typological methods. But here, criticism begins what might be called its 'doubling' of the object under analysis." Manfredo Tafuri, 1987, *"L'architecture dans le boudoir,"* The Sphere and the Labyrinth: Avant-Gardes and Architecture from Piranesi to the 1970s, trans. Pellegrino d'Acierno, Robert Connolly, Cambridge, Mass.: MIT Press: 272. Also see, Gülru Mutlu, "Doubling: 'Italy, The New Domestic Landscape' as a Historical Project," unpublished Ph.D. diss., Middle East Technical University, 2009.

[166] Adrian Forty. " 'Spatial Mechanics': Scientific Metaphors in Architecture," 2000: 87-101.

another course of transformation, coupled with the scientific endeavors of modernism, which underlies the critical re-formation of its vocabulary and the conception of architectural part as an abstract content.

The introduction of the word "space" into the vocabulary of architecture signifies a milestone for the discipline of architecture. Henri Lefevbre's statement that "[a]ny definition of architecture itself requires a prior analysis and exposition of the concept of space" is actually based on a precarious illusion due to the fact that, as Forty indicates, the word "space" did not exist in the architectural vocabulary until the end of nineteenth century.[167] It is impossible to talk about space without the brutal critique of Henri Lefebvre. His well-known argument of space as a social construct calls into question almost everything said about space in architecture. The purpose of Lefebvre's critique was based on the problem created by the divergence from "lived space," where he intends to restore the bodily dimension excluded from space. It is a challenging task to adequately summarize the argument of his seminal and complex book *The Production of Space* (1974), yet it is valuable to bring out some of his remarks, which directly touch on architecture and architectural drawing in respect to their critical embodiments of space.

Acknowledging the distinction between "architectural space" and the "space of architects" is fundamental for Lefebvre.[168] "Architectural space" is a form of social space, which is produced by the "lived experience" of bodies present in space. The "space of architects" on the other hand, is a space refined by the practices and discourses of architects. According to Lefebvre, "it is hard to thing of any specialized

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[167] For a detailed account on the historicity of the word "space" in architectural vocabulary see, Adrian Forty, "Space," Words and Buildings, 2000: 256-275.

[168] Henri Lefebvre. The Production of Space. Trans. Donald Nicholson-Smith. Oxford: Blackwell Publishing, 1991.

discipline that is not involved, immediately or mediately, with space"[169] and architecture does not have a stronger claim on space than any other discipline simply because its relation to building sustains an integrity with space. Moreover, there is no discipline that adequately reflects on the notion of "social space," as all disciplines have an innate tendency to distill it as an abstract entity, which will respond to their disciplinary intentions, discursive constitutions and professional practices.

Challenging the long-established assumptions of space as a pre-existing, neutral given, Lefebvre claims that the space of architects is not a neutral, transparent space defined by Euclidean geometry; it is an already produced space – "the space of the dominant mode of production, and hence the space of capitalism."[170] His aphorisms continues to include the eyes of these ultimate authorities of space and their apparatus of design, such as their techniques of drawings, and Lefebvre emphasizes that they are also effected by the dominant means of power and constituted through the space in which they live.

Drawing has been highly damaged by the criticisms of Lefebvre. Unfolding Lefebvre's critique about the authority alluded to architects on space, Forty indicates the difficult position of drawing in architecture as; "the practice of drawing is itself prime means through which social space is turned into abstraction, homogenized for the purposes of exchange, and drained of lived experience."[171] Moreover, architecture, mainly through its practices of drawing, privileged the eye above all other senses and reduced space into a visual image. Thus, Lefebvre's critique of "space of architects" finds its expression as "abstract space," which is actually the creation of philosophy and of the sciences. Since it "is formulated in the head of a

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[169] Ibid. 107.

[170] Ibid. 360.

[171] Adrian Forty, "Space," Words and Buildings, 2000: 274.

thinker before being projected onto social and even physical reality,"[172] it creates a false consciousness of space, which is not constituted by being lived, but by the representations of it.

Thinking of drawing as a medium that neutralizes space to produce more of its abstract replicas cannot be an anachronistic statement. Although Lefebvre's criticisms are prevalent for modernist conceptions of space, yet neither drawing was the only apparatus in charge of creating space, and surely it will not be, nor architecture was always concerned with space as it is acknowledged by modernism. Returning to Forty's determination of the absence of "space" in architectural vocabulary, Lefebvre's critique leads us to suppose, although he did not actually do it, that there exists a discourse on architecture before the term itself entered the vocabulary. Respectively, it also makes us assume drawing and space had an innate relationship that architects never hesitated to abuse. The problem is not to criticize Lefebvre or legitimize all the other philosophical approaches to "space". However, an awareness of the different dimensions of the word "space," such as its "historicity", is significant to acknowledge both its becoming into the purest, irreducible "element" of architecture and the contingencies that lead to its accusation as an abstract product of the ideologies of drawing as well as of architecture.

When Gottfried Semper advanced his theory of what originates architectural form, it was groundbreaking for architecture to think its origins without the classical orders. In *Die vier Elemente der Baukunst* (1850-51), Semper proposed "four elements;" the heart and three other elements to protect it – the roof, the enclosure and the mound.[173] His formalizations of these elements were critical in two aspects. First, what Semper prefers to call as "elements" were not actually the elements itself but rather particular

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[172] Henri Lefebvre. The Production of Space, 1991: 398.

[173] Harry Francis Mallgrave and Wolfgang Herrmann under Gottfried Semper, The Four Elements of Architecture and Other Writings. Cambridge: Cambridge University Press, 1989: 102.

techniques of form generation as opposed to architectural elements conceived as concrete contents. Harry Francis Mallgrave rightly contends to "the use of term 'elements' in this regard is misleading since Semper conceived them not as material elements or forms, but as 'motives' or 'ideas', as technical operations based in the applied arts."[174] What Semper was trying to theorize was beyond the materiality, compositionality or visuality of architectural form and what he conceived as elements were rather abstract contents fostering and guiding its very formation. As he declared later in the Prolegomenon in *Der Stil* (1860), the four elements that he was proposing were "the constituent parts of form *that are not form itself*, but the idea, the force, the task, and the means, in other words, the basic preconditions of form."[175] From Semper on, parts of architecture were not solely concrete contents that materially construct the whole, but they were abstract contents that formally, methodologically and "spatially" define the architectural form. Second, Semper's "four elements" led to an understating of architecture formed by an urge toward "the enclosing of space." Spatial enclosure subordinated the material components as the aim of protecting the heart was meant to protect the "space" that the fire was situated within. With Semper, architectural form was founded on "space", primarily through the notion of "enclosure."

The notion of enclosure found itself a sturdy place in the following theories of architecture and in the assertive statements defining what architecture is, what its purpose is and what it is constituted of. According to Mallgrave, "enclosure" was a prominent theme of architecture in Germany in 1840s but Semper was the only one who suggested that it was the fundamental property of architecture.[176] Semper was

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[174] Ibid. 124.

[175] Ibid. The "Prolegomena" has been translated by Harry Francis Mallgrave and Wolfgang Herrmann under Gottfried Semper, The Four Elements of Architecture and Other Writings, 1989: 183 [Italics original; Gottfried Semper. "Prolegomena" in *Der Stil*, vol I (2nd ed.), 1879: 213].

[176] Harry Francis Mallgrave. Gottfried Semper. The Architect of the Nineteenth Century. New Heaven and London: Yale University Press, 1996: 288.

the ultimate source of the conception of space in the first decade of twentieth century. Adolf Loos claimed that "[t]he architect's general task is to provide a warm and livable space."[177] Hendrik Petrus Berlage assessed architecture as "the art of spatial enclosure"[178] and boldly declared that "the purpose of architecture is to create space, and it should thus proceed from space."[179] Likewise Peter Behrens stated that "[f]or architecture is the creation of volumes, and its task is not to clad but essentially to enclose space."[180]

Space and the conceptualization of architectural part as an abstract content can be assessed as a two-fold development. As the notion of enclosure is interpreted as the primary task of architecture, the "architectural elements" that will sustain the conditions of enclosure gained prominence in the conception and production of architectural form. On the other hand, space itself has been formulated as an "architectural part" under the influence of the impulses already started in nineteenth century toward the "scientization" and modernization of the discipline.

Space and form allied to become an "elemental content" of architecture and eased the re-conceptualization of architectural part as an abstract content. In his remarkable essay, "The Problem of Form in the Fine Arts" (1893), the German sculptor Adolf Hildebrand elegantly stated that "space itself, in the sense of inherent form, becomes

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[177] Adolf Loos. "The Principle of Cladding" (1898), in Spoken Into the Void. Collected Essays 1897-1900. Trans. J. O. Newman and J. H. Smith. Cambridge, Mass.: The MIT Press, 1982: 66.

[178] Hendrik Petrus Berlage. "Thoughts on Style" (1905), in Hendrik Petrus Berlage: Thoughts on Style 1886-1909. Introd. Ian Boyd Whyte, trans. Ian Boyd Whyte and Wim De Wit. Santa Monica, CA: Getty Publications, 1996: 152.

[179] Ibid. "The Foundations and Development of Architecture" (1908), 1996: 209.

[180] Peter Behrens. "Art and Technology" (1910), in *Industriekultur.* Peter Behrens and the AEG. Ed. T. Buddensieg, trans. I. Boyd Whyte. Cambridge, Mass.: The MIT Press, 1984: 217.

effective form for the eye."[181] He suggested the problem of space has to be formulated in a particular manner for architecture as "[o]ur relation to space finds its direct expression in architecture."[182] Emphasizing the primacy of comprehending "space as a form" to appreciate what is beyond the materiality of components as well as to escape the understanding of their togetherness merely as a physical construction, Hildebrand claimed "[i]t is only within the spatial context of a specific perceptual whole that the functional idea can develop into a specific form."[183] Part has become aware of its abstract content when it is related to architectural form not only as a concrete part of a constructed whole, but through the space resulting from that particular concrete whole. Part was no longer identified purely by its physical self; its relationship with the whole was no longer simply defined by material and constructional parthood. As part has elevated from its materiality and acknowledged by its abstract content, there emerged a "tendency to turn particulars into abstract generalities,"[184] most famous of which is the becoming of walls into "the wall."

To theorize his conception of space further in *Der Stil*, Semper claimed, "[t]he wall is that architectural that formally represents and makes visible the *enclosed space as such*."[185] Following his path, Berlage explained, both in *Thoughts on Style* (1905) and *Foundations and Development* (1908), the prime element of architecture, literally and

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[181] Adolf Hildebrand. "The Problem of Form in Fine Arts," in Empathy, Form and Space: Problems in German Aesthetics, 1873-1893. Eds. Harry Francis Mallgrave and Eleftherios Ikonomou. Santa Monica, CA: The Getty Center for the History of Art and the Humanities, 1994: 227-279.

[182] Ibid.

[183] Ibid. 269.

[184] Adrian Forty. Words and Buildings, 2000: 22. The tendency toward "abstract generalities" is interpreted by Forty as a criticism of the past, posed by modernism. The reading of this tendency as a consequence of the reconceptualization of part as an abstract content belongs to the author.

[185] Harry Francis Mallgrave and Wolfgang Herrmann, Gottfried Semper, The Four Elements of Architecture. 254 [Italics original].

figuratively, was the wall: "the naked wall in all its simple beauty."[186] "The wall" was the key to architecture's basic task, the enclosure of space. In *Foundations and Development*, he stated that:

> The art of architecture resides in the creation of spaces, not in the design of facades. A spatial enclosure is produced by walls, and thus the space or the various spaces find external expression in a more or less complex arrangement of walls. It is also important in this sense that the walls should remain flat, for an overarticulated wall loses its intrinsic, wall-like character.[187]

"The wall" praised as the principal element forming the space united with its abstract content and indeed freed itself from the burdens its constructional parthood. For Alberti, "the wall is never an objective *datum*; it is always *denominated*, given the logical and structural valuation which determines whether it is to be a generative or subordinate element in a given system."[188] The recovery of architectural part by the acknowledgement of its abstract content was not simply an "abstraction" of "architectural element," but actually indicated an "abstraction" of architectural form itself for Modern Architecture. Architectural form was not only founded on but also symbolized by "the wall." Mark Wigley remarks that Modern Architecture owes a great deal to its "white walls"[189] in constructing a coherent image of its systematical executions. "White walls" were used to sustain the modernist obsession with refusing the contingencies of history for the sake of achieving the "naked-type form"[190] and became a "tabula rasa" for Modern Architecture. The reconceptualization of "the

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[186] As quoted in Ian Boyd Whyte. "Introduction," Hendrik Petrus Berlage: Thoughts on Style 1886-1909, 1996: 29.

[187] Ibid.

[188] Hubert Damisch. "The Column and the Wall," AD Profile 21: Leon Battista Alberti. Ed. Joseph Rykwert, vol. 49, no. 5-6, 1977: 20 [Italics original].

[189] Mark Wigley. White Walls, Designer Dresses: The Fashioning of Modern Architecture. Cambridge, Mass.: The MIT Press, 1995: xxii-xxiii.

[190] Ibid. 185.

wall" as an architectural part acknowledged by its abstract content was innately a change in the mereological definition of the "part," yet it has been used and abused to manifest the formal anxieties of Modern Architecture.

One of Le Corbusier's renowned "Five Points," the free plan was founded on the abstract content of the wall and its spatial proficiencies rather than its structural competence in the physical construction of the whole. As Alan Colquhoun explains, "[t]he free plan contradicts the principle by which distribution was constrained by the need for vertically continuous structural walls and replaces it with a free arrangement of nonstructural partitions determined by functional convenience."[191] The free plan was not solely a property, an abstract content, of architectural form but a suggestion of architectural form itself. The reconceptualization of "architectural element" as a "spatial part" changed the conception and production of architectural form as well as its perception. Both "the wall" and "the free plan" were architectural forms and also the abstract contents of architectural form. With the introduction of the modernist concept of space, the definition of architectural part has been radically altered and the mereological relation between the part and the whole is redefined.

The idea of enclosure recently found itself a marginal form as the primary condition of creating space. Contemporary architecture has developed an architectural concept called "envelope." The envelope is formalized as an immediate part of architectural space by literally enclosing it as a single volume. Interpreted as a meta-surface that holds together the divergent parts, both concrete and abstract, of the whole floating in space, the envelope can be read as a contemporary extension of Mies van der Rohe's curtain wall iconized by the Seagram Building. Michael Hays claims that "lack of meaning, and flattened out neutrality that allows the envelope to be used as an axiomatic wrapper or membrane and to collapse programs and events that would

[191] Alan Conquhoun. "Displacement of Concepts in Le Corbusier," Essays in Architectural Criticism: Modern Architecture and Historical Change. Cambridge, Mass.: The MIT Press, 1981: 51. First published in Architectural Design, vol. 43, April 1972: 220-243.

otherwise seem impossibly unrelated."[192] In this context, the envelope can be assessed as an extremity of architectural part toward the enclosed space.

As indicated before, the reconceptualization of architectural part as an abstract content has a two-fold development following the introduction of the concept of space. Architectural parts are acknowledged beyond their operational and constructional strengths in the constitution of the whole and formalized as conceptual and theoretical contents of / as architectural form. Besides the abstractionism of part and the spatial possibilities of architectural form theorized after it, there is the continuation of scientization of the discipline, which underlies the endeavors of defining space as an architectural part. With Semper, space has been recognized as part of architecture, yet its re-formulation as an architectural part has advanced a distinctive model for the generation of architectural form and significantly changed how architectural whole is, and arguably should be, studied.

The use of scientific metaphors, such as structure, function and circulation, characterizing the architectural vocabulary of the nineteenth century resulted from a common tendency to approach buildings not as aesthetic works but rather as closed systems interlocking co-operative parts. Violet-le-Duc's theory of structure entailing an approach to building as a "body" was one of the most typical examples of this tendency. The concept of function has been used in a similar manner to symbolize the activity of parts constituting the material body of the building. Though "circulation" suggested a different understanding of the whole beyond the materiality of building,[193]

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[192] K. Michael Hays. "The Envelope as Mediator," in The State of Architecture at the Beginning of the 21st Century. Eds. Bernard Tschumi and Irene Cheng. New York: The Monacelli Press, 2003: 67.

[193] In contemporary architectural parlance, "circulation" stands as the conventional description for the means of movement, particularly human movement, within or around a building. Viollet-le-Duc, Cesar Daly, and Frankl used "circulation" to think of a self-contained system beyond the physical body of building. In the wake of its modernist exaggeration, Julien Guadet devoted a whole chapter on *"Les circulations"* in the fifth edition of *Eléments et Théories d'Architecture* and studied "circulation" as an independent category within architectural composition.

it was not until the introduction of the concept of space that not only "circulation" but all other frequent scientific metaphors have achieved a competence in advancing the definitions of part and whole. "Circulation" is expanded as an abstract content through the concept of space and acquired a disproportionately large amount of prominence as a fundamental part of architectural form, reminding the extravagancy of Le Corbusier's ambitious statement "architecture is circulation." [194] The essential formalization of space as an architectural part was due its coupling with function; form had to follow function as it was no longer dependent on the concrete parts and the material constitution of the whole, but rather on space. At the threshold of becoming a "constructional part" of the whole, space is "particularized" by means of function; it was not only the primary task of architecture but also its means.

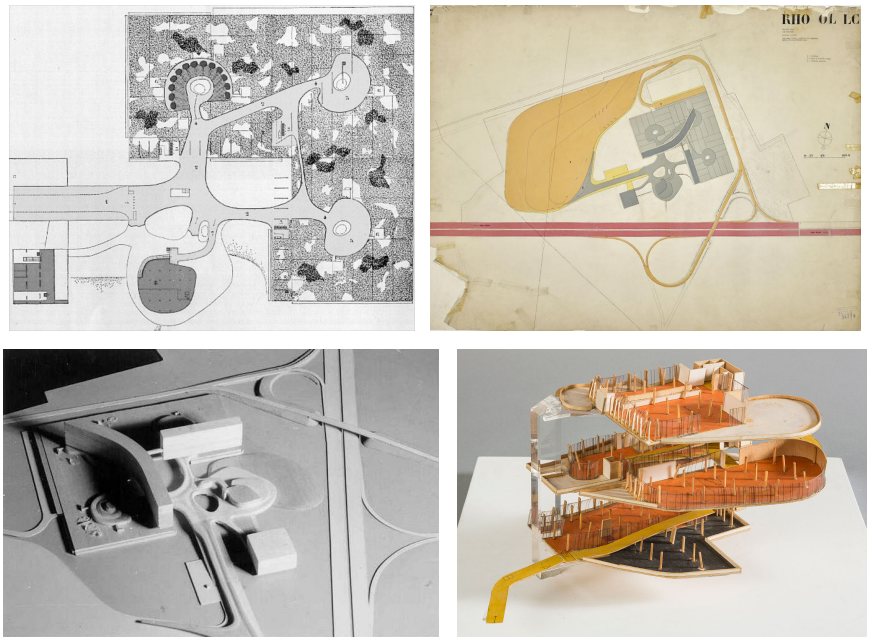

Figure 23. Circulation / Promenade as architectural part, Le Corbusier.

Top-left: Fourth and fifth floor plan for Olivetti Electronic Center design [Le Corbusier: *Œuvre Complète* 1957-1965, London: Thames and Hudson, 1963: 123.]; top-right: Site plan for Olivetti Electronic Center [Fondation Le Corbusier.]; *bottom-left:* Model for Olivetti Electronic Center [Fondation Le Corbusier.]; *bottom-right:* Carpenter Center for the visual arts [Fondation Le Corbusier.]

[194] Le Corbusier. Precisions: On the State of Architecture and City Planning, trans. Edith Schreiber Aujame, Cambridge, Mass.: The MIT Press, 1991: 47.

Space and its formation as an architectural part fabricated the concept of "functionalism" and led to a discourse of "program" in architecture. "Function," "program," "use" and later on "event" were the most pronounced representations of architectural part. These terms, ironically contributing and refuting one another, were commonly based on the idea that architectural form is founded on space. Regarding the famous dictum of "a house is a machine for living in," Le Corbusier aimed at re-formalizing the architectural whole as an assemblage of "space-parts." When space conceived as the fundamental part constituting the whole, the operation of division is applied to define the relations and the order of the "space-parts," and further the dimensions and proportions. The term "program"[195] is introduced to re-define and re-classify the architectural whole; "architectural elements," or rather, parts as concrete contents were no longer qualified to specify the "typology" of an architectural whole but instead spaces as programmatic parts were authorized. Architectural wholes has come to be defined according to a "requirement list" based on itemized programs or functions, which simply refer to the size and the type of the "space-parts" to be assembled.

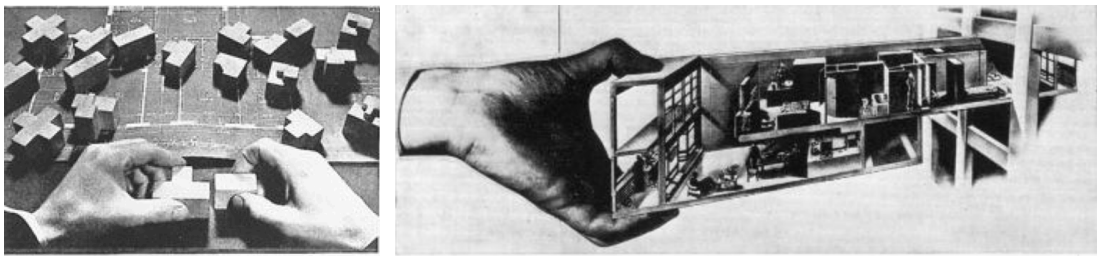

Figure 24. Method of design using unit plans and block models, developed by the Housing division of the Public Works Administration, from Architectural Record, March 1935.
[Hyungmin Pai. The Portfolio and the Diagram: Architecture, Discourse, and Modernity in America Cambridge, Mass.: The MIT Press, 2002: 240]

Figure 25. Housing unit as a ready-made "bottle," Le Corbuiser.
[Le Corbusier. *Œuvre complète* 1946-1952. Basel; Boston: Birkhäuser, 1999: 186]

[195] Bahar Beslioğlu develops a reconceptualization of the term "program" based on the difficulty of defining "program" in architecture and assesses it as a fruitful, pragmatic and intellectual source. "The 'Programmatic Experimentation' in the Work of Gordon Matta-Clark," unpublished Ph.D. diss., METU Department of Architecture, 2008.

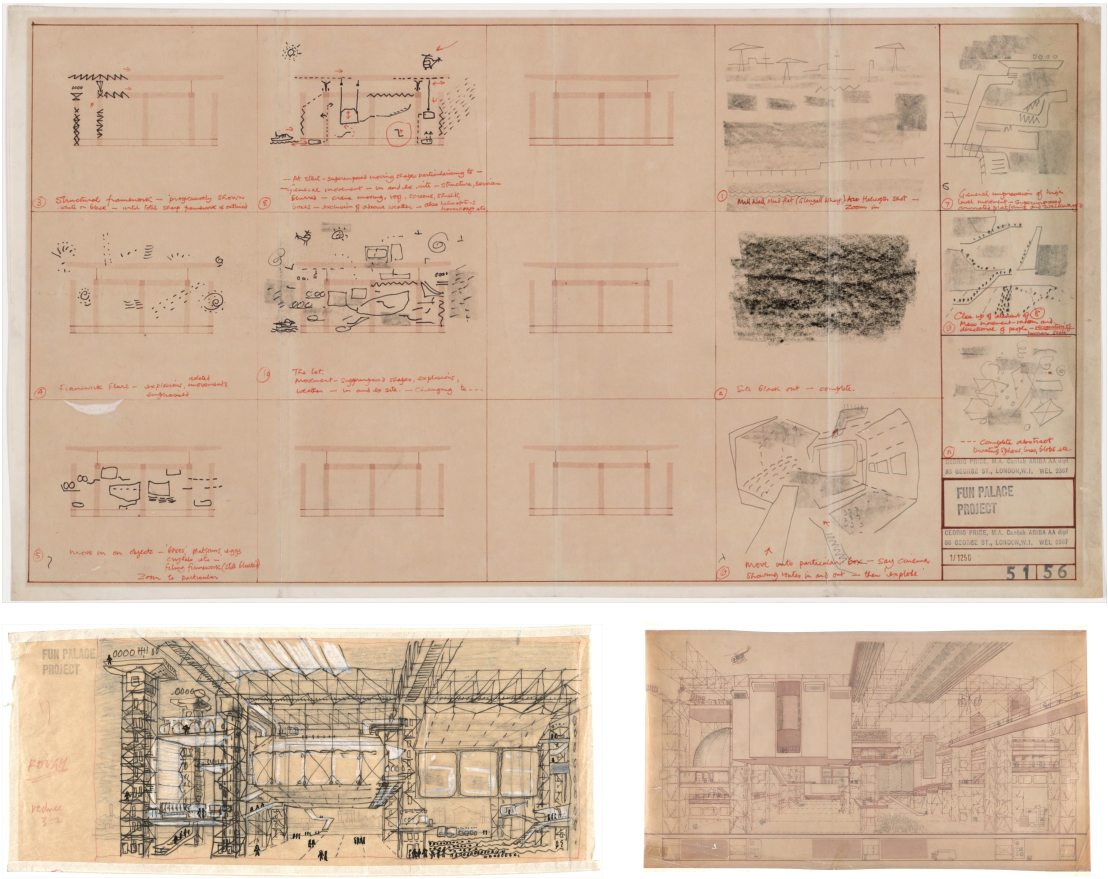

Figure 26. Fun Palace for Joan Littlewood Project, Stratford East, London, England, Cedric Price, 1959-1961.

Top: Storyboard for film and sketches for Fun Palace; *bottom:* perspective drawings for Fun Palace. [Museum of Modern Art, Architecture and Design.]

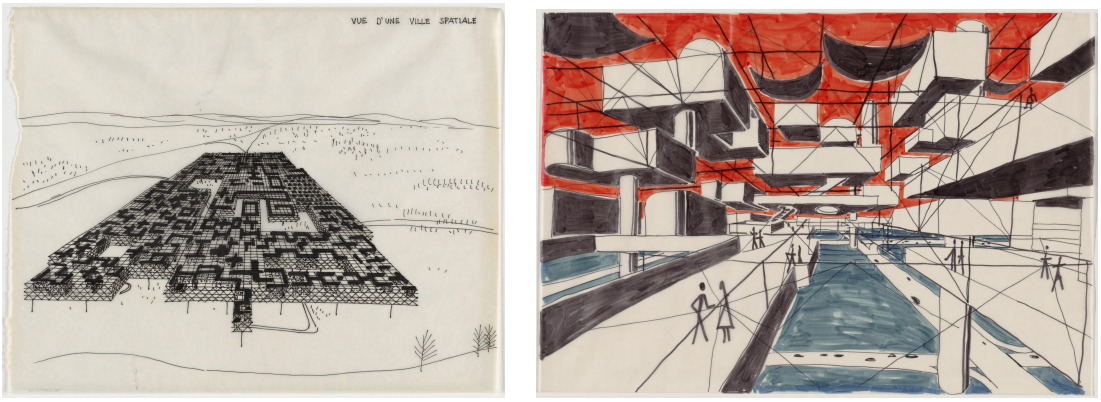

Figure 27. Spatial City, Yona Friedman, 1958.

Left: Aerial perspective for Spatial City; *right:* perspective drawing for Spatial City. [MoMA, Architecture and Design.]

Although the common tendency in conceptualizing and practicing space as an architectural part is the approach of defining it as the programmatic and functional component of an architectural whole, a banal example of which include rooms as parts of a house, the conceptualization of space as a "part" was actually "scaleless." Not only the total volume of an apartment could be a "part" in an apartment block, the total space occupied by a building or even a public space could become a "part" of the city. Space was dependent on a "functional parthood" to be defined as a mereological part of the whole it constitutes, thus the whole was founded on a "functional" integrity and unity of its parts.

"Space" as an architectural part did not have any formal appeal or material existence and could only organize the whole "relationally". The content of function could only provide information for the relationality of space-parts. In the wake of this ambiguity, "diagram" emerged as an antidote as a mode of ordering the whole and led to its own architectural discourse. However, logical and relational framework offered by the diagram was not sufficient to achieve a formal and material expression of the whole. The word "use" was operationalized to implement the missing information to determine the extents of space. With the idea of "use," space is defined by "standards," which have been founded on the idea of a pre-existing user to accommodate and occupy the space. Space-parts are dimensioned to become the "building blocks," while "the building becomes a diagram of an oversimplified program for living."[196]

In *"If I had to teach you architecture,"* a design primer published in 1938, Le Corbusier explains the standard procedure to start a design process by visualizing it as a "bubble-diagram" as followed:

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[196] Robert Venturi. Complexity and Contradiction in Architecture. New York: Museum of Modern Art, 1977: 17.

You will begin by drawing a straight line, round which you will build up the necessary units in their proper order, each with the minimum area. Then on a sort of genealogical tree you work out their circulation, putting the appropriate units next to each other.[197]

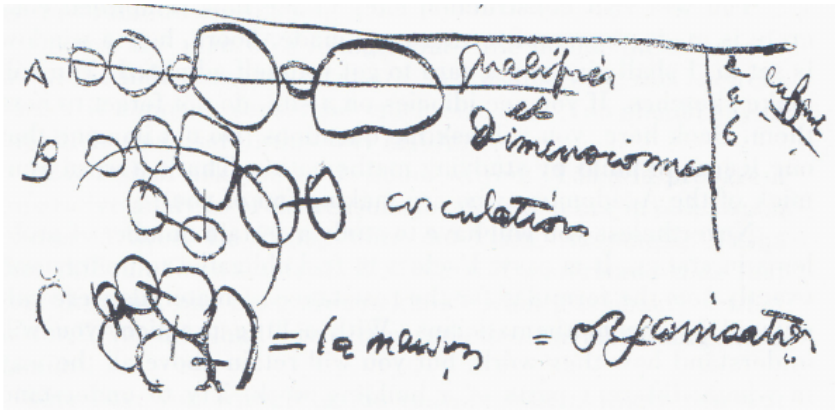

Figure 28. Bubble diagram, Le Corbusier.
[Le Corbusier, "If I had to teach you architecture," 1938.]

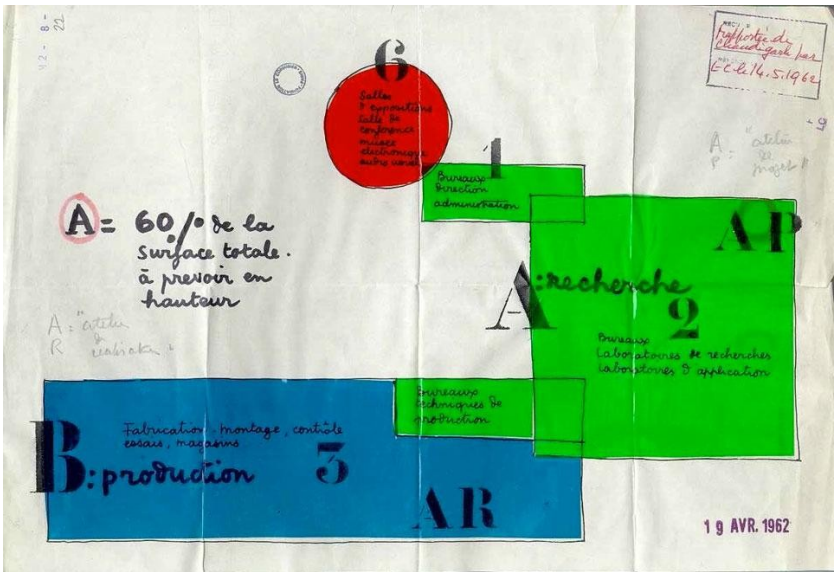

Figure 29. Diagram of program elements in Olivetti Electronic Center, Le Corbusier.
[Fondation Le Corbusier]

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[197] Le Corbusier, "If I had to teach you architecture," Focus. London, 1938: 3-12. See, Claude Schnaidt, Hannes Meyer: Buildings, Projects and Writings. New York: Architectural Book, 1965: 42; Klaus Herdeg, The Decorated Diagram: Harvard Architecture and the Failure of the Bauhaus Legacy. Cambridge, Mass.: MIT Press, 1983: 83-85.

Anderson claimed that "within modern architecture, functionalism is a fiction – a fiction in the sense of an error."[198] Insisting on the fact that no description or definition of function can be directly translated into architectural form, Anderson observes that building elements, as concrete parts, are forged to metaphorically reflect the "functional" essence of a building. Referring to the articulation of structural details in Turbine Factory, he claims that:

> [T]he great pin-joints of the arches of Peter Behrens's Turbine Factory in Berlin, beautifully machined and displayed on pedestals just above street level, insist on their own objectness while suggesting themselves as the engines of their own structural system and cognate to those engines of another mechanical system fabricated within.[199]

Figure 30. Part as a metaphor of function, pin-joints of Turbine Factory, Berlin, Peter Behrens. [Photographed by the author.]

Louis Sullivan's far-famed declaration of "form follows function" was incompetent for responding the pompous requirements of Modern Architecture. Haunted by functionalism, it inflated the idea of program as a prerequisite of architectural form and rectified design process as a problem-solving activity. Hays analyzes the "functionalist" pretentions of Modern Architecture as a prelude to design methods movement and claims that:

> Modern Architecture's envy of the theories and methods of the "exact sciences" lasted well into the 1960's, in the form of operational research and design

[198] Stanford Anderson. "The Fiction of Function," Assemblage, no. 2, 1987: 20.

[199] Ibid. 22.

> methodologies that held that a careful description of any building's program – the physical conditions required for the performance of specific functions – and a systematic adherence to that description in the process of design should result in a direct transposition of functional demands into built form.[200]

As definition of architectural parts expanded to include abstract contents of concrete elements and to conceive space as an almost constructional constituent, the conception and production of architectural form has been significantly transformed. The mereological identity of architectural whole has been re-defined with its spatial and functional unity rather than the material and constructional integrity of its parts. The acknowledgement of part as an abstract content was not simply a change in the definition of architectural form but critically initiated a novel approach in the paradigm of founded form.

4.2.3 Individualization of part

Individualization of part can be assessed as a reaction toward the ontological priority of whole. The instability of the mereological distance between part and whole can be observed by means of the individualization of part through which the "wholeness" of architectural form is questioned. The individualization of part includes both abstract and concrete contents of part, not part as an abstract content or a concrete content, but it requires an acknowledgement of part as both, which yields into differentiations in the epistemological and methodological approaches to architectural form. As definition of architectural parts expanded to merge the abstract and concrete contents of part, the mereological subordination of part has started to dissolve. It is not simply a matter of reformulation of what an architectural part is or how it operates but rather a theoretical and critical approach to the concept of part. There is a multiplicity in approaches of individualizing part in architecture, which varies from the exaggerated applications of parts to the very questionings of parthood.

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[200] Michael K. Hays. Architecture Theory since 1968. Cambridge, Mass.: The MIT Press, 1998: 36.

Mies van der Rohe, as one of the much-debated architects of all time, can be assessed as the most iconic figure of an architecture that is founded on the individualization of parts. His approach to the concept of part radically changed the perception of architectural form, which had been traditionally acknowledged as a materially constructed whole. Mies van der Rohe established an understanding of "form of parts," both in the sense that a part was an architectural form itself and could also contribute to the understanding of architectural form as a whole beyond materially or physically constructing it. Accordingly he studied the definition of part as an "architectural individual"; different forms of relationships that could be established between these parts without damaging their individuality; and as last but not the least how an architectural whole could be defined beyond the materiality of its parts.

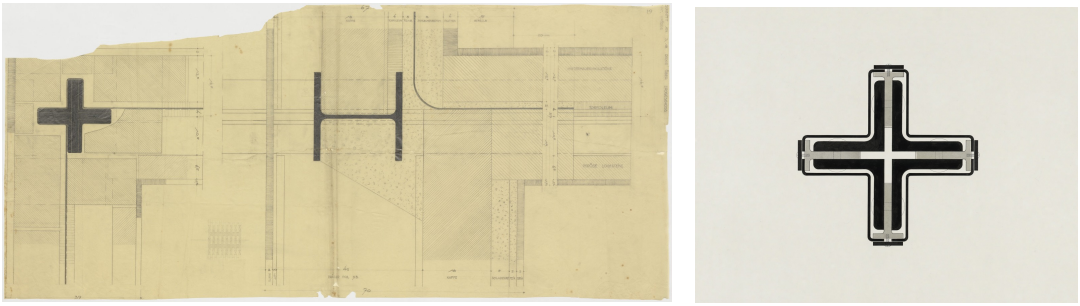

Figure 31. Definition of architectural part as an individual, Mies van der Rohe.
Left: Section detail, Tugendhat House, Mies van der Rohe, 1928-1930 [MoMA, Architecture and Design]; *right:* Horizontal column section, Barcelona Pavilion, Mies van der Rohe, 1929 [MoMA, Architecture and Design]

Figure 32. Different forms of relationship between individual parts, Mies van der Rohe.
Left: Farnsworth House, platform perspective sketch, Mies van der Rohe, 1945-51. [MoMA, Architecture and Design]; *middle:* Farnsworth House [photographed by the author.]; right: Barcelona Pavilion [photographed by Esatcan Coşkun.]

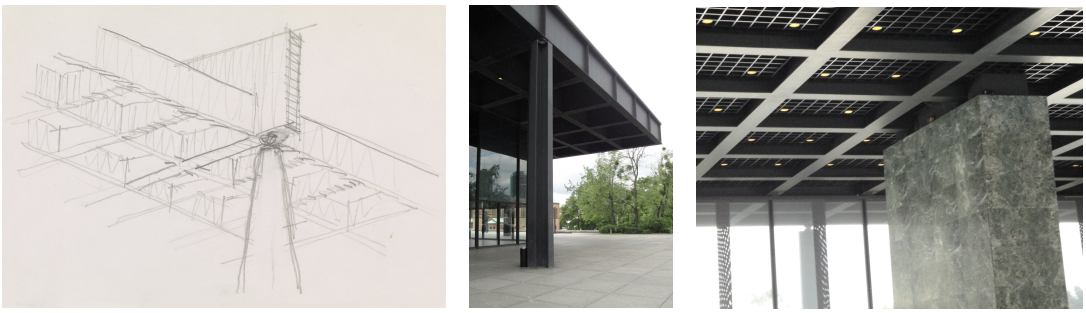

Figure 33. Different forms of relationship between individual parts, Mies van der Rohe.

Left: Perspective drawing for column top and ceiling, Ron Bacardi y Compania, Mies van der Rohe, 1975. [MoMA, Architecture and Design]; *middle & right:* Neue Nationalgalerie Berlin [photographed by the author.]

Figure 34. Architectural whole beyond individual parts, Mies van der Rohe.

Left: Brick Country House plan, Mies van der Rohe, 1964 [MoMA, Architecture and Design]; *right:* Collage, Neue Nationalgalerie Berlin, Mies van der Rohe, 1962-68 [MoMA, Architecture and Design]

Robert Venturi brutally criticized the augmented separation and clarity of architectural element in order to achieve a purified unity of whole and argued for the complexity and contradiction of the whole through the ambiguity of the "architectural element": "Architecture is form *and* substance – abstract and concrete – and its meaning derives from its interior characteristics and its particular context. An architectural element is perceived as form *and* structure, texture *and* material."[201] Venturi favored "juxtaposition" rather than "separation," as exemplified by the Assembly Building in Chandigarh of Le Corbusier, "superadjacencies" and "hyperporximities" rather than passive distanciations of different elements toward a

[201] Robert Venturi. Complexity and Contradiction, 1977: 20.

integrity of contradiction. Rejecting the Miesian individualization of part, he claimed that "[a]pparent irrationality of a part will be justified by the resultant rationality of the whole, or characteristics of a part will be compromised for the sake of the whole."[202] Venturi was not opposing against the individuality of the part but rather criticizing the reductionist formalism of the whole founded on the purified individualization of its parts. Appreciating the "violent juxtaposition"[203] of the assembly hall as a formally and functionally distinct individual over the serenity of the grid, he embraced the circumstantiality of composition.

At the beginning of the twentieth century, Analytical Cubism offered an exceptional approach that significantly changed both the definitions and perceptions of the concepts of part and whole. The founders of the movement, Braque and Picasso, started to conceptually break down their objects, analyzing them by identifying the constituent elements and reassembling them in an abstract way. They were also experimenting with recombining different sections and viewpoints of an object. The result was not only an unforeseen image of the whole produced by its individualized parts but also a critical statement on the definitions, relations and dependencies between part and whole, which have been assumed to be founded and firm.

A similar approach in the individualization of part and have found itself a striking place in the conception and production of architectural form hardly toward the end of the twentieth century. The notion of individualization triggered the questioning of the concepts of part and whole from within and critically conceptualized as a disruptive operation to "unfound" the architectural form. Part is individualized by disposing all the formal, functional, constructional and semantic burdens of "being part of a whole" and liberated from its ontological dependency. The individualized part has started to dig out the whole from within and embarked an ontological tyranny over it.

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[202] Ibid. 25.

[203] Ibid. 45, 57.

The consistency, integrity and unity of the whole are suspended to steer it from its foundations. As part individualized to be completely detached from its "partness," any possibility of founding it by means of its relationality to other parts and to a whole is lost as well; it could only be there by its "presence."[204] What was previously an architectural part, whether abstract or concrete, could be mereologically assessed as a "successor form" of it. A successor column or a successor stair both is and is not an architectural part, which suspends in a mereological ambiguity and yet continues to carry the "traces"[205] of its past and future. In the wake of this "deconstruction," the whole could no longer be founded but rather supplemented.[206] Both "presence" and "trace" are deconstruction concepts that have been embraced in "deconstructivist" architecture" and particularly in the works of Eisenman. To detach the architectural part from its "partness," in other words, to dismantle its presence, Eisenman suggested "[o]ne to pull apart the one-to-one relationship between structure, form, meaning, content, symbolism, etc. so that it is possible to make many meanings."[207] With an urge to unfound the architectural form, he introduced a break between form

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[204] "Presence" is a concept that Jacques Derrida rejects in his philosophy of "deconstruction" as both the past and the present depend on the presence of the present. Accordingly, the future is an anticipated presence, whereas the past is a previous presence. See, Jacques Derrida, Positions. Paris: Minuit, 1972.

[205] Derrida (1978) states that "[e]ach element [...] is constituted of the trace within it or the other elements of the chain or system." Thus, the trace, through its various possibilities, determines the structure of what exists as a possibility of existence; it precedes this existence. According to deconstruction, the concept of trace is connected to the concept of presence because presence involves a trace of its absence or its constant change. Thus, a concept can only be present through the absence it contains. A trace is a "mark of the absence of a presence, an always-already absent present" (1976). See, Jacques Derrida, Writing and difference. Chicago: University of Chicago Press, 1978; Of grammatology. Trans. G. C. Spivak Baltimore: Johns Hopkins University Press.

[206] The "supplement" is a concept of deconstruction formalized by Jacques Derrida. Following Derrida's line of thought, the supplement can be defined as an extra element that is added to a structure or a textual system where the supplement is secondary in importance to the structure assumed to be a complete system in itself. With this concept, Derrida contends that there is no self-contained structure or phenomenon; structures consistently need a supplement or a complement.

[207] Peter Eisenman. "Strong Form, Weak Form," Architecture in Transition, 1991: 34.

and function which results in what he calls "displacement."[208] What Eisenman established was actually a displacement of parthood – an implemented inconsistency and ambiguity of the mereological definition of part. To illustrate, a successor-column can be formally a part of the whole but may not function like a column or a staircase can spatially connect different levels but may not serve as a circulation element to reach them.

Another figure who celebrated, and still continues to, the individualization of part is Rem Koolhaas. He abundantly experimented with individualizing the abstract and concrete contents of part. Majority of both his textual and architectural works are "assembled" rather than composed without any nostalgic desire of control. As one of the recent manifestations of Koolhaas' controversial approach,[209] 14th Venice Architecture Biennale (2014) was called "Fundamentals" and the central pavilion was devoted to "Elements of Architecture." His selection and his exhibition in respect to the data he collected is historical and archival, yet acritical and atypical as there are many reasons that these fifteen elements, which Koolhaas assesses to be the

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[208] Ibid.

[209] Barry Bergdoll assesses what Koolhaas did is precisely what architectural history, influenced by such historians as Carlo Ginzburg and Robert Darnton, has been doing for over a generation and contends we are more in the realm of a neo-modern interest in avant-garde origins than in an engagement with, say, classicism of the *longue durée*. He claims that: "What are we to make of the return of the archive as a fascination in the era of the digital, when physical materials are increasingly irrelevant and the organization of big data, even historical big data, into display seems an old paradigm—consume time and space when everything can be at hand instantaneously with a few taps, or if you've friended Siri, with voice control?"

On the other hand, Hal Foster poses a criticism in claiming that "To return to 'Elements" or 'Fundamentals' is an old modernist impulse. But I took this impulse on the part of Koolhaas to be not only ironic but also auto-deconstructive, so to speak, in the sense that the examples provided in the main pavilion of his show indicated how ridiculous it is at this point in time to search for anything like fundamentals when it comes to floors, walls, ceilings, and the rest."

See, Barry Bergdoll, Keller Easterling, and Hal Foster, "Notes on the Venice Biennale," in The Avery Review, no. 4, Decemeber 2014; http://www.averyreview.com/issues/4/venice. [Last accessed in August 1st, 2017]

"the often overlooked but universally familiar elements of architecture used by any architect, anywhere, any time," cannot be presented next to one another – toilet can controversially be studied as an architectural fundamental against the discourses, theories and debates developed on and through the history of "the" façade or any individualization of door or corridor as an "architectural element" neglects the abstract content of these architectural parts as temporal and transitory spaces and interferes with any possibility of discussing the notion of in-betweenness and so on.

One can propagate on these inconsistencies, ambiguities and confusions behind the selection of Koolhaas' selection and present reservations and criticisms yet it is beyond the scope of this study. What matters is the unexpected possibility he found in the individualizations of part and the architectural authorization attained to it to immediately and controversially become its fundamentals and its elements. Koolhaas' system is based on "nomenclature" and nothing else, if he can call a part, name it, in other words, "individualize" it, then it can be searched, studied and presented as an "element". He does not provide any epistemological and methodological models for the definition of architectural elements or does not aim at offering approaches to theorize what is fundamental in/to architecture since what actually a "façade" is and means for architecture is discussed, widely and longly, for centuries. Koolhaas starts and proceeds with the individualizations of part. Based on these individualizations, he searches and collects what and how that part has been defined rather than trying to define what it actually is or what it includes or excludes. Seeking for a system or framework to select these elements would inevitably leads to a critical assessment, which Koolhaas, arguably, avoided. Eisenman states that "[Koolhaas] doesn't believe in grammar" and explains the historical background of his disbelief as followed:

> [W]hen he was at the Architecture Association School in 1972, in the spring of '72 when he quit – because he never finish school, you have to understand – because he went to the new director and he said, quote: 'I want to learn fundamentals. Where can I learn fundamentals?'

> And the director looked at him and said: 'We don't teach fundamentals here. We teach language.' And then he quit. So there is a relationship between quitting the school in 1972 and Fundamentals today. Okay? [210]

Whether to achieve a new perception of the whole or to fundamentally shake it, individualization of part should be assessed as an epistemological and methodological approach to architectural from, through and within which the architectural operationality of part is explored and expanded.

4.2.4 Epistemological primacy of part

Alberti formalized "the column" as a model for defining architectural part. The column was not autonomous as a founded form, and to be part of a founded form it could not, but as Hubert Damisch remarks it certainly did have an identity.[211] He claims that the Albertian column can be considered as "the representative of a more general class"[212] due to the ambiguity it embraces as a part as observed in Alberti's statement: "Because for myself, I would not say that an arch is anything else than a curved beam; and what is that if not a transverse column."[213] Alberti sees the column as a model for acknowledging part as an architectural element as well as for distinguishing the nature of structure, skin and infill that make up the architectural whole. As a beam can be read as a transverse column, so can a wall be a continuous column and an arcade be a discontinuous wall and so on. The significance of

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[210] Interview with Peter Eisenman, by Valentina Ciuffi. For the full transcript of the interview see, https://www.dezeen.com/2014/06/09/rem-koolhaas-at-the-end-of-career-says-peter-eisenman/ [Last accessed in August 1st, 2017]

[211] Hubert Damisch. "The Column and the Wall," 1977: 22.

[212] Ibid.

[213] Ibid. 21. As translated by and quoted in Damisch. Rykwert translates Alberti as "for I call an arch nothing but a curved beam, an what is a beam but a column laid crossways?" in On the Art of Building, Book III, chapter VI, 1988: 69.

Albertian column is that it suggests an epistemology of architectural part. By using the column as a model, Alberti builds up on it.

Part has an epistemological primacy in the production of knowledge of architectural form. Not only the classical treatises and modernist manifestations build architectural practices and discourses on the very concept of part but also the acts and theories of learning are based on the acknowledgement of part. Peter Collins claims that "present concept of architectural education unquestionably had its roots in the system, which originated in Paris in 1671 as part of Louis XIV's establishment of the *Académie Royale d'Architecture*."[214] During the eighteenth century, with the efforts of Jacques-François Blondel, it established the initial principles for full-time architectural education. After the revolution it merged with the *Écoles des Beaux-Arts*, which was founded by Cardinal Mazarin in 1648.[215] Since the early eighteenth century, the pedagogical approach that was developed in the Academy has been referred to as the Beaux-Arts system. As a prestigious academic institution, the *École des Beaux-Arts* advanced a complex system of pedagogy, theory and practice based on a specific method and philosophy of architectural design.[216] There were two fundamental components of its method – the *"analytique"* and the *"esquisse"*. *Analytique* is a self-descriptive and highly powerful term to understand the foundational principles of education, learning, designing, and organizing knowledge. *Analytiques* were initial design problems directed toward "the organization of

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[214] Peter Collins, "The Eighteenth Century Origins of Our System of Full-Time Architectural Schooling," Journal of Architectural Education, Vol. 36, No. 1, Beginnings, November 1979: 2.

[215] Ibid.

[216] For a thorough explication of the pedagogical system of the *École des Beaux-Arts* see, Richard Chafee, "The Teaching of Architecture at the *École des Beaux-Arts*," in Arthur Drexler, ed., The Architecture of the Ecole des Beaux-Arts. Cambridge, Mass.: The MIT Press, 1977. Also noteworthy is a special November 1979 issue of Journal of Architectural Education, vol. 33, no. 2, edited by Lawrence Anderson and Peter Collins, on architectural education and its roots in the Beaux-Arts.

elements definitely borrowed from the classics into simple structures." [217] The *analytique* was a codified design problem that is based on the analysis of the basic elements of architecture and provided foundation for developing competence in architectural design.

Drawing was at the core of architectural education of the *École des Beaux-Arts*. It was assessed and employed as a tool of "survey." Learning and designing was conducted by the act of drawing that starts with the *analytique*; the students were studying the precedents and surveying into their bodies to produce knowledge of the "architectural part." After the survey of architectural elements, small exercises of design to integrate and combine these elements are performed. While the *analytique* focused on the part, the *esquisse* was concerned with the whole. "Composition" was the key concept of the *esquisse,* embraced to indicate the act and process of design of the whole. The system based on the dialectics of part and whole is explained by Marco Frascari as: "A column is a detail as well as it is a larger whole, and a whole classical round temple is sometimes a detail, when it is a lantern on the top of a dome."[218]

The epistemological primacy of part in learning and design has been the core of theoretical works and practical treatises particularly in early twentieth century. Following the discourse of composition initiated by Durand, Julien Guadet compiled his lecture notes published between in a work of four volumes entitled *"Éléments et théorie de l'architecture."* Guadet claimed that "to compose is to make use of what is known [*ce qu'on sait*]. Composition has materials just as

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[217] Jean Paul Carlhian, "The *École des Beaux-Arts*: Modes and Manners," JAE, Vol. 33, No. 2, Beginnings, November 1979: 8.

[218] Marco Frascari, "The Tell-the-Tale Detail," VIA 7: The Building of Architecture (1984), reprinted in Kate Nesbitt, ed., Theorizing a New Agenda for Architecture. New York: Princeton Architectural Press, 1996: 501.

construction has, and these materials are, precisely, the Elements of Architecture"[219] and he continues as:

> What is it, to compose? It is to put together, weld, unite, the parts of a whole. The parts, in their turn, are the Elements of Composition, and just as you will realize your conceptions with walls, openings, vaults, roofs – all elements of architecture – you will establish your composition with rooms, vestibules, exists and staircases. These are the Elements of Composition.[220]

Reyner Banham assesses Guadet's approach as "particulate;"[221] while structural and functional members should be acknowledged as elements of architecture, actually "building elements," the combinations of these elements would result in certain volumetric definitions that are called elements of composition, which would then be assembled to make the whole building. Guadet actually proceeds with "criteria of parthood" to distinguish the elements, such as functional/structural parthood and spatial/compositional parthood, and what has come to be known as "element" in the mainstream vocabulary of architecture today is based on his identification of structural/functional parts.

In *Changing Ideals in Modern Architecture*, Peter Collins argues that the emergence of new building types – hospitals and administrative halls in the eighteenth century; banks, offices, hotels, and railway stations in the nineteenth century – formed the background of the notion of program,[222] which implied a change both in the definition of "design problems" and of "architectural parts." Collins has noted that the idea of the program as a list of design requirements first evolved with the French

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[219] Guadet as translated and quoted in Reyner Banham. Theory and Design in the First Machine Age. New York: Praeger Publishers, 1967: 20.

[220] Ibid.

[221] Reyner Banham. Theory and Design in the First Machine Age, 1967: 20.

[222] Peter Collins. Changing Ideals in Modern Architecture. Kingston: McGill-Queens University Press, 1967: 219–220.

Prix de Rome competitions of the mid-eighteenth century. The typical Beaux-Arts program was extremely vague in its indication of size and required facilities.

"A COLONIAL INSTITUTE" Program by E. L. Masqueray

To be located in Washington, on a lot 800' x 1200' with streets all around, and the long exposure to the north and south. Graduated students of Colonial College would meet there prominent men of this country during their postgraduate course, and would get familiar with the institutions and characteristics of the country. At the same time, people of the United States would get acquainted with the representative people of the tropical dependencies, understand them, and by that mutual acquaintance develop feelings of esteem and friendship so necessary to harmonious and progressive relations.

This institute would consist of three distinct groups of buildings, not necessarily disconnected.

1st—*The Administration.* Residence for President and family. Lodging for two Secretaries. Residence should be large and afford ample room for the accommodation of a few invited guests. The office building should consist of rooms for Secretaries' offices, Information Bureau, Record Rooms, Janitor, one Committee Room, etc.

2nd—*Library-Museum.* Large library room, beautifully decorated; four private studies; two galleries (rooms) to show, in elaborated glass cases, minerals, precious stones, resources of Colonial countries, the walls decorated with tropical views. One large lecture room, seating 1200, to be used also for graduating exercises, etc. Small dressing room for lecturer.

All this part of the Institute to be treated monumentally and so arranged that it could be thrown into one on important occasions.

3rd—*Botanical Garden,* where would be shown plants of the United States, which could be introduced in the Colonies, and large green-houses where tropical plants could be kept and studied. Small aquarium in them for the study of fish. Six class rooms of studies adjoining. The garden does not necessarily need to be a motif by itself. It could be arranged as a setting to the buildings of the institution.

The arrangement of stories, one or several in each part of the institute, is left to the judgment of the competitors. Toilet rooms should be provided where needed. In some prominent location, court or garden, a monument or fountain to "Civilization bringing peace to uncivilized countries" will be located.

For the esquisse give a general plan at 1/64" scale. Facade and Section at the same scale. The esquisse must be done in ink.

For the finished drawings give two plans at 1st and 2nd floors, one main facade, one side facade, and one longitudinal section, all at 1/16' scale; and a detail of the facade at ½" scale to make a drawing about 3' x 4'.

Figure 35. "A Colonial Institute" program by E. L. Masqueray for the first Paris Prize, 1904.

[Joseph Esherick, "Architectural Education in the Thirties and Seventies: A Personal View," in Sprio Kostof, ed., The Architect: Chapters in the History of the Profession. New York; Oxford: Oxford University Press, 1986: 252.]

The program of "A Colonial Institute" drawn up by E. L. Masqueray for the first Paris Prize, an extended competition which was first conducted by the "Society of Beaux-Arts Architects" and then by the "Beaux-Arts Institute of Design" in 1904, did not include any quantifiable information except the size of the imagery site located in Washington and the large lecture room with 1200 seating capacity. The initial description of institute was rather formally organizational as it was suggested to "consist of three distinct groups of buildings, not necessarily disconnected."[223] These three groups of buildings include (1) the administration, (2) library-museum and (3) botanical garden. Residence for President and family "should be *large* and afford *ample* room for the accommodation of a few invited guests," whereas library-museum should be "treated monumentally" with a large library room "beautifully decorated."[224] As Joseph Esherick indicates "[t]he program, in its skeletal form and open suggestiveness, leaving nearly all functional interpretations to the competitor (and, it must be noted, equally to the jury) was also characteristic."[225]

With the introduction of the word "space" into architectural vocabulary and the increasing obsession with "scientization," the program has transformed into a numerically specified list of requirements for spaces with different "functions." Modernist deflection in the definition of design problems led to a significant change in design theories from compositions of architectural elements to "planning" and "programming" of buildings conceived as systematical and functional organizations. Parts, which specify the definition of design problem and thus identify the architectural whole, were no longer columns, doors or porticos but rather offices,

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[223] The program of "A Colonial Institute," written by E. L. Masquery and published in Society of Beaux-Arts Architects, Winning Designs, Paris Prize in Architecture, 1904–1927. New York: Pencil Points Press, 1928. This particular program was also reprinted in Joseph Esherick, "Architectural Education in the Thirties and Seventies: A Personal View," in Sprio Kostof, ed., The Architect: Chapters in the History of the Profession. New York; Oxford: Oxford University Press, 1986: 252.

[224] Ibid. [Emphasis added].

[225] Ibid. 251.

restrooms, and assembly halls. Consequently, treatises of architecture transformed from catalogues of ready-made parts into manuals of standardized space layouts, of which Ernst Neufert's *Architect's Data* has become an iconic symbol.

As space has come to be recognized as an architectural element, the dominant means of defining parts of architectural form has become "function" and "program." To challenge the modernist assumptions of the ideal space as an outcome of a pre-defined function, Güven Arif Sargın and Ayşen Savaş conducted studio projects in the 4th year Architectural Design Studio at METU with the use of a theme as the generator of a program.[226] By interrogating into the implications of the change in the design problems condensed around the pre-given program on architectural education, Sargın claims that:

> Architectural education, on the other hand, particularly plays a central role in this unceasingly overwhelming endeavour to be able to exercise innovative methods/models/paradigms through which it is believed that contemporary needs/problems/conditions can only be understood by those alternative processes of architectural education.[227]

The questioning of program as a pre-given constituent of architectural form is surely an advanced task for an architecture student. Sargın and Savaş critically shifts the nature of design problems in the 4th year so as to push the conventional boundaries of design as well as to advance students' competences. Following the studies in 4th year architectural design studio between 2004-2011, Sargın established a fundamental change in the formation of 2nd year architectural design studio in 2014, which has

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[226] One of the themes was also presented as a book entitled as "Hybrid Spaces," see Güven Arif Sargın. Hybrid Spaces. METU, Ankara, 2004.
Ayşen Savaş, evaluates the role of program in terms of the hybrid as a theme as follows: "The goal of this assignment, therefore, was not to question the strength of a given architectural program but to test its relevancy with an over ruling theme-hybrid; and challenge its authority with a total displacement-Albania. The belief is that 'program', a known term for architectural discourse, is defamiliarized in these new locations". See, Ayşen Savaş. "Architectural Program" in Hybrid Spaces, 2004: 7.

[227] Ibid. 17.

been expanded by İnci Basa in the following years. Particularly the first semester of the year is re-designed as a transition studio from the abstract nature of basic design problems of the first year. Aiming at formalizing a "foundation" for architectural design, the 2nd year architectural design studio in 2014 was developed over the theme "Elements," and then in 2015 it was reconfigured as "Components."[228] Both Elements and Components were conducted as continuous series of design exercises through and within which a variety of architectural parts have been explored.

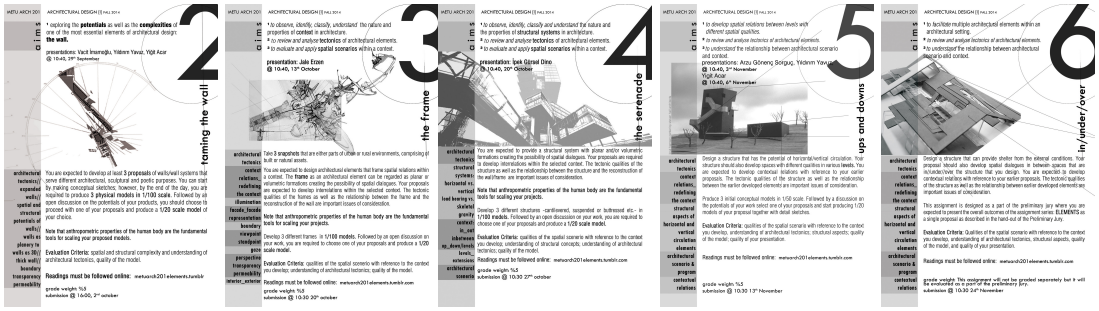

Figure 36. "Elements," assignment series in Arch 201 conducted in Fall 2014, METU Department of Architecture.

[Architectural Design Studios 2014-2015, METU Department of Architecture; "Elements" // Arch 201 Fall 2014: http://metuarch201elements.tumblr.com]

Figure 37. "Components," assignment series in Arch 201 conducted in Fall 2015, METU Department of Architecture.

[Architectural Design Studios 2014-2015, METU Department of Architecture; "Components" // Arch 201 Fall 2015: http://metuarch201components.tumblr.com]

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[228] For studio briefs, assignment series and student works see, Architectural Design Studios 2014-2015 & 2015-2016, METU Department of Architecture. Also see, "Elements" // Arch 201 Fall 2014: http://metuarch201elements.tumblr.com; and "Components" // Arch 201 Fall 2015: <http://metuarch201components.tumblr.com> [Last accessed in August 1st, 2017].

While Elements comprised “the taming of the wall,” “the frame,” “the serenade,” “ups and downs,” and “in/under/over,” Components contained “topographic condition + structure,” “spatial definition,” “diagrammatic statement,” “spatial movement,” and “locus of cultivation + spatial narration.” What was common and essential in Elements and Components was the conscious hesitation embedded in the definition of “parts,” yet to become elements and components. All of the indications were critical accounts on what an architectural part is and how it can be acknowledged in its integrity of abstract and concrete contents. Both Elements and Components suggested epistemological and methodological approaches in architectural form by instrumentalizing the concept of part as a theoretical and operational tool in architectural design.

4.3 “Moment of unity”

“Moment of unity” refers to a particular class of parts that are powerful in founding architectural form. Referring back to the original definition by Husserl, this peculiar part-form binds all the parts in the whole and blend through the whole within which it is contained. Moment of unity founds and is founded on all the parts. Considering architectural form, “moment of unity” can be assessed both as a property that is delivered by and as a principle that leads toward the whole.

Symmetry is the ultimate “moment of unity” that a founded form can embody. It is not simply a visual, formal and perceptual property of form but rather a relational statement indicating the conditions of interchangeability of the parts within the whole. Symmetry also refers to the invariance of the whole under specific operations and denotes the capability of self-recovery. Symmetry and laws of foundation work mutually, one is continuously sustained and conveyed by the other. Yet, it should be acknowledged that symmetry, as well as all the other possibilities of moment of unity, is an abstract content which cannot be distinguished as the moment of unity

without distinguishing the parts and the whole that it founds; it is blended in architectural form.

Moment of unity does not necessarily have to be a universal principle of order or timeless concept, such as symmetry, which is applied to or embraced in architecture. Architectural form can trigger the emergence of new conceptualizations of moment of unity – one of the strongest examples of which is defined as "phenomenal transparency." Colin Rowe and Robert Slutzky defines "phenomenal transparency" as "an inherent quality of organization."[229] However what is intended and what could make the reading of phenomenal transparency as a moment of unity is best explained in the analysis of Le Corbusier's Villa Garche where Rowe and Slutzky claim that "there is a continuous dialectic between fact and implication. The reality of deep space is constantly opposed to the inference of shallow space; and by means of the resultant tension, reading after reading is enforced."[230] The indication of "continuous dialectic between fact and implication" perfectly describes the nature of phenomenal transparency as a moment of unity; it renders it as a part, yet a peculiar kind of it, which is present in and presented by all the other parts and the whole.

4.4 Compositions

Composition is a loaded term intertwined with a complex history and multiplicity of meanings in architecture. Considering the paradigm of founded form, composition refers both to the field within which laws of foundation are cultivated and to the very whole that is cultivated. It simultaneously fabricates, summons and compiles parts. Composition is the course of foundedness.

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[229] Colin Rowe and Robert Slutzky. "Transparency: Literal and Phenomenal," Transparency. Basel: Birkhauser-Verlag, 1997: 21-55. First published in Perspecta, vol. 8, 1963: 45-54.

[230] Ibid.

As architecture embraced the idea of *"disegno,"* drawing is reconsidered as an act of design, or rather, the legitimate field of design. As indicated in respect to foundations, drawing states a field to accommodate the foundations from which architectural forms will be cultivated and composition is the very course of it. In other words, while composition refers to the methodology and the set of processes conducted by laws of foundation, drawing both lays the ground and provides the means to perform composition. Following the idea of disegno, composition and drawing are unified so as to achieve a definition of architectural design. It is by the augmented correspondence between composition and drawing, which enabled architectural design to be taught and learnt.

The *analytique* and the *esquisse* were the fundamentals of education in Beaux-Arts and provided pedagogical models for learning architectural design. The *analytique* of the part and the *esquiss*e of the whole together formed a foundation for architectural learning. Drawing was at the core of the academic discipline and assessed as the disciplinary tool to be employed in/as the act of architectural design – it was the founding act of design. Composition was an essential concept for Beaux-Arts system, which underlay the distanciation from architectural history as the key source of producing knowledge during the latter half of the nineteenth century. David Van Zanten and Barry Bergdoll have indicated that history and design had a difficult relationship after Labrouste and Viollet-le-Duc have challenged history as the theoretical basis of architecture. Architectural design was no longer had to validate itself with the absolute norms of history but rather could be understood, learnt, thaught, and practiced by means of composition. According to Van Zanten, "composition" became an extremely comprehensive term, by including the concepts of distribution and disposition, which in turn signified "the essential act of architectural design."[231] Composition is a complex word with a compelling history of

[231] David Van Zanten, "Architectural Composition at the École des Beaux-Arts from Charles Percier to Charles Garnier," in Arthur Drexler, ed., The Architecture of the *École des Beaux-Arts*. Cambridge, Mass.: The MIT Press: 112.

meanings and shifting connotations. Architectural discourse in the nineteenth century has been developed around the theories of composition, of which Durand's *Précis des leçons d'architecture* is considered to be the origins.

Durand aimed at "a systematization of architectural knowledge" by discovering the generic principles that are implicit in works of architecture. Challenged by the dichotomies between particular and general and abstract and concrete, Durand tried to answer the question of how to make architecture without any recourse to historical styles. To transcend the limits of history, he developed a theory of architecture that also formed the basis of his lessons in *École polytechnique*. Durand's work is collected in two seminal books: *"Recuiel et paralléle des édifices de tout genre, anciens et modernes,"* published between 1799 and 1801 and *"Précis des leçons d'architecture données à l'École royale polytechnique*," published for the first time between 1802 and 1805.

In the *Recueil*, Durand employed a logic to place and deduct general principles of architecture by collecting and analyzing the buildings from past. He employed and proposed "classification" as a methodology for extracting these general principles. Durand looked into architectural form by instrumentalizing conceptual categories to survey it critically rather than descriptively. To enable the definition of the general principles extracted from particular examples as the fundamentals of architectural design, he introduced a series of steps to be acknowledged as the process of architectural design. In *Précis des leçons*, Durand stated as:

> [D]educe the general principles of architecture; and once these are known, it will only remain for us to apply them, (1) to the objects that architecture uses, that is, the elements of buildings; (2) to the combination of these elements, in other words, composition in general; and (3) to the alliance of these combinations in the composition of a specific building.[232]

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[232] Jean-Nicolas-Louis Durand. *Précis* of the Lectures on Architecture with *Graphic* Portion of the Lectures on Architecture. Intro. Antoine Picon, trans. David Britt. Los Angeles: CA: Getty Publications, 2000: 78.

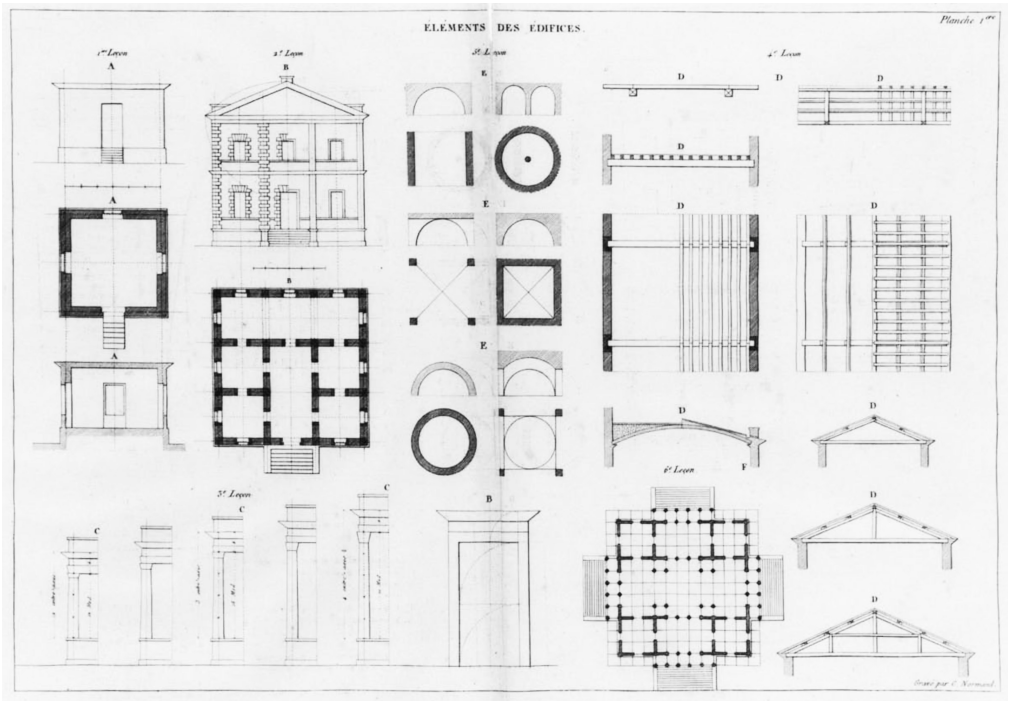

Figure 38. ***Éléments des edifices,*** **Durand.**
[*Graphic* Portion of the Lectures on Architecture 1821, Plate 1]

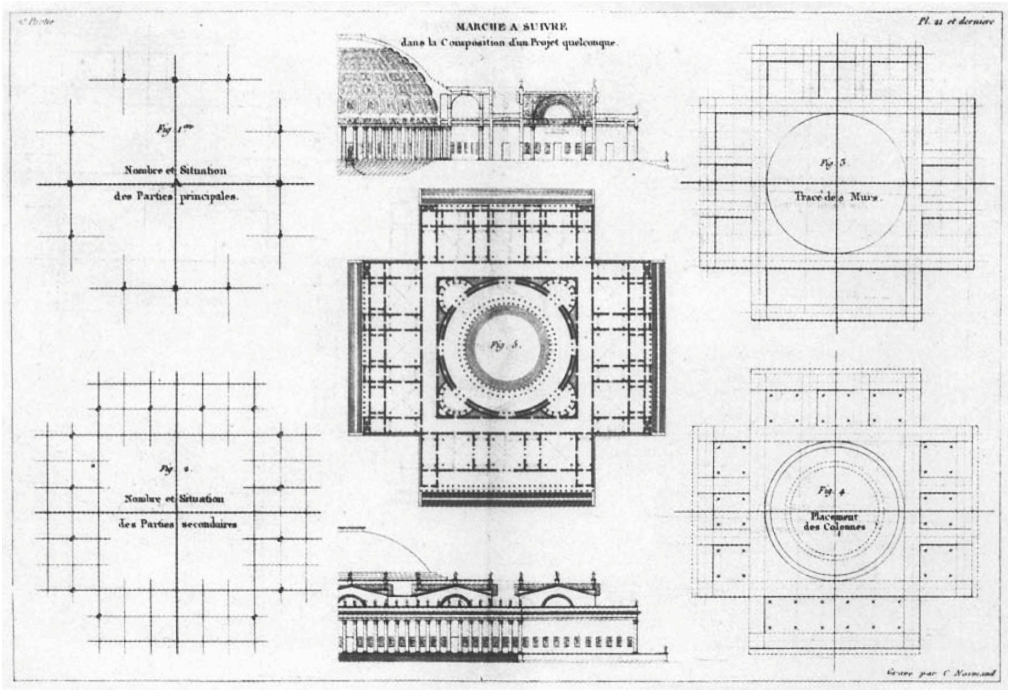

Figure 39. ***Marche à suivre dans la composition d'un projet quelconque*****, Durand.**
[*Précis des leçons d'architecture* 4th ed. 1825, vol. 2, Plate 21]

Starting with "elements of buildings" indicates that the concept of part has epistemological primacy for Durand as well and it was fundamental for "composition," which refers to the combination of these parts in scales of order. What was critical for Durand is the definition of "elements" as universal and timeless parts of architecture, which are present in and available for any building, without any consideration of historical style or period. The conception of composition as an act and process of architectural design has contributed to the apprehension of part as an abstract content. Durand has confronted with the challenge of separating the abstract and concrete contents of part in his theory of composition developed through *Précis des leçons*. His elements of buildings *(éléments des edifices)* oscillate between two points of view: (1) forms and proportions, (2) materials and construction. Durand studied qualities and use of materials under elements of buildings besides forms and proportions. The plate illustrating *"Les éléments des edifices"* (see Figure 38) shows that elements such as slabs and pitched roofs are conceived as concrete and constructional parts of the building, whereas the drawings of vaults and columns remain rather geometrical and schematic to focus on the formal and proportional properties of the elements and to render them as abstract contents which are generic rather particular. Durand's indication of *éléments des edifices* is truthful and fair as these parts are "elements of buildings" yet to become "parts of architecture."

Following elements of buildings, Durand explains "composition in general," which refers to the combinations of the elements previously defined incrementally toward the building as a whole. Composition proceeds with "combination of the elements of buildings," which includes columns, walls, windows, doors, etc; then "the parts of buildings," meaning porches, vestibules, stairs, rooms, courtyards, and so on; and finally "building as a whole," which indicates the combination of the parts and ensembles of buildings.[233] While Guadet translated Durand's "elements of buildings" in "elements of architecture", Durand's definition of "the parts of buildings"

[233] Ibid. 89-127.

coincides with Guadet's definition of "elements of composition." However, regarding the abstract and concrete contents of part inheres, Guadet's interpretations can be understood as an extension of Durand's explanation of the process to be followed in the composition of buildings, because what Durand articulates is actually the method of composition rather than the building itself. Durand illustrates in the plate entitled "*Marche à suivre dans la composition d'un projet quelconque* / Procedure to be followed in the composition of any project" (see Figure 39), the steps or stages of composition by reversing the process that he explains in the beginning. It is assumed that the building will start from a single element or at least a group of elements, which will be assembled step by step to produce larger parts that will eventually end up in the whole building. However, in the "Procedure," Durand starts from the whole as an abstract and conceptual entity and applies a form of taxis to articulate it. If three initial steps identified by Durand are studied in relation to one another it becomes visible that there is a "leap" between the first step concentrating on "elements of buildings" and "procedure to be followed in the composition of any project." Elements of buildings are combined locally or partially to achieve different formations of parts of building but these parts are not assembled to compose the whole building. Composition actually develops in two parallel ways, one running from parts to the whole and the other coming from whole to the parts, but not as a single linear process of steps through which smaller parts incrementally combined into larger parts and finally into the whole. To enable the combinations of "parts of building," Durand also studies the whole and constructs a tentative framework within which these parts of buildings will be accommodated. Guadet's translation of "parts of buildings" as "elements of composition" can be seen as an endeavor to manage the "leap" between part and whole. However, the "leap" is not simply a matter of scale increasing from part to whole, but rather it embodies an ontological problem between abstract and concrete realms. While "elements of building" are concrete as parts, the building that is intended along the "procedure to be followed in the composition" is abstract as a whole.

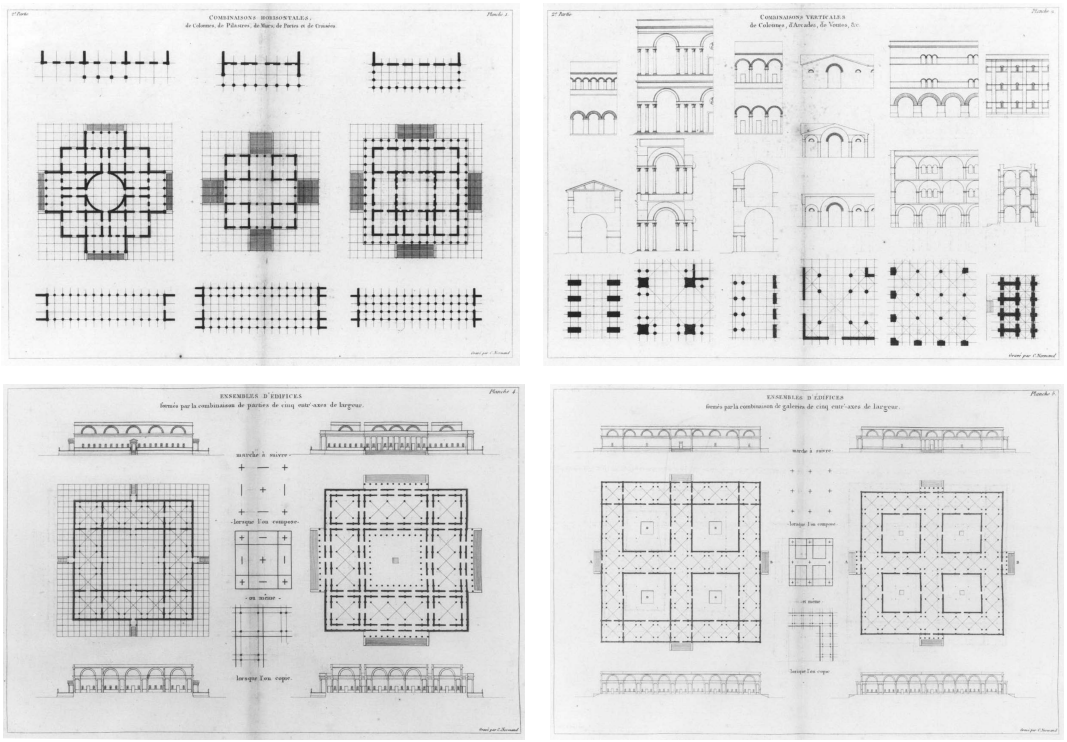

Figure 40. Excerpts from *Précis des leçons*, Durand.
Top-left: Combinaisons Horisontales de Colonnes, de Pilasters, de Murs, de Portes et de Croisées / Horizontal Combinations of Columns, Pilasters, Walls, Doors, and Cruises [*Précis* of the Lectures on Architecture, vol.1, Part II Composition in General, Plate 1]; *top-right: Combinaisons Verticales de Colonnes, d'Arcades, de Voûtes* / Vertical Combinations of Columns, Arcades and Vaults [*Précis* of the Lectures on Architecture vol.1, Part II Composition in General, Plate 2]; *bottom-left: Ensembles d'Edifices* / Ensembles of Buildings [*Graphic* Portion of the Lectures on Architectures on Architecture, Plate 4]; *bottom-right: Ensembles d'Edifices* / Ensembles of Buildings [*Graphic* Portion of the Lectures on Architectures on Architecture, Plate 4].

Regardless of the methodological intricacies and deficiencies that are left unexplained or unresolved and the ontological inconsistencies that are beyond the problem of architecture and architectural design, Durand's work should be acknowledged as a grand theory of composition and a critical discourse on architectural design. His theory led to a comprehensive understanding of design not as an act of architectural paraphrasing of the precedents into elegant contemporaries but rather as a creative act of architectural achievement. Durand's theory of composition has made its way to twentieth century particularly through Guadet's *Éléments et théorie de l'architecture*. According to Banham, it is a challenging task

to accurately assess Guadet's contribution to modern theory in the wake of the Rationalist attitude and Abstract art.[234] Addressing to the "vicissitudes" of architectural vocabulary about the word "composition", Colin Rowe claims that "between 1900 and 1930 the major critical interest of the architectural profession throughout the English speaking world lay in the elucidation of the principles of architectural composition."[235] The turn of twentieth century witnessed a proliferation of books devoted to the formalization of the principles of architectural compositions, noteworthy of which include John Vredenburgh Van Pelt's *"A Discussion of Composition: Especially as Applied to Architecture"* (1902), John Beverley Robinson's *"Architectural Composition"* (1908), David Varon's *"Indication in Architectural Design"* (1916) and *"Architectural Composition"* (1923), Nathaniel C. Curtis' *"Architectural Composition"* (1923), Howard Robertson's *"The Principles of Architectural Composition"* (1924), John Harbeson's *"The Study of Architectural Design"* (1926), Robert Atkinson and Hope Bengal's *"Theory and Elements of Architecture"* (1926), and Trystan Edwards' *"Architectural Style"*[236] (1926).

However, as approaches to the architectural design have been redefined to meet the requirements of scientization, functionalism, and objectivity, or rather *"sachlichkeit,"* the heavy formalism that composition suggests has started to be criticized. While composition is abandoned by the accusations of its formal

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[234] See Banham, "The Academic tradition and the concept of elementary composition," in Theory and Design in the First Machine Age, 1967: 14-22.

[235] Colin Rowe. "Character and Composition; or Some Vicissitudes of Architectural Vocabulary in the Nineteenth Century," The Mathematics of the Ideal Villa and Other Essays. Cambridge, Mass.: The MIT Press, 1987: 60 [First published in Oppositions 2, 1974].

[236] Trystan Edwards coins the term "grammar of design" in his treatise on aesthetics entitled "The Things Which Are Seen." Edwards applies the formal principles – number, punctuation, and inflection – that he proposed as "grammar of design" to architecture later in "Architectural Style." Though the title "Architectural Style" seems to suggest otherwise, Edwards insisted that style is "expressional" and secondary to the compositional rules of architecture. See Trystan Edwards. The Things Which Are Seen: A Revaluation of the Visual Arts. London: Philip Allan & Co, 1921; Trystan Edwards. Architectural Style. London: Faber and Gwyer, 1926.

intentions, the very conventions that it has been founded, namely the orthographic drawing, was never questioned. Leaving the formal and methodological approaches of composition behind, the orthographic set suggested a "rationale" for the conceptual and material production of space in Modern Architecture. The orthographic projection, as a technique of drawing concentrated on representing the "objectness" of the object, met with the requirements of rationalization and objectivity. With the emergence of the idea of program, the definition of architectural design has been deflected from a composition of parts, which are usually identified as constructional elements of buildings, into a kind of problem-solving activity to achieve a functional distribution of space. Especially the prominence of the "plan" increased to become the "generator" of architecture[237] and the act of design started to be recognized rather as an act of "planning." Composition has been categorically detached from architectural design as problems of design was no longer concerned with "architectural elements" but rather with "architectural programs."

Combined with the introduction of the word space to architectural vocabulary and the recovery of the concept of part as an abstract content, the underlying premises of modernization controversially led to the abstraction of architectural form itself. The "objectivity" inherent in orthographic drawing has evolved into a "style" of architectural form beyond its instrumentality in solving the practical problems of functional distribution of spaces. Criticizing the correspondence between Modern Architecture and its representations, Anthony Vidler claims that:

> This apparent identity of the modernist drawing and its object, both informed by a geometrical linearity that tends toward the diagrammatic, has, throughout the modern period, led to charges that the one is the result of the other, that architecture has too-slavishly followed the conventions of its own representation. Modern architecture, *concerned to represent space and form abstractly*, avoiding the decorative and constructional codes of historical

[237] The statement refers to Le Corbusier's ambitious claim that "the plan is the generator." Le Corbusier. *Vers Une Architecture* / Toward an Architecture, Introduction by Jean-Louis Cohen, trans. John Goodman. Los Angeles, Calif.: Getty Research Institute, 2007: 86.

> architectures, is thus accused of reductivism, of geometrical sterility, and thence of alienation from the human.[238]

Modernism, above all the pretentions it had, was an attempt to wipe the slate clean, to break from the historical continuity of the previous centuries which has come to be known as the classical paradigm. Modernism marked a deep break with the classicist persistence by reflecting its implications on architectural form as well as on the processes of its making. The reduction of architecture to pure functionality and of architectural form to pure geometry was, in fact, a fake abstraction. Functionalism, assigned as the initiative of architectural design, was a modernist substitute for the compositional principles of classicism. Undecorated, functional objects were no different than the elements chosen from antiquity – primitive distillations of classical products reformulated by the preconditions of modernism. Modern Architecture controversially ended up being another positivist declaration of style not grounded on the rules of nature but rather on the science and technology. Architectural forms had to follow standards to maintain their autonomy and thus to achieve an architecture of from within, which naively extended Modern Architecture into a manifestation of form. In this regard, denial of composition due to its formalist intentions is surely polemical for Modern Architecture. Mies van der Rohe refused "to recognize problems of form; but only problems of building," but, arguably, only dealt with the problems that he selected. Paul Rudolph has clearly stated the implications of the modernist deflection in the definition of design problems:

> All problems can never be solved, indeed it is a characteristic of the twentieth century that architects are highly selective in determining which problems they want to solve. Mies, for instance, makes wonderful buildings only because he ignores many aspects of a building. If he solved more problems,

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[238] Anthony Vidler. "Diagrams of Diagrams: Architectural Abstraction and Modern Representation." Representations. University of California Press No.72, Autumn 2000: 8 [Emphasis added]. Vidler indicated that the problem of modernist representation resulted from "too easy translation of the new graphic techniques used by modern architect into built form," which led to an "architecture, that is, looked too much like the geometry with which it was designed and depicted."

> his buildings would be far less potent. This paradox is heightened by the commitments to functionalism.[239]

Whether directed to the problems of proportion or function, architectural form is conceived, produced and "founded" by means of parts and wholes. Composition, leaving aside all the prejudices directed to it in architecture, indicates a course to conduct laws of foundation and to instruct parts and whole toward one another. Regardless of the nature of parts, which could be spaces as well as columns, and of the intended whole, which could be a functional distribution as well as a material constitution, composition should be acknowledged as a theory to understand the mereological construction of architectural form.

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[239] Paul Rudolf. "For Perspecta," Perspecta, vol. 7, 1961: 51.

CHAPTER 5

FLAT FORM

Flat form does not seek for dependency or relationality between part and whole. It acknowledges both the part and the whole as circumstantial and contextual concepts by focusing on the resonance between the two. Part and whole are not defined and characterized by the condition of "being part" or "being whole," they independently coexist. Flat form is condensed by emergence and coherency and does not demand integrity and unity. In this regard, flat form cannot be explained and acknowledged by the analysis of parts and wholes, as both are instable and unpredictable, but it can rather be studied by means of its appearances through the conditions and processes that contextualize the formations of parts and wholes. The inquiry will unfold two approaches to form, where the mereological definitions of part and whole are occasionally suspended and flatness is either contrived or emergent.

5.1 Part-wise and Whole-wise: Contrived Flatness

Readings of architecture and its disciplinary formation on design commonly refer to a tripartite structuring of its historical relationship with science. First is identified by the theoretical attempts seeking for the origins of the relation in-between, which usually extends to the very beginnings of architecture's disciplinarity in Renaissance, as illuminated by Alberto Pérez-Gómez's comprehensive work *"Architecture and the Crisis of Modern Science"* (1983), whereas the second part of the historicity of the relation between architecture and science is marked by the rise of the machines and the pretentious ideals of modernism which are critically mapped in *"Theory and Design in the First Machine Age"* by Reyner Banham in 1960. The last part, which have started in 1960s and still continues, is an augmented motivation toward science that particularly initiated a project to "scientise design" by pushing the disciplinary

boundaries of architecture further. This ongoing aspiration is initially characterized with the development of "Design Methods Movement," which later enhanced by the tools and processes of computation in the 1990s.

Structuralism was the initial source of theoretical inspirations between 1960-1970, divided between the linguistic approaches following Ferdinand de Saussure and the logical studies to advance mathematical models as operative tools to be employed in design. Oscillating between the studies of language, considering the systematical formation of its structure and signs, and the constructions of artificial languages, theories of architecture has been predominantly ruled by the modes of "structural thinking." The advent of computer languages carved out an "epistemological niche" both to re-formalize and to be formalized by the disciplinary practices of different fields. Disciplines formalized on a mathematical basis, particularly major branches of engineering and their sub-disciplines or cross-curricular disciplines, rapidly and easily adapted and integrated the use of computer into their professional practices and embraced computational approaches as research strategies.[240] However, this was a challenging task for architecture and necessitated a fundamental deflection from the conventions and assumptions of the discipline in acquiring knowledge. The use of computer and essentially the introduction of computational models indicated a Kuhnian shift in architecture, which triggered the development of various strategies and methods to manage the slowly maturing processes of design research, design as research, research in design, research by design, and so on.

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[240] The Latin origin of the term engineer as *"ingeniare"* refers to a figure who invents and contrives, however the Arabic counterpart of the term provides a rather direct link with the act of engineering and the figure of the engineer. *"Mühendis"* corresponds to the term "engineer" in Turkish and is derived from the root *"hnds"* in Arabic. Although the word *"hendese"* is acknowledged as "geometry," which literally indicates the measurement of earth or land, it essentially means to measure and to calculate and renders *"mühendis"* into the figure who measures and calculates. Considering the origins of the term "engineer" in different contexts, it is possible to understand how the introduction of computation as an operational and theoretical tool radically differs between engineering disciplines and architecture.

The common tendency in approaching architectural problems with computer and computational models was the formalization of design process and design criteria in such a way that will enable the use of the tools of this new paradigm to generate "forms" as "solutions." Christopher Alexander was one of the leading figures who determined the underlying endeavors of the quest for "method." In his Ph.D. dissertation entitled *"Notes on the Synthesis of Form,"* Alexander presented an approach to formalize the design process and developed a methodology for mathematically modeling architectural and urban problems. The idea of form reduced into an end result, or rather, to a solution to a problem, and the growing obsession with the processes generating it was prevalent in the early struggles of contextualizing computation in the approaches to design, which was illustrated by Leslie Martin's thoughts on the significance of "intentions and processes" toward form:

> I do not propose to speak about the forms and images. Form is the end product of a process. I prefer to discuss what seems to me far more important to the architect: some of the intentions and the processes that cause forms to exist and give them their significance and meaning.[241]

Separating form from the processes, intentions or sequences leading to it was a critical intervention to the epistemic content of form, which has been previously founded by the processes, and thus embodied the traces of its internal logic. Moreover, surely end products have a form but form has never been recognized solely as an "end product" in architecture. Acknowledged as a disciplinary product of architecture, form contrives "objects of architectural thought" and accumulates architectural knowledge. Form, assessed as "the end product of a process" or as "the solution to a problem," is no longer "founded" but rather "found," which led to an emerging discourse of "form-finding." As form disturbed by the tools and models of computation and questioned as the kernel of architectural knowledge, it was necessary to re-define design by considering what is to know by and how to know

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[241] Leslie Martin. "Architect's Approach to Architecture," RIBA Journal, May 1967: 20.

through and within its processes. In the conference *"Architecture and the Computer,"* organized by Boston Archtiectural Center in 1964, Christopher Alexander claimed in his talk entitled *"A Much Asked Question about Computers and Design"* that:

> But there is a danger in the currently fashionable preoccupation with computing machinery, which goes far beyond irrelevancy. The effort to state a problem in such a way that a computer can be used to solve it will distort the view of the problem. It will allow us to consider only those aspects of the problem, which can be encoded - and in many cases these are the most trivial and the least relevant aspects.[242]

Until the end of 1970s, digital technologies were incorporated in design process to develop methodologies for achieving solutions. William Mitchell's overview of these early decades of computation presented the typical characteristics of design problem and design criteria as well-formulated statements and architectural design as a "problem solving process," within which designer seeks through the multiplicity of possible solutions.[243] Mitchell's work was entitled "Computer Aided Architectural Design" indicating the immaturity of the relationship between architectural design and computer as architectural design could only be "aided" by computers and incapable of embracing the inner logic of working through computers and computation. 1980s is critical in the history of design studies. Within this decade, the overworked attempts to establish a scientific method to rationalize design have started to be questioned. Design thinking has started to be recognized as a realm yet-to-be discovered rather than a process of problem solving that has to be controlled. The studies have started to seek for the possibilities of a design research, which was no longer confined with the reductionist and artificial premises of design methodology.

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[242] Christopher Alexander. "A Much Asked Question about Computers and Design," presented at the Architecture and the Computer, Boston Architectural Center, conference proceedings, 1964: 52.

[243] William Mitchell. Computer Aided Architectural Design. New York: Van Nostrand Reinhold, 1977.

Computation, which remained as an instrumental tool of investigation in design research, hardly recognized as a critical tool of thought and production in design until 1990s. Besides the researches aimed at acquiring knowledge by design and computation, it is observed that the consideration of the philosophical and theoretical aspects of design emerged. Attempts to comprehend the epistemological foundations of computation necessitated "theoretical conceptualizations" of the emergent computational context and led to the formation of new critical vocabularies to re-define architectural design rather than concentrating on the nature of the act of designing itself.

5.1.1 Toward a Mereological Nihilism

"Fold," "monad," "morph/ing," "warp/ing," "continuity," "hybrid/ization," "complexity," "multiplicity," "variability" etc. can be recognized as the outstanding concepts of the computational context, which elevated the use of computational tools and models as novel approaches in design. The inception of these theoretical concepts implied further assessments of design, which was excessively identified with the marginal rejections of its past and argued as "non-standard," "non-linear," and "non-deterministic."[244] These concepts are porous and permeable as well as they usually entail one another, while "complexity" and "continuity" become prominent rather as comprehensive theories framing the conditions suggested by the others and underlying the premises of computational design. Among the abovementioned theoretical concepts, Deleuze's interpretations on Leibniz's mathematics of

[244] For the theoretical conceptualization of "non-standard" see, Architectures Non Standard, eds. Frédéric Migayrou and Zeynep Mennan. Centre Georges Pompidou, 2003. For "non-linearity" and "non-determinism," and occasionally "indeterminacy," see Charles Jencks, "Nonlinear Architecture: New Science=New Architecture?" in Mario Carpo ed., The Digital Turn in Architecture 1992-2012, Chichester: Wiley, 2013; Branko Kolarevic, "Towards Non-Linearity and Indeterminacy in Design," Cognition and Computation in Digital Design. The University of Sydney Faculty of Architecture, Design Computing Cognition'04; Branko Kolarevic, Architecture in the Digital Age: Design and Manufacturing. London and New York: Spon Press, 2003.

"continuity" and the conceptualization of the "fold" with Cache's formalization of the *"objectile"* and theoretical concentration on "topology" have predominantly transformed the processes of design and forged the expressions of form. Primacy of "continuity" and the indeterminacy enhanced by topology resulted in a fascination with folds mediated as spline-dominated, vector-controlled, ever bending yet unbreakable curves in a continuous flow. Carpo assessed the "curving folds emerged in the early 1990s as a design strategy internal to the architectural debate of the time" as "the digital turn," which he later noticed to be not the ultimate digital turn but rather the first one.[245] Although topology does not necessitate any "curvilinearity" of form, architecture has been invaded with various generations of it. Unfolding the misconception of topology in architecture, Cache claims that:

> One single topological structure has an infinity of Euclidean *incarnations*, the variations of which are not relevant for topology, about which topology has nothing to say. New topological structures can be incarnated in Euclidean space as squared figures as well as curved figures. Topology cannot be said to be curved because it precedes any assignment of metrical curvature. Because topological structures are often represented with in some ways indefinite curved surfaces, one might think that topology brings free curvature to architecture, but this is a misunderstanding. When mathematicians draw those kind of free surfaces, they mean to indicate that they do not care about the actual shape in which topology can be incarnated. In so doing, they should open the mind of architects and allow them to think of spatial structures before styling them as either curved or squared. And, of course, as soon as it comes to actually making a geometrical figure out of a topological structure, we enter into Euclidean geometry; that is, the design of complex curvature is essentially Euclidean. One should not think of Euclidean geometry as cubes opposed to the free interlacing of topology.[246]

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[245] Mario Carpo. The Digital Turn in Architecture 1992-2012, 2013: 9. Carpo later identifies a "second digital turn" in architecture, which initiated a break with the simplified continuity that splines dominated and embraced the messiness of the "big data" as suggested by the paradigm of complexity. Carpo's book entitled *"The Second Digital Turn: Design Beyond Intelligence"* will soon be published by the MIT Press – the release date announced by Amazon as September 15, 2017.

[246] Bernard Cache. "A Plea for Euclid," ANY, no. 24 | Design after Mies: Boxing the Long Shadow at IIT. Anyone Corporation, 1999. Reprinted in Projectiles, London: AA Publications, 2011: 31- 59. Also available at Arch'it: http://architettura.it/extended/19990501/ep07en_01.htm. [Last accessed in August 12, 2017]

Topology indicated a field of possibilities for discovering the fundamentally innate properties and relations of a system, which could result in a multiplicity of formal expressions. As theories of continuity start to dominate the researches and practices of architectural design and superficially implied the "continuity" of architectural form, topology opposed geometry, and without being noticed, took over mereology. Although the two, topology and mereology, are not conflicting but rather contributing theories, the discipline of architecture failed to acknowledge that. Acknowledging the restrictive nature of both when purely obeyed, Roberto Casati and Achille Varzi address to "the problem of interaction between mereological and topological concept"[247] in their philosophical survey on space and spatial things entitled *"Parts and Places: The Structures of Spatial Representation."* They seek for the possibilities of combining mereology and topology and develop two strategies:

> The first – the one we favor – is perhaps the obvious one: if topology eludes the bounds of mereology, and if its importance is to be fully recognized, then we may add it to a mereological basis. From this point of view, mereology can be seen as a ground theory upon which theories of greater and greater complexity (including topology as well as, say, morphology or kinematics) can be erected with the help of additional notions and principles. The second strategy is more radical. Insofar as topology is a stronger theory than mereology, one may consider turning things around: one could start form topology right away and define mereological notions in terms of topological primitives. From this point of view, just as mereology may be seen as a natural generalization of the basic theory of identity (parthood, overlapping, and even mereological fusion subsuming singular identity as a definable special case), topology may be seen as a generalization of mereology in which the general relation of connection takes over parthood and overlap as special cases.[248]

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[247] Roberto Casati and Achille C. Varzi. Parts and Places: The Structures of Spatial Representation. Cambridge, Mass.: The MIT Press, 1999: 4.

[248] Ibid. 5. Casati and Varzi formalize the two approaches toward "mereotopology" on the borderline of the very concepts of "part" and "spatial boundaries." They indicate that "boundaries are ontologically on a par with (albeit parasitic upon) exntended parts. But unlike extended parts, spatial boundaries have a peculiar relation to space, yet do not take up any space." They articulate this deep philosophical distinction in Chapter 5 entitled "Boundaries," in Parts and Places: 71-98.

Although the hybridized reading of mereology and topology extends beyond the scope of this study, acknowledging the extended relationality of mereology and topology is significant to observe the lack of its awareness in architecture. Captivated by topology and the misconceived implications of theory of continuity, architecture's obsession with the ever morphing and warping forms of immediate smoothness led to a "mereological nihilism."

Mereological nihilism is a position that rejects the idea that objects are constituted of parts. Accordingly, there are no composite objects which contain proper parts, in which proper refers to an identifiable form of parthood such as being functional, structural and so on. In the same manner, these objects cannot become parts of another object. Thus, the relation between part and whole is rejected and any necessity for their ontological dependency is collapsed. In mereological nihilism, only "mereological simples" exist, which are pure wholes that are not constructed by parts. Mereologically, a "simple," or an atom, "is an entity with no proper-parts, regardless of whether it is point-like or has spatial (and/or temporal) extension."[249]

For architecture, mereological nihilism was not intended but rather imposed. In the absence of a vocabulary, both lexical and architectural, of parts to conceive or produce these continuous wholes, or to be terminologically accurate, these continuous "objects," namely the *objectile*, there emerged a need to contrive "simples" that will enable their conceptual, formal and material fabrication. The definitions of part and whole are epistemologically deflected by the collapse of their ontological dependency and mereological relationality. It is possible to observe different tendencies to negotiate between part and whole, which can hardly be identified as parts or wholes, yet the reluctance in acknowledging the relationality of the two is common for all approaches. Architectural form tends to ignore one next to

[249] Achille Varzi "Mereology," The Stanford Encyclopedia of Philosophy (Winter 2016 Edition), Edward N. Zalta (ed.); <https://plato.stanford.edu/archives/win2016/entries/mereology/>. [Last accessed in August 01, 2017]

the other; being part or being whole is always contingent. This study suggests the terms "part-wise" and "whole-wise" to assess the epistemological and methodological approaches to form, as it is possible to produce but not to acknowledge or explain the one with reference to the other. Instead of foundations, there are "resolutions" and "inflections," respectively wholes resolved into part-wises and parts inflected toward whole-wises. This study assesses the prevailing conceptions and applications of computation in architectural design with the powerful conviction in the theory of continuity in the 1990s as an interim of "mereological nihilism," where the conditions of being part or being whole is reluctant and contingent; and the "flatness" of form is not innate but rather "contrived."

5.1.2 Part-wise | Resolutions

One of the most pretentious assessments of theory of continuity is Patrik Schumacher's conceptualization of it as a style, which he calls "parametricism". Acknowledging that parametricism has its roots in digital animation software, Schumacher remarks that "what confronts us is a new style rather than merely a set of techniques" and turns, arguably, the most frequent term of digital practices into a symbol of his design manifesto. He recapitulates the processes of digital thinking and the *objectile* defined by continuous variation, differential iteration and mass-customization into an "elegance of ordered complexity." Referring to the core principles and methodological approaches that a style embodies to construct its means to encounter design problems, Schumacher formulates the "heuristics of parametricism":

- Negative heuristics (taboos): avoid rigid geometric primitives such as squares, triangles and circles; avoid simple repetition of elements, avoid juxtaposition of unrelated elements or systems.

- Positive heuristics (dogmas): consider all forms to be parametrically malleable; differentiate gradually (at varying rates), inflect and correlate systematically.[250]

The "malleability" and "continuous differentiation" sustained by parametric design tools indicated a resolution in the relationality of part and whole, which, according to Schumacher, has enabled complexity. As ontological dependencies of and hierarchical relationships between parts and wholes collapse and form drifts into a permissive fluidity, architecture faced, though unconsciously, with "mereological nihilism." In the wake of this perplexity, architectural design has been identified as an attempt to manage the gap between the continuity that exhausts form into an indeterminate abstraction and the continuity that polishes form into a smooth concretization. The immediacy of design processes sustained by digital literalisation has been reflected upon the approaches to form, meaning that the hesitation in the stability of form is overcome by means of its "immediate" computability. Parametric design tools enabled the conception and production of form as an "instant whole," which, mereologically, is not defined or established by parts, yet, architecturally, needs to be constructed by parts. However, regarding the epistemological dimension of part as a mereological concept defined according to its ontological competences in constructing a whole and/or to its ontological presence distinguishable within a whole, the "mereological simples" that will be assembled into the instant whole cannot be acknowledged as parts in foundationalist terms. Struggling with an extremity of the object, the *objectile* itself, or themselves, practices of architectural design started to treat mereological simples as if they were there *a priori* – a fake assumption that architects did not hesitate to embrace in a desperation to achieve a new definition of architectural form. On the contrary, parametricism was actually instrumentalized to execute a "resolution" of the instant whole in order to contrive mereological simples, thus rendering them critically *a posteriori*. What is acquired

[250] Patrik Schumacher. "Parametricism: A New Global Style for Architecture and Urban Design," AD | Digital Cities, vol. 79, no. 4, July/August 2009:16.

can be assessed as a "part-wise," which is strangely a part that neither founds nor is founded upon the instant whole. Part-wise is and is not exclusive for a whole, as in a context where parts no longer epistemologically precede or ontologically depend upon wholes, the strategies that accomplish the instantiations and the resolutions of form become significant as their primary signifier. Thus, part-wise should be acknowledged not as a static component but rather as an operation; it is a "performance" that enables the appearance of form in various instances. It is possible to observe two major strategies performed on instant wholes to activate the resolution; the first is marked by a tendency of recourse to conventions to facilitate a mereological piecing of form and the second is a project of naturalization to translate form into a mereological chunk of computable data.

Recourse to conventions has been a common trend in the conception and production of form in digital practices of early 1990s. In the absence of a vocabulary, both lexical and architectural, of architectural simples, architects have started to operationalize the known methods and techniques of understanding form. Although the computational processes of design were not necessarily concerned with mereological formation or proceed through mereological information, architects reverted form into a matter of parts by employing an unfamiliar mereological approach. By applying conventions of architectural drawing to *contrive* a mereological definition of form, instances of the *objectile* have been projected into a whole not composed of but rather performed with part-wises. Previously exercised techniques of representation, such as surface developments and sections, conducted and instructed the processes of architectural design by illustrating not only the organizational logic but also the material construction of the whole through dissections, flayings, strechings, peepings, and so on. These techniques have been re-utilized in such a way that to study a whole by parts, which did not initially construct the whole that they are *contrived* form and even were not present in the whole that they are supposed to construct. Among these conventional drawings and projection techniques, "sectioning" has been glorified as an omnipresent

performance to approach instant wholes as a constructed, rather than purely computed, entity. Consequently, the "section," which has been a mereological part of architectural form in conventional terms, has become an actual form of part that is both exclusive to and unrestricted by the whole it performs. In this regard, the section proceeds as an operation and a performance, thus should be acknowledged as *a form of contriving parts*, suggesting a mereology of the "part-wise." While Greg Lynn's branding of "Embryologic Houses" presented the typical conceptualization and application of section as the part-wise, NOX's FreshH_2O eXPO declared a manifestation of "hypersurface," within which the part-wises of section and of development were intertwined into "a bundle, a braid of splines."[251] Lynn explains what and *how* an embryologic house is:

> Using design techniques of flexible manufacturing borrowed from the automotive, naval and aeronautical design industries, every house in the line is of a unique shape and size while conforming to a fixed number of components and fabrication operations. The form and space of the houses are modified within the predefined limits of the components. In addition, a change in any individual panel or strut is transmitted throughout every other element in the whole.[252]

It is by the mereological insincerity of part-wise, which is immediate yet "anexact,"[253] exclusive yet unrestricted, that the "continuous differentiation" of the,

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[251] Lars Spuybroek. "Motor Geometry," in The Digital Turn in Architecture, 2013: 111.

[252] Greg Lynn. "Embryologic Houses," in The Digital Turn in Architecture, 2013: 125. First published in Contemporary Processes in Architecture | AD Profile 145, AD 70, May/June 2000: 26-35.

[253] Referring to Husserl's definition of rigorous "anexact geometry," Lynn states "these geometries can be determined with precision yet cannot be reduced to average points or dimension. Anexact geometries often appear to be merely figural in this regard. Unlike exact geometries, it is meaningless to repeat identically an anexact geometric figure outside the specific context within which it is situated." Greg Lynn. "Architectural Curvilinearity: The Folded, the Pliant and the Supple," in The Digital Turn, 2013: 29-44. Although the geometric figure of a part-wise is not the concern of mereology, the contextual nature of its definition is critical for acknowledging the ephemerality of its precise immediacy. See, Edmund Husserl, "The Origin of Geometry," Edmund Husserl's Origin of Geometry: An Introduction. Jacques Derrida, trans. John P. Leavey Jr., Lincoln and London: University of Nebraska Press Lincoln, 1989.

arguably nihilist, whole is managed. The augmented correspondence implied between form and space remains critical, yet both become architectural through a mereological performance between the part-wise and the instant whole, where whole is reluctant to occupy part-wises and part-wises are contingent on the instances of whole. As seen in the "mereological resolution" of Embryologic Houses, there is no definition of part toward *the* whole but rather there are instant wholes from which part-wises are *contrived*. Part-wise is a mereological hoax played by parametric design; it leaps between absence and presence.

Besides the digital re-utilization of conventional techniques in architectural drawing, a project of naturalization has been developed to achieve a purely computational definition of form. Naturalization means an extreme translation of information, occupying a substantially variant nature, into a quantified numerical language. Forcing an acute abstraction, naturalization brings forth virtualization, and thus dematerialization, which neutralizes visual, spatial, physical, structural, etc. properties of form into computable data. The *mereological resolution* performed to enable the naturalization of form can be assessed as "atomization." Atomization is an apathetic application usually based on a pattern superposed onto the instant whole to resolve it into mereological simples, or rather into "atoms." Atomization is performable both planarly and volumetrically depending on the nature of information going to be embedded in and thus become computable through the atoms. In other words, atomization is not solely a means of mereological resolution with an intended formal expression, but it is also a means of calculation, documentation and production, which render mereologically nihilist wholes into chunks of atoms – the part-wises *contrived* by atomization. The augmented abstraction enforced by atomization, the apathetic virtualization imposed by naturalization brings forth a "phenomenological remoteness," which radically deflects both the modes in which architectural form is conceived and produced and the ways through which it is perceived and interpreted.

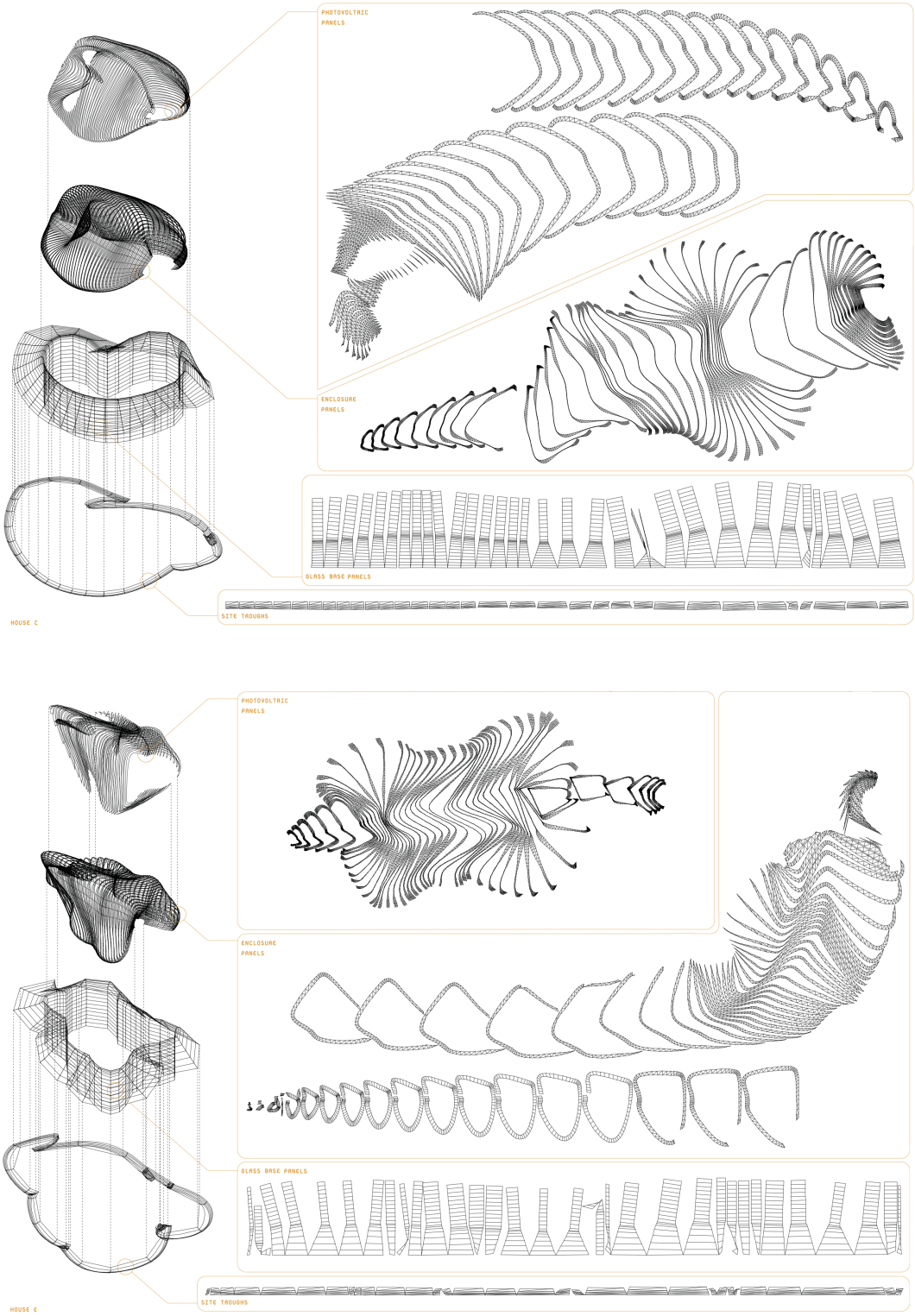

Figure 41. "Mereological resolution" of Embryologic Houses, Greg Lynn.

[The Digital Turn in Architecture, 2013: 128-129.]

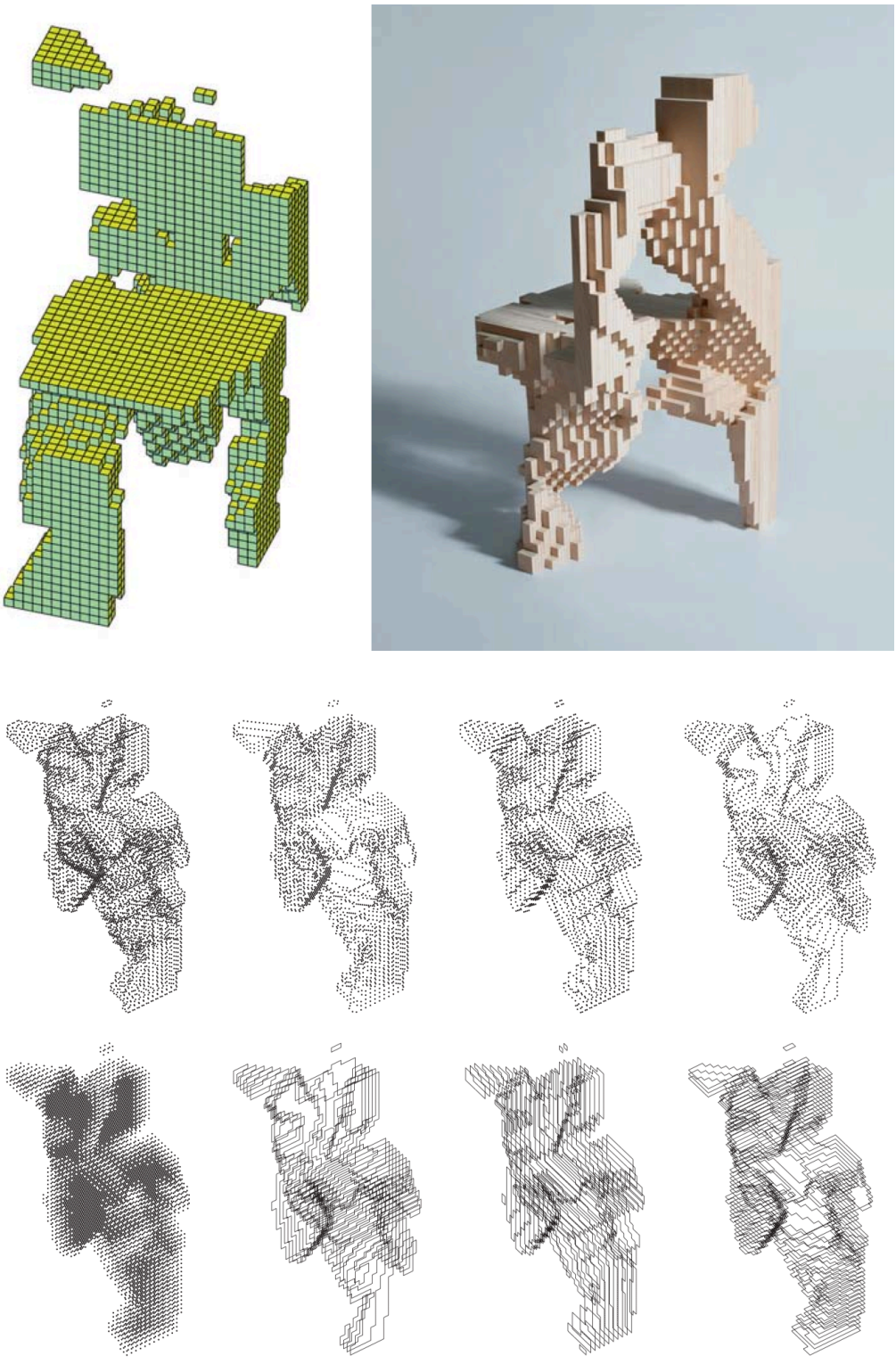

Figure 42. "Voxelization" in Computational Chair, EZCT Architecture & Design Research.
[The Digital Turn in Architecture, 2013: 200.]

Among various strategies of atomization developed by computation technologies, "tessellation" and "voxelization" represent two fundamental approaches in atomization. Tessellations recognized as the application of two-dimensional triangular or polygonal patterns, designate a top-down approach, with an inescapable formal preference, to *contrive* atoms from an instant whole and thus contribute to the pragmatics of the surface. On the other hand, voxelizations are performed to *contrive* three-dimensional atoms and converts an instant whole into a chunk of "voxels," regardless of the formal or spatial attributes of the instant whole. While in voxelization, the voxels may be atomized as formally and volumetrically identical, the part-wises atomized by tessellation, usually differ in extent yet remain morphologically identical. Carpo praises voxel over spline in claiming that spline was "a tool for simplification," whereas voxel is "a tool for coping with, managing and some would even say extolling complexity."[254] Referring to a departure from digital design approaches and computational technologies of the 1990s, he states that "[y]esterday's spline-dominated environment was elegant and modern; today's data-driven design environment is necessarily post-modern: disconnected, broken, fragmentary, rickety, patchy, and aggregatory,."[255] Carpo will presumably be celebrating the voxel and its competences in responding and reflecting the messiness of complexity and the "big data" in his forthcoming book *"The Second Digital Turn: Design Beyond Intelligence"*.[256]

As indicated, tessellation and voxelization are not merely formal performances operated on instant wholes to enable its material and physical fabrication but they are rather computational methods used to calculate and predict the real-world behavior of a digital object. The atomization procedure that these methods suggest is called

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[254] Mario Carpo. "Breaking the Curve: Big Data and Design," Artforum, February 2014: 173.

[255] Ibid.

[256] Mario Carpo. The Second Digital Turn: Design Beyond Intelligence. Cambridge, Mass.: The MIT Press, 2017 [forthcoming].

"finite element analysis" or "finite element method." The explanation of FEA software developed by Autodesk is as followed:

> Finite element analysis (FEA) is a computerized method for predicting how a product reacts to real-world forces, vibration, heat, fluid flow, and other physical effects. Finite element analysis shows whether a product will break, wear out, or work the way it was designed. It is called analysis, but in the product development process, it is used to predict what is going to happen when the product is used.
>
> EA works by breaking down a real object into a large number (thousands to hundreds of thousands) of finite elements, such as little cubes. Mathematical equations help predict the behavior of each element. A computer then adds up all the individual behaviors to predict the behavior of the actual object.[257]

Although a digital object, *objectile*, is initially conceived, and eventually going to be produced, with a mereological nihilism, its design in computational environment nevertheless necessitates a mereological approach to form by instantiating it as a whole of parts – of part-wises that are either discrete or anexact. While tessellation and voxelization may remain as analytical tools in the processes of design and desaturated in formal expression, it should be acknowledged that both are computational methods disciplined by mereology and significantly instruct architectural form by contriving part-wises.

Atomization can be utilized to develop structural solutions and further be extended into an expression of form itself. 15th Venice Architecture Biennale (2016), curated by Alejandro Aravena, accommodated an outstanding instance of atomization as part of the exhibition held at the Arsenale. The centerpiece of the exhibition *"Beyond Bending – Learning from the Past to Design a Better Future"* was the Armadillo Vault – a freeform stone shell. The Armadillo Vault is the result of an intensive collaboration between the Block Research Group, ETH Zurich, Ochsendorf DeJong & Block (ODB Engineering), and the Escobedo Group. The structure is described as

[257] Finite Element Analysis (FEA) software by Autodesk. https://www.autodesk.com/solutions/finite-element-analysis. [Last accessed in August 10, 2017].

"an unreinforced, freeform vault consisting of 399 discrete limestone blocks with thicknesses ranging from 5 to 12 cm."[258] There is no mortar used between the blocks and it spans 15 m in pure compression. The processes of computational design and digital fabrication include "the form-finding process of the shell's funicular geometry, the discretization of the thrust surface, the computational modeling and optimization of the block geometry, and the machining process."[259] The design of tessellation is at the intersection of problem definition, which is defined as a task to achieve a freeform vault in compression, and of the fabrication and assembly requirements, which necessitate a hybridization of traditional and digital techniques in masonry construction. It is also an architectural challenge as the intended form is free-standing, yet have to interact with the venue, which is historically and spatially distinct. The process of design initiated with form-finding oriented toward outlining a whole to foster a spatial integration with Arsenal and also to increase the structural challenge of computing and fabricating a freeform vault. Form-finding is refined by optimization and tessellation through which *part-wises are contrived* to enable the construction of the vault. To illustrate:

> The special geometry of the vault, which allows it to stand like a three-dimensional puzzle – subject only to compression loading – was the outcome of a form-finding and optimization process […] The form of the vault was divided into courses, which in turn were articulated into individual blocks. By staggering the block and aligning the courses in accordance with the flow of forces and the edge lines, a stable interlocking of all stones was guaranteed.[260]

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[258] Matthias Rippmann, Tom Van Mele, Mariana Popescu, Edyta Augustynowicz, Tomás Méndez Echenagucia, Cristián Calvo Barentin, Ursula Frick, and Philippe Block. "The Armadillo Vault: Computational Design and Digital Fabrication of a Freeform Stone Shell," presented at Advances in Architectural Geometry (AAG) held at ETH Zurich in September, 2016. Eds. Sigrid Adriaenssens, Fabio Gramazio, Matthias Kohler, Achim Menges, Mark Pauly, conference proceedings: 345.

[259] Ibid.

[260] Philippe Block, Tom Van Mele, Matthias Rippmann, Matthew DeJong John Ochsendorf, Matt Escobedo David Escobedo. "Armadillo Vault - An Extreme Discrete Stone Shell," DETAIL, 10 Issue on "Roof structures," October 2016: 942. For design, fabrication and installation processes see the video available at http://www.armadillovault.com/video/ [Last accessed in August 10, 2017].

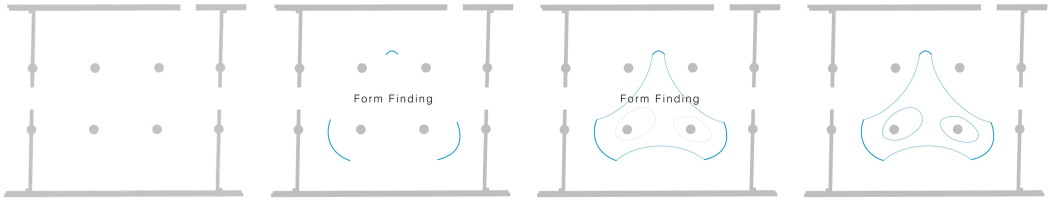

Figure 43. Form-finding process in the design of the Armadillo Vault.
[Produced by the author from the video available at http://www.armadillovault.com/video/]

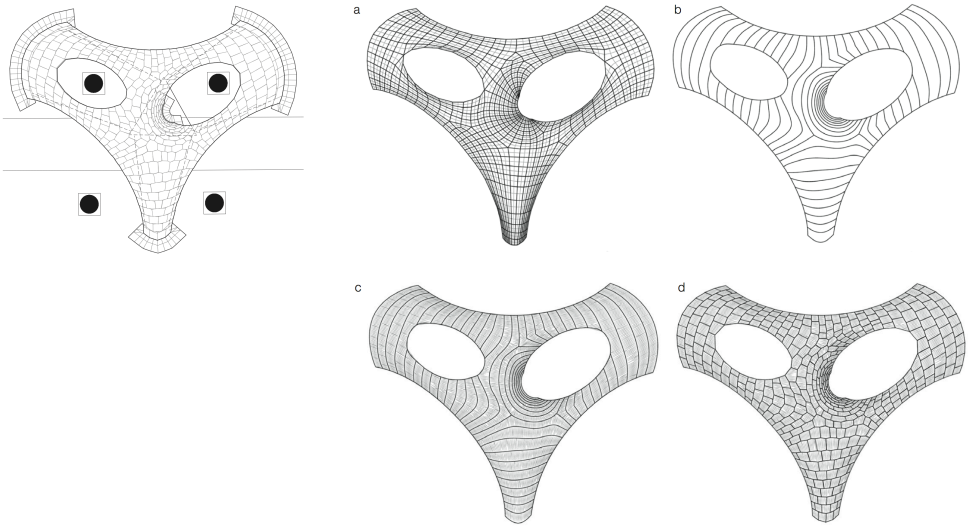

Figure 44. Tessellation design of the Armadillo Vault.
[Block Research Group et al. "Armadillo Vault - An Extreme Discrete Stone Shell," 2016: 941, 944]

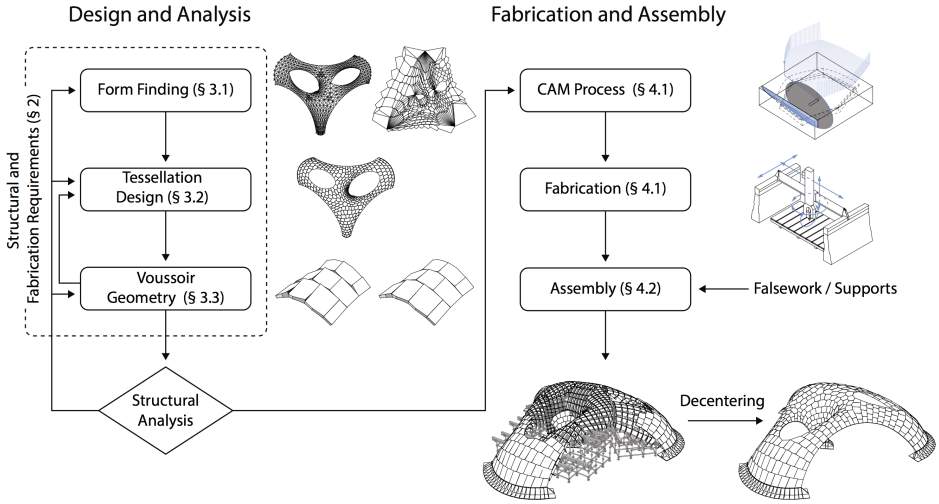

Figure 45. Tessellation design of the Armadillo Vault.
[Block Research Group et al. "The Armadillo Vault," 2016: 349.]

Although the vault as a whole does not formally based on tessellation and on the individual blocks, the "voussoir"s, *contrived* by tessellation, it structurally depends on them. In this regard, the atomization, embraced after the process of form-finding in order to optimize the structural design and the processes of fabrication and assembly, presents a peculiar mereological approach where parts that are supposed to construct the whole are introduced *a posteriori*. Regarding the case of the Armadillo Vault, the whole is not ontologically founded on the parts since parts are not defined by "being-part" of that particular whole but rather *contrived* from the whole. Thus, a voussoir in the Armadillo Vault is a *part-wise* that performs together with other part-wises to instantiate the vault as a whole without constructing any ontological attachments to it.

Figure 46. The Armadillo Vault at Venice Architecture Biennale 2016.
[Photographed by Esatcan Coşkun.]

Atomization is not only a methodological approach embraced in the computational processes of design or structural analysis but also is a highly prevalent system in digitized processes of production and documentation. Extreme forms of atomization can be illustrated by the mechanisms of 3d-printing and laser-scanning, both of which apply a brute resolution of the whole, regardless of its nature as an objectile or as an artifact, into part-wises that are at the threshold of perception and cognition. In 3d-printing, or rather in general terms additive manufacturing, the digital model of an object is encoded and transferred in a file format called STL, which is commonly assumed as an abbreviation of stereolithography, yet it is also referred as "Standard Triangle Language" or "Standard Tesselation Language." STL files stores the information of the object by encoding its surface geometry through tessellation and disregards all other properties of the object intended to embody, such as color, texture, material, scale etc. The object is atomized into a chunk of infinitely many triangles described in three-dimensional Cartesian coordinate system. STL file is further processed by an operation called "slicer," which converts the tessellated chunk into a series of thin layers to instruct the process of additive manufacturing. Layer thickness is identified by resolution in dot per inch (dpi) or micrometers (μm), which means that each layer is then atomized into point-like particles, "3d dots" in a specific diameter determined by the resolution of the printer. In short, to enable the production of a digital object by additive manufacturing, the object is subjected to a series of atomizations based on different patterns and systems of resolution through which the object is successively redefined as a whole with varying part-wises.

On the opposite side of the material production of a digital object is the digital documentation of a material object. Laser scanning is a commonly known and practiced methodology since the turn of the century, for digitally encoding a physically existing artefact, building or even a field. Replaced as the primary means of exploration and representation of objects, yet to be constructed, drawing is also abandoned as a tool of documentation. Contemporary processes of documentation can hardly be called as "survey", which is conducted as a series of in-situ analysis

based on drawing and mapping practices supported by tools and machines of measurement. Conventionally, surveys include a thorough understanding of a site or an artefact in consideration. The process is pre-structured but also in a flux of drawing, writing (describing), photographing, and measuring. Surveys used to be considered as critical practices of understanding as well as analytical processes of documentation. On the other hand, mechanical and operational systems of contemporary tools of documentation are based on a homogenization of the artefact or the field in consideration. Three-dimensional laser scanning works as a recording mechanism that only receives and collects the data of points in coordinates and colors. Laser scanner sends a laser beam toward the object to be scanned, and then receives the laser beam reflected from the surface of the object. By processing the information of return time, the scanner calculates the distance of that particular point on the surface of the object and generates three-dimensional coordinates of that point relative to the scanner's position. This procedure is repeated through multiple stations that the scanner is set so as to scan the artefact or the field in all possible directions. The result is a "point cloud," which digitally encodes and represents the scanned object – the artefact or the field being scanned is recognized as an undifferentiated whole, which is reduced, or rather, resolved, into and redefined as a "cloud" of infinitely many number of points. In other words, the object is forced to an extreme naturalization and homogenization that is far beyond any conceptual or formal abstraction. By means of laser scanning, the object is atomized into points flying in the digital space and converted into an extremely precise yet volatile whole, which is identified as a cloud.

Atomization, as a mereological performance for contriving part-wises and thus for achieving a definition and conception of the objectile as a whole, is a powerful methodology in managing the complexity of form in digital environment as long as its implications on the disciplinary products of architecture are acknowledged. Computational processes enforce naturalization and push architectural form to the extremity of abstraction by entirely redefining it by means of atomization. What is at

stake is the "architecturalness" of form, as it is, arguably, desaturated for the sake of the augmented codification of form as a whole with infinitely many number of points, dots, triangles, polygons, or cubes. It is possible to argue that atomization results in a "methodological absurdity" and "redundant precision,"[261] unless the critical distance between "accuracy" and "precision" is acknowledged. In *"Architecture of Error,"* Francesca Hughes inquires into historical and contemporary approaches to the notion of precision alongside the various struggles to escape "error" in different fields and claims that,

> [The] interface between mathematical theory and observable experiment is key to understanding the role of precision in the domains from which it was imported into architecture […] the methodologies of industrialized manufacturing, military, and medical operative strategies and, more recently, the unparalleled promiscuity of software that can model cars, black wholes and buildings all in the same breadth.[262]

5.1.3 Whole-wise | Inflections

In addition to resolution and the performance of the part-wise it elicits as methodological approaches widely embraced in computational design to manage the mereological nihilism of the objectile under the influence of continuity, it is possible to disclose a counter approach in the conception and production of form, which is predominantly based on the possibilities of part as a mereologically expanded concept. Toward the end of the 1990s, architectural field has started to accommodate various studies focusing on the pragmatics of parts and the behavioral patterns in their accumulation or coexistence. Architects have advanced not only concepts but also products to define the contemporary mereological simples of architecture in digital age, which would be accepted and treated as *a priori* in the design process. As

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[261] Francesca Hughes. The Architecture of Error: Matter, Measure, and the Misadventures of Precision. Cambridge, Mass.: The MIT Press, 2014: 5.

[262] Ibid. 29.

mereological simples were introduced to act as the new "building blocks," computational design research has been condensed around the methods and strategies to process these mereological simples toward a "togetherness," which is unpredictable yet computable; which is contingent and yet producible. Such togetherness, resulting from the mere coexistence of parts critically approaches to an aggregate in Husserlian terms, cannot be mereologically acknowledged as a whole but rather as a "whole-wise," toward which parts are not aggregated but rather "inflected." Whole-wise, similar to part-wise, is not a static entity or a destined end product but instead it is an operation through which the pragmatics mereological simples could be studied and developed. As opposed to *resolutions* by means of which *part-wises are contrived from instant wholes*, in *inflections* the *whole-wises are contrived from mereological simples*.

Inflection is not an unfamiliar concept for architectural design and theory. Trystan Edwards coined the term "inflection" in his treatise on aesthetics *"The Things Which Are Seen: A Revaluation of the Visual Arts"*[263] first published in 1921. To formulate a "grammar of design," he elaborated formal relationships, namely number, punctuation and inflection. Edwards applied these three canons to architecture in *"Architectural Style"*[264] (1926), which later published with the title *"Style and Composition in Architecture: An Exposition of the Canon of Number, Punctuation and Inflection."* He sought for a grammar of design by establishing a set of criteria of judgment "between things and ideas, between matter and mind." Although his works on architecture usually coupled with the notion of "style," Edwards emphasized that style is secondary to the compositional rules and attempted to provide a grammar for logical justification independent of historical styles. His initial ideas on inflection in *The Things Which Are Seen* are multifaceted; he unfolds the

[263] Trystan Edwards. The Things Which Are Seen: A Revaluation of the Visual Arts. London: Philip Allan & Co, 1921.

[264] Trystan Edwards. Architectural Style. London: Faber and Gwyer, 1926.

concept by references and examples from various fields ranging from language to nature.[265] The essence of Edwards' conceptualization is captured in his following statement that "inflection is a certain sensitiveness to similarities and differences"[266] – a definition of which will be critically influential on theories of architecture and design regarding the re-conceptualizations of part and whole.

Venturi, half a century later than Edwards, embraced the notion of inflection as an architectural strategy toward "the difficult whole,"[267] where "the whole encourages the fragmentary part."[268] According to Venturi, "the degree of wholeness can vary"[269] and he acknowledges inflection as an operational and perceptual structure that unifies the discontinuity of diverse parts into an implied whole. Venturi's *Complexity and Contradiction* presented the first thorough account on inflection as an architectural strategy toward complexity and a marginal assessment on the relationality of part and whole:

> Inflection in architecture is the way in which the whole is implied by exploiting the nature of the individual parts, rather than their position or number. By inflecting toward something outside themselves, the parts contain their own linkage: inflected parts are more integral with the whole than are *un*inflected parts. Inflection is a means of distinguishing diverse parts while implying continuity. It involves the art of fragment […] In terms of perception it is dependent on something outside itself, and in whose direction it inflects.[270]

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[265] Trystan Edwards. The Things Which Are Seen, 1921: 193-210.

[266] Ibid. 194.

[267] See Robert Venturi, "The Obligation Toward the Difficult Whole" in Complexity and Contradiction, 1977: 88-105.

[268] Ibid. 88.

[269] Ibid.

[270] Ibid. 88, 90 [Italics original].

The notion of inflection made its way into contemporary theory by Bernard Cache's conceptualization of the term as a theoretical image of the "fold" in his seminal work *"Earth Moves: The Furnishing of Territories"* published in 1995. Although it is a far-fetched attempt to seek a continuity between Edwards and Cache, the trilogy of Edwards's grammar of design based on the formal principles of number, punctuation and inflection astonishingly resonates in Cache's classification of images in respect to the formal elements: inflection, vector and frame. Not only the trilogy but also the intention to formalize principles and elements that are present beyond historical styles and periods is common in both works regarding Cache's claim that:

> Inflection, vector, and frame would constitute an alphabet whose rules are never determined but are always determinable, as they are always present in the images that have been elaborated throughout the ages, even if each period, each artist, or each work emphasizes one or another of these elements and must each time invent its own modes of configuration.[271]

Concentrating back on the concept of inflection, Anne Boyman, translator of Earth Moves, indicates in the preface that inflection "involves a flexible kind of continuity that is not totalized, finalized, or closed."[272] Cache's conception of inflection is identified as an "intrinsic singularity,"[273] where relations suspend and multiplicities are condensed into an unlimited space. Deleuze refers Cache and his conception of inflection in *The Fold: Leibniz and the Baroque* and declares "inflection is the ideal genetic element of the variable curve or fold."[274] Inflection is both a state of things and a way of looking at things, which initiates a process between generation and perception.

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[271] Bernard Cache. Earth Moves, 1995: 2.

[272] Ibid. See, Anne Boyman, "Translator's Preface" in Earth Moves, 1995: x.

[273] Ibid. 17.

[274] Gilles Deleuze. The Fold, 2006: 15.

The recent appearance of the term inflection is found in Schumacher's theory of elegance. Based on the conceptualization of the term suggested by Venturi, Schumacher interprets inflection as a compositional principle that is practical in understanding the methodological approaches embraced in computational design. He instrumentalizes inflection as a strategy of "self-organization," which is a phenomenon to indicate the inner working of complex systems in respect to the theories of emergence. Schumacher assesses Venturi's "difficult whole" as a "compositional integrity of diversity"[275] and suggests that:

> The concept of inflection can be generalized so that elegance requires that the layers and subsystems of a complex composition are mutually inflected. Every new element or new layer that enters the complex will both inflect the overall composition and will in turn be inflected.[276]

Acknowledging all layers of meaning in theorizations of the concept of inflection in architecture, it is possible to develop an understanding of inflection as a methodology of the whole-wise, by means of which architectural form is explored with an awareness of coexisting similarities and differences next to continuities and fragmentations in an unrestricted field of variations. Yet, it should also be acknowledged that the *contrived* whole-wise is never exclusive to the parts, as the *inflected* parts are never exclusive to "a" whole-wise. Inflection maintains the contingent relationality between parts, as mereological simples, and whole-wises, as mereological aggregations of these simples, in such a way that when the motive or direction of inflection deflects, the whole-wise deviates into another variation and when the inflection collapses, the forces that inflect parts toward the whole-wise dissolves with it.

Although inflection suggests a strong theory of flatness in the ontological definition of part and whole, its applications in computational design proliferated in its

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[275] Patrik Schumacher. "Arguing for Elegance," AD | Elegance, vol. 77, issue 1, January/February 2007: 32.

[276] Ibid.

contrived versions. The urge to define mereological simples of architecture was prevalent in computational design research at the turn of the century as a methodological strategy to explore possibilities in architectural form. While these mereological simples can be selected from formally familiar building blocks, they can also be generated by tools of computation. It is hardly controversial to claim that Lynn's experimentations on "Blobwall" explicitly illustrate the attempt in redefining mereological simples of architecture:

> The design of Blobwall begins with a redefinition of architecture's most basic building unit – the brick – in lightweight, plastic, colourful, modular elements custom-shaped using the latest CNC technology. The freestanding, indoor/outdoor wall system is built of a low-density, recyclable, impact-resistant polymer. The blob unit, or 'brick', is a tri-lobed hollow shape that is mass-produced through rotational moulding.[277]

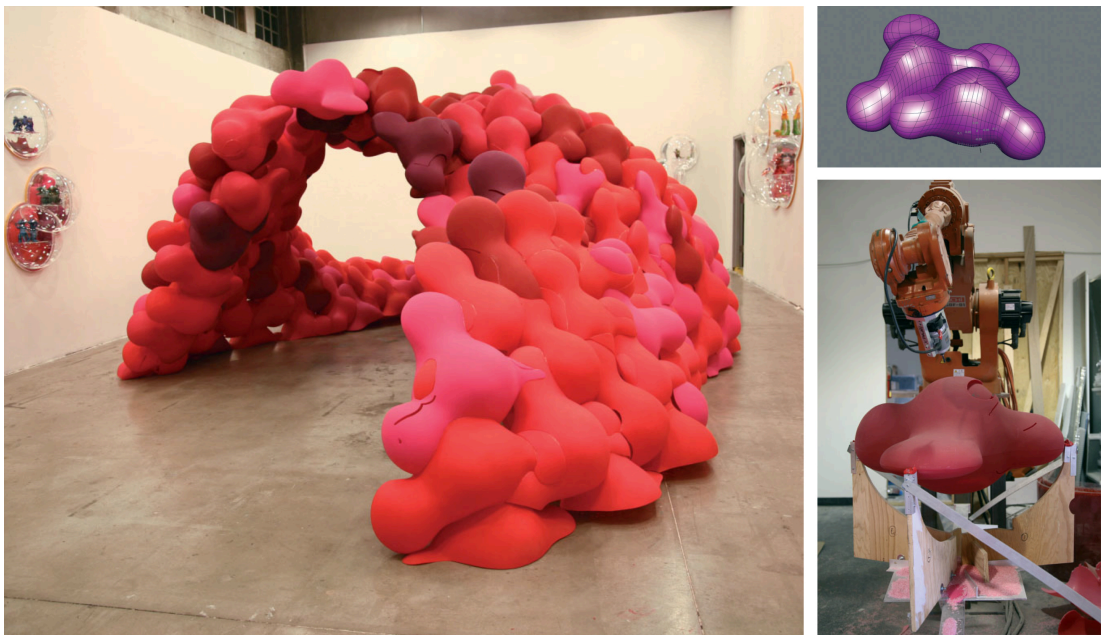

Figure 47. The Blobwall as a "whole-wise," Greg Lynn.

Left: The Blobwall at "Greg Lynn FORM: Blobwall Pavilion," an exhibition at SCI-Arc in Los Angeles, 2008; *top-rigt:* Screen capture of two blob units being intersected in Maya; *bottom-rigt:* A blob unit being cut by a rotational moulding machine. [Greg Lynn. "Blobwall," 2009: 96-99.]

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[277] Greg Lynn. "Blobwall 2006-2008 by Greg Lynn FORM" AD Special Issue | Closing the Gap, vol.79, issue 2, March/April 2009: 96.

Leaving aside the abundance of terms from computational lexicon used to describe the material properties and the fabrication processes, the blob unit is a declaration of part as an architectural form, which intends to change not only its mereological definition but also the ways through which it operates when freed from the subordination of the whole and from the conventional practices of construction. Yet, the blob units and their production as individual self-contained entities is only a starting point in the process toward the Blobwall. The intended wall is not constructed by stacking the identical pre-manufactured blobs, which are ready to be used in their initial state.

A blobwall has to be fully modeled in digital media using 3d modeling or animation software such as 3dsMAX or Maya. What is critical in the digital model is that the individual blob units are not solid entities in this virtual environment; their immateriality allow their violent juxtapositions, intersections, superpositions, penetrations, etc., meaning that the self-contained nature and the smooth continuity of the polymer surface of the blob unit is virtually preserved. However, to enable the material execution of the blobwall, the individual blocks should be "customized" and stripped from their indifference, in other words, what is left after juxtapositions and superpositions should be determined for each individual blob unit. Using Boolean functions, a process of subtracting the overlapping volumes between the individual blob units starts. Yet, it should be noted that the choice of which blob unit should be located first and how the following unit should be customized in such a way that it will be added as if it really intersects or penetrates through that preceding unit is arbitrary, or rather, contingent upon designer's choice and is not guided or determined by a computational algorithm. After each and every individual blob unit is modified by a series of subtract operation, the "successor" blob units are acquired. Each blob unit, both the initials and the successors, are labeled to specify its location and to guide the process of assembly. The information regarding the three dimensional extents of these successor blob units is then sent to a 5-axis routing machine by means of which each individual self-contained blob unit is cut (see

Figure 47) After all the blob units are cut, "[e]ach wall is *assembled* from individual robotically cut hollow bricks that *interlock with exact precision*."[278]

There is a leap between the individual blob unit and the Blobwall. Neither the blob unit has an affect on the form of the Blobwall, nor the Blobwall necessitates the individual blob unit to embody a tri-lobed hollow shape. The process of heavy customization sustains their contingent relationality. In this regard, each variation of the Blobwall performs a whole-wise; it is *contrived* alongside rather than constructed by the parts. In "The Whole and Its Parts," Deleuze and Guattari strictly rejects "the myth of the existence of fragments that, like pieces of an antique statue, are merely waiting for the last one to be turned up, so that they may all be glued back together to create a unity that is precisely the same as the original unity."[279] They continue as:

> [W]e are struck by the fact that all the parts are produced as asymmetrical sections, paths that suddenly come to an end, hermetically sealed boxes, noncommunicating vessels, watertight compartments, in which there are gaps even between things that are contiguous, gaps that are affirmations, *pieces of a puzzle belonging not to any puzzle but to many, pieces assembled by forcing them into a certain place where they may or may not belong, their unmatched edges violently bent out of shape, forcibly made to fit together, to interlock, with a number of pieces always left over*.[280]

Regarding Deleuze and Guattari's statements, the Blobwall could be approached as an unfinished or an unrestricted puzzle, the pieces of which are not exclusive to it. Although its premises stem from the idea of inflection, the Blobwall, regarding its material instance, can hardly be assessed as an inflection as the process of customization brutally intervenes in the nature of the parts to *contrive* the whole-wise rather than inflecting them toward an implied whole by embracing their individuality and multiplicity. The field of possibilities discovered by the Blobwall remains

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[278] Ibid. [Emphasis added].

[279] Gilles Deleuze and Félix Guattari. "The Whole and Its Parts," 2009: 42.

[280] Ibid. 42-43 [Emphasis added].

valuable regarding the attempt to redefine the mereological simples of architecture and the questioning of the relationality between part and whole as a performance rather than a predefined set of principles to be followed. The concept of inflection extensively influenced the studies in computational design research and utilized as a methodology to manage the contingency of parts and to contrive genuine statements on the definition of the whole. The outstanding performances of inflection have been developed particularly through the combinations of material, behavior and data, which are typically represented by the works of Achim Menges and Gramazio Koehler Research (See Figures 48-49).

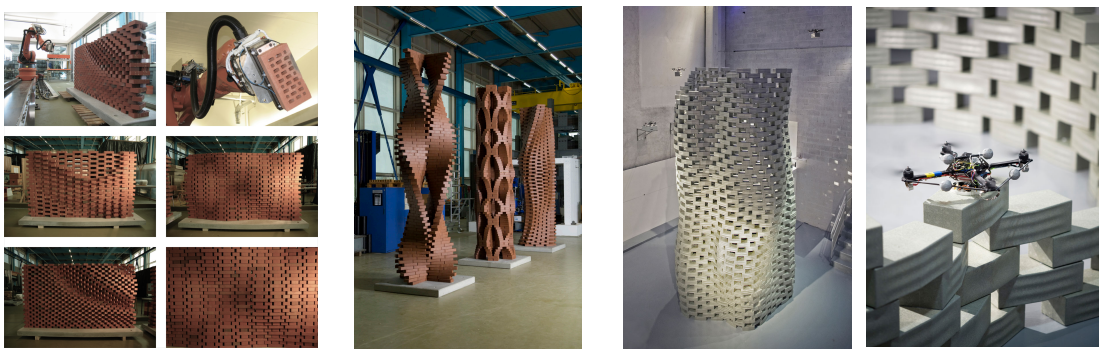

Figure 48. "Inflections" - Spatial dispositions of bricks, Gramazio Koehler Research.

Left: The Programmed Wall, ETH Zurich, 2006; *middle:* The Programmed Column, ETH Zurich, 2010; *right:* Flight Assembled Architecture, architectural installation at FRAC Centre Orléans. [http://gramaziokohler.arch.ethz.ch]

Figure 49. "Inflections" - Additive digital fabrication of structural frameworks in wood, Gramazio Koehler Research.

Left: The Sequential Wall, ETH Zurich, 2008; *right:* The Sequential Structure, ETH Zurich, collaboration with Block Research Group, 2010. [http://gramaziokohler.arch.ethz.ch]

What is critical, both for part-wise and whole-wise, is that the form is no longer exclusive to architecture; neither parts nor wholes are fairly architectural. Part-wise and whole-wise arrest as much as they emancipate in the conception and production of architectural form. The methodological approaches developed on the basis of part-wise and whole-wise are theoretically and practically significant in the digital age, where epistemologies of part and whole radically deflect and the discipline of architecture seeks for a redefinition of its mereological formation in respect to the theories of emergence and the ontology of "flatness."

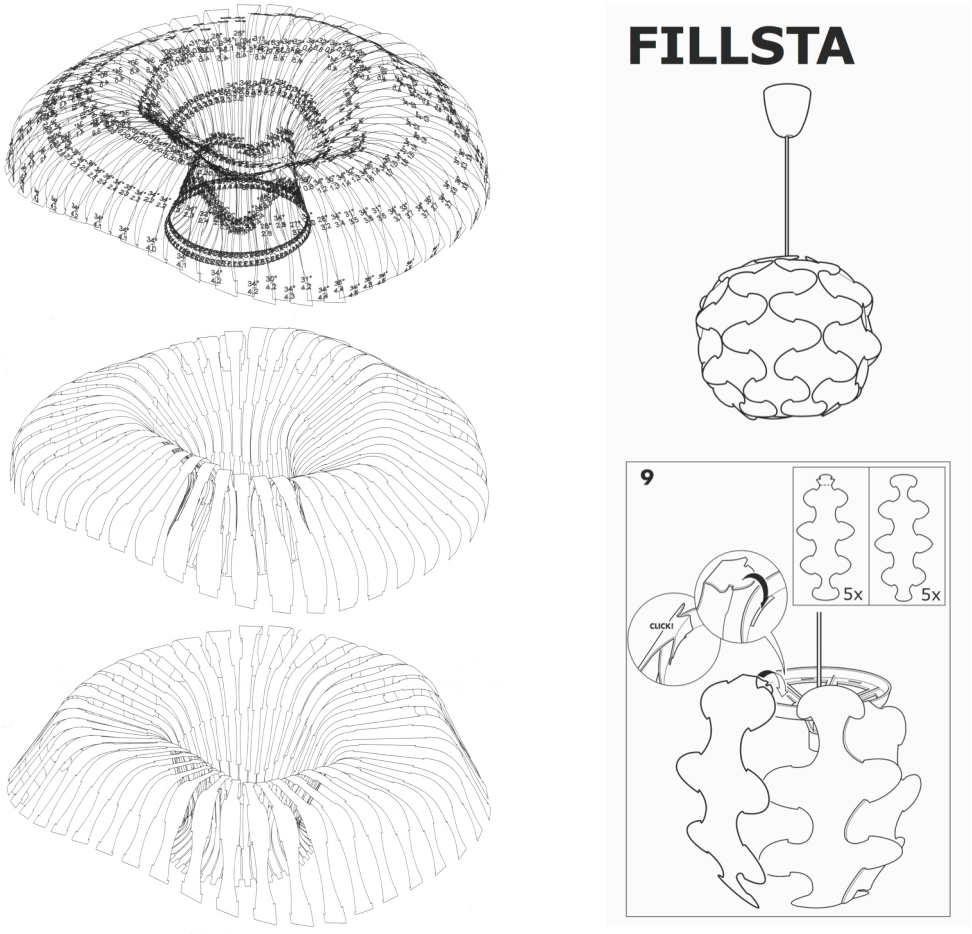

Figure 50. Part-wise and whole-wise at the threshold of architectural form.
Left (3): Achim Menges and Jan Knippers, ICD/ITKE Pavilion, Stuttgart 2010 [Theories of the Digital in Architecture. Eds. Rivka Oxman and Robert Oxman. London; New York: Routledge, 2014: 384]; *right:* IKEA Fillsta Lamp [assembly instructions].

5.2 Parts as Wholes | Wholes as Parts: Emergent Flatness

When form is emergent, rather than composed, the critical vocabularies formalized to understand or identify the form become definitive of the properties of the processes that generate the form. It is possible to claim that architectural vocabularies conventionally condense around the definition of parts with their tasks and competences due to the epistemological primacy attained by the concept of part in architecture. However, in the paradigm of complexity the majority of the lexicon denotes the properties or principles of the processes that generate form rather than the form itself and thus the properties or aspects of form becomes dependent on and identified by the properties of the processes of its generation. Under the dominance of theories of complexity and emergence, architecture is obliged to reformulate the disciplinarity of design and redefine the ways of acquiring and disseminating knowledge by displacing its products – namely the architectural form.

Digital media and computation technologies presented a new paradigm to architectural design through the possibility of directly working with "deeper relational structures"[281] such as computer codes. Pablo Lorenzo-Eiroa claims that the emphasis has been shifted from an understanding of "perceptual structures" to "conceptual structures,"[282] which results in a critical re-definition of architecture and its disciplinarity:

> Computation not only informs implicit formal processes, but classifies and creates signifiers – re-defining architecture. Software then becomes a meta-ahistorical deterritorialization machine that encompasses the discipline by finding novel means to constitute form.[283]

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[281] Lorenzo-Eiroa, Pablo. "Form:in:form, On the Relationship Between Digital Signifiers and Formal Autonomy." Architecture in Formation: On the Nature of Information in Digital Architecture. Eds. Pablo Lorenzo-Eiroa and Aaron Sprecher. London: Taylor & Francis, 2013: 10-21.

[282] Ibid.

[283] Ibid. 21.

With the growing influence of information technologies and digital media and the theoretical field expanded by Deleuze and Guattari's *A Thousand Plateaus*, architecture has started to assimilate the concepts folding, assemblage, body without organs and so on for the sake of promoting an understanding what is architectural by its dissolution into networks of relations, lines of flight, flows of information, intensities of matters, vectors and speeds, and ever-transforming processes. While Lynn worked on conceptualizing "fold" as an operational strategy to overcome the dialectical oppositions between part and whole, inside and outside, figure and ground, etc., Schumacher declared "parametricism" as a "global style," which aims at relationality on the scale of systems rather than parts and wholes. Lynn describes the formation of the fold as followed:

> A folded mixture is neither homogeneous, like whipped cream, nor fragmented, like chopped nuts, but smooth and heterogeneous. In both cooking and geology, there is no preliminary organization which becomes folded but rather there are unrelated elements or pure intensities that are intricated through a joint manipulation. Disparate elements can be incorporated into smooth mixtures through various manipulations including fulling.[284]

Lynn's elaboration of the fold as an operational space where elements come and act together toward a whole that does not undermine or suppress but rather embrace the peculiarities of its ingredients and appears along their intricacies. On the other hand, Schumacher articulates parametricism as:

> Parametricism involves a conceptual shift from part-to-whole relationships to component-system relationships, system-to-system relationships and system-subsystem relationships. Parametricism prefers open systems that always remain incomplete; that is, without establishing wholes. As the density of associations increases, so components may become associated in multiple systems. The correlation of initially independent systems implies the formation of a new encompassing system.[285]

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[284] Greg Lynn. "Folding in Architecture," in The Digital Turn in Architecture, 2013: 31.

[285] Patrik Schumacher. "Parametricism," 2009: 23 [see, note 7].

Although theories of complexity and emergence demanded a transposition in the discourse of parts and wholes, architectural design lingered around the formal possibilities and variations of the non-standard. Architectural form was either a surface of continuous variation or a chunk of interacting entities for the computational design research and practices in the 1990s. The process and the method are praised over the product by instrumentalizing computation as the means of endorsing complexity. The inherent complexities of architectural design have been suspended in favor of discovering the complexities of computational design, which ultimately re-framed the epistemologies of design. As architectural design has been stripped off from its disciplinarity and generalized within the contemporary culture of computational design, the architectural form obscured into flows and processes, where it was naturalized to be "represented" by a script or an algorithm. The "architecturalness" of form faded under the heavy abstraction forced by computation and was re-formalized as a relational structure of numerical, or rather, quantitative data. Tom Wiscombe argues the implications of the deep naturalization enforced through computational design processes on the architectural form and confirms that:

> [Y]ou loose too much information when everything in an architectural problem has to be processed through an algorithm. Inputs are forced to become quantitative or otherwise abstract in order to be able to be computed, so it is not surprising that outputs are also anemic.[286]

The architectural form is arrested in the field of computation where cars and black holes can be modeled in the same software and atmospheric conditions and city sprawls can be explained likewise as parameterized phenomena. Acknowledged as a complex structure, "*how* architectural form is" overwhelms "*what* architectural is" and radically deflects the methodological and epistemological approaches used to conceive and produce it. Where wholes are no longer the ultimate ends and the parts

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[286] Tom Wiscombe. "A Higher Order of Organizational Complexity," interview by Ralf Broekman and Olaf Winkler in BUILD magazine, March 2010. Available at Tom Wiscombe Architects website: <http://projects.tomwiscombe.com/filter/interviews/INTERVIEW-BYOLAF-WINKLER>
[Last accessed in August 12, 2017]

are no longer the sole means of composing and decomposing the wholes, the mereology of architectural form needs to be transposed so as to render the concept of part and whole transposable in order to achieve a thorough understanding of "flatness." Architectural form anticipates to be re-conceptualized as a disciplinary product of architecture where the conditions of being part and being whole are circumstantial and contextual; and the flatness of form is "emergent."

5.2.1 Flatness as a Representation

In his seminal article entitled *"Architecture of Complexity"*[287] (1962), Herbert Simon elaborates the concept of complexity and analyzes the ways in which complex systems are organized and can be described. He identifies complex systems as "made up of a large number of parts that interact in a nonsimple way"[288] and emphasizes that the main problem of complexity stems from the difficulty of representing complex systems. According to Simon, the "representation" of complex systems directly depends on the ways *how* that system is structured; *how* it works, adapts, responds and/or evolves; and thus *how* it becomes legible and intelligible. Simon initially addresses to the notion of hierarchy and how it becomes instrumental in interpreting different forms of complexity. He rejects the conventional apprehension of the term hierarchy that narrows the meaning down to a "formal organization, [where] each system consists of a 'boss' and a set of sub-ordinate systems."[289]

Simon introduces hierarchy in a broader sense to indicate a "formal hierarchy" as a governing principle found in "complex systems analyzable into successive sets of

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[287] Herbert Simon. "Architecture of Complexity," Proceedings of the American Philosophical Society, vol. 106, no. 6, December 1962: 467-482.

[288] Ibid. 468.

[289] Ibid.

subsystems."[290] Covering a range of social, biological, physical, and symbolic systems, he unfolds and expands the concept of hierarchy as a form of developing complex structures by introducing the notion of "flatness." Simon remarks to the non-uniform and seemingly random distributions of parts in biological and physical systems as complex structures that are actually analyzable through "flat hierarchy":

> [A] diamond is hierarchic, for it is a crystal structure of carbon atoms that can be further decomposed into protons, neutrons, and electrons. However, it is a very 'flat' hierarchy, in which the number of first-order subsystems belonging to the crystal can be indefinitely large. A volume of molecular gas is a flat hierarchy in the same sense. In ordinary usage, we tend to reserve the word 'hierarchy' for a system that is divided into a *small or moderate number* of subsystems, each of which may be further subdivided. Hence, we do not ordinarily think of or refer to a diamond or a gas as a hierarchic structure. Similarly, a linear polymer is simply a chain, which may be very long, of identical sub-parts, the monomers. At the molecular level it is a very flat hierarchy.[291]

For Simon, "flatness" is a concept that represents the relational structure of a hierarchy embedded and thus results in a complex system. In other words, flatness is a tool for studying "the relation between complex systems and their descriptions." To advance the representation and the description of complex systems, Simon proposes a distinction between what he calls "state descriptions" and "process descriptions." He illustrates the difference by describing a circle with these two modes of apprehending complex structures, respectively: (1) "A circle is the locus of all points equidistant from a given point;" (2) "To construct a circle, rotate a compass with one arm fixed until the other arm has returned to its starting point."[292] While state descriptions *identify what the objects are*, the process descriptions *model how the objects are*. Simon claimed "[h]ow complex or simple a structure is depends

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[290] Ibid.

[291] Ibid. 469 [Italics original].

[292] Ibid. 479.

critically upon the way in which we describe it"[293] and suggested that the development of theories of complexity heavily depends on the advancement of process descriptions. The augmented correlation between the state descriptions and process descriptions facilitated the attempts of finding the right representation of a complex system by analyzing and formalizing its organizational structure, dynamic properties, behavioral tendencies, and evolutionary processes.

Process descriptions indicated a necessity to distinguish the product from the processes that generates the product. Therefore, the laws or the rules that will govern the ways in which states can change become important. What Simon identifies as "parts interact in nonsimple ways" is critical to acknowledge complexity and to articulate the process descriptions that will yield into a complex structure. Analyzing a whole through its parts and studying these parts separately is a powerful methodology for understanding and developing models for understanding, yet when the whole cannot be treated as the sum of its parts, or rather, when the parts do not interact in simple ways, then the analytical study of parts remain insufficient for understanding and describing the whole.

John Holland[294] argues that "building blocks" are essential in understanding and manipulating complex systems, whether they are biological cells or computers. He follows the model of hierarchical combination that Simon used to construct and evaluate complex systems and claims that it is fundamental to "develop hierarchical

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[293] Ibid. 481.

[294] John Holland explores various concepts, such as numbers, board games and maps as precursors of scientific models, and embraces computer-based models to formalize a scientific approach and to provide a foundation for studying emergence. He states that "[…] it is unlikely that a topic as complicated as emergence will submit to a concise definition, and I have no such definition to offer. I can, however, provide some markers that stake out the territory, along with some requirements for studying the terrain." For his exceptional studies on complexity and emergence see, John H. Holland. "Emergence," Philosophica, 59, 1997: 11-40; Emergence from Chaos to Order. Oxford: Oxford University Press,1998; Hidden Order: How Adaptation Builds Complexity. New York: Addison-Wesly, 1995; Complexity: A Very Short Introduction. Oxford: Oxford University Press, 2014.

descriptions with successive levels of building blocks"[295] for modeling complexity. By means of hierarchy, Holland embraces an approach to complexity in terms of "*mechanisms* and procedures for *combining* them."[296] Through examining various scientific models for understanding complexity, he suggests that computer models advance the possibilities of discovering and describing the processes and properties of complexity by defining the building blocks and formulating the set of principles or rules that will instruct the building blocks. However, the strength of a computational model lies in what is not defined or formulated and thus remains hidden until the consequences become visible. Holland articulates the processing of a computational model as followed:

> To implement a model on a computer we first determine the model's major components – the model's building blocks. Then we implement these components as sets of instructions in the computer called subroutines. Finally the subroutines are combined in the computer in a way that determines their interactions, yielding the overall program that defines the model. The result is a computer-based realization of the transition function (rules) that defines the model's behavior.[297]

By virtue of interactions of the building blocks acting upon one another according to a certain set of instructions, the computational model reveals a "behavior" that is distinctive for identifying a complex system. This generated behavior is known as the "emergent behavior" of a system, which is far beyond the capacities of individual parts or building blocks. Holland assesses "emergent behavior" as "an essential requirement for calling a system complex."[298] He confirms that "[e]mergence itself is a property without a sharp demarcation" and it "only occurs when the activities of the parts do not simply sum up to give the behavior of the whole. That is, emergent

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[295] John Holland. "Emergence," 1997: 28.

[296] Ibid.

[297] Ibid. 25.

[298] John Holland. Complexity, 2014: 41.

phenomena only occur when the whole is indeed more than a sum of its parts."[299] Emergence is neither predictable nor instructible and neither traceable nor decomposable from the individual states or acts of parts. Interactions are the fundamental elements to study emergence, yet it should be acknowledged that they rather operate in a distributed manner. Although the states of parts and the rules that will govern the processes can be described hierarchically, the resulting interactions cannot simply be perceived and described hierarchically.

Holland remarks "the rules or laws generate the complexity, and the ever-changing flux of patterns that follows leads to perpetual novelty and emergence." It is possible to assess emergence as an ambiguous phenomenon, which is related to and yet independent from its constituents. Emergence is the ostensive condensation of interactions, while both the parts and their combinations, namely the wholes, which occur by interaction, perform circumstantially and contextually. In other words, the interactions are not centralized, directed, or authorized but they are rather *distributed* and *localized* and the hierarchical pre-ordering of the system is *flattened* through the emergent behavior of the complex system. Thus, "flatness" should be acknowledged as a representation – an abstraction of theory of complexity and emergence.

5.2.2 Transposing Architectural Mereology | Flattening Parts and Wholes

Theory of emergence, particularly from the 1970s on, has been influential on various disciplines and studies of different scale.[300] The proliferation of philosophical concepts of ontological irreducibility and the scientific approaches concentrated on deciphering complex systems prevailed the field of architectural research toward the turn of the century as architectural practices become heavily connected with digital

[299] John Holland. "Emergence," 1997: 32.

[300] Tom Wiscombe. "Emergent Models of Architectural Practice." Perspecta | Architecture After All, vol. 38, 2006: 57-68.

media and computation technologies. Although the use of computational models and the theorizations of associated concepts remain prominent for the majority of the work produced in the field of architecture, emergence has become effective as a tool of architectural design research, which is widely referred as form finding, from different perspectives and has been used to deal with diverse tasks.

It is possible to observe two predominant tracks in the acknowledgement of emergence as an architectural concept: (1) the design research concentrated on the pragmatics of form and force, namely the morphogenetic experiments on the material behaviors of complex structures and (2) the studies aimed at theorizing the changes in the way of designing and understanding architectural form in respect to the deflection in the epistemology of part and whole. While the first track seeks for a correspondence between material and form by the literalisation of structural behavior as *the* emergent behavior that generates the form within, the second track interrogates the patterns of relationality, such as resonance and empathy, in the lack of ontological dependency between parts and wholes, in other words, where parts and wholes are discrete and any relationality emerge within is flat.

The origins of the first track can be traced back to pioneering research of Frei Otto continuing on since 1960s. His particular interest in the natural processes and structural behaviors of self-organizing forms result in a formalization of design as an experimental investigation. Discovering the space of possibilities of form changing according to various conditions of forces and materials, Otto instrumentalized “form finding” in design process. He extensively worked with experimental models at all stages of design and expanded the field of form finding particularly through physical models, which he emphasized the necessity of working with the exact materials that will be used in the full-scale construction, and later on advanced his studies with digital models.

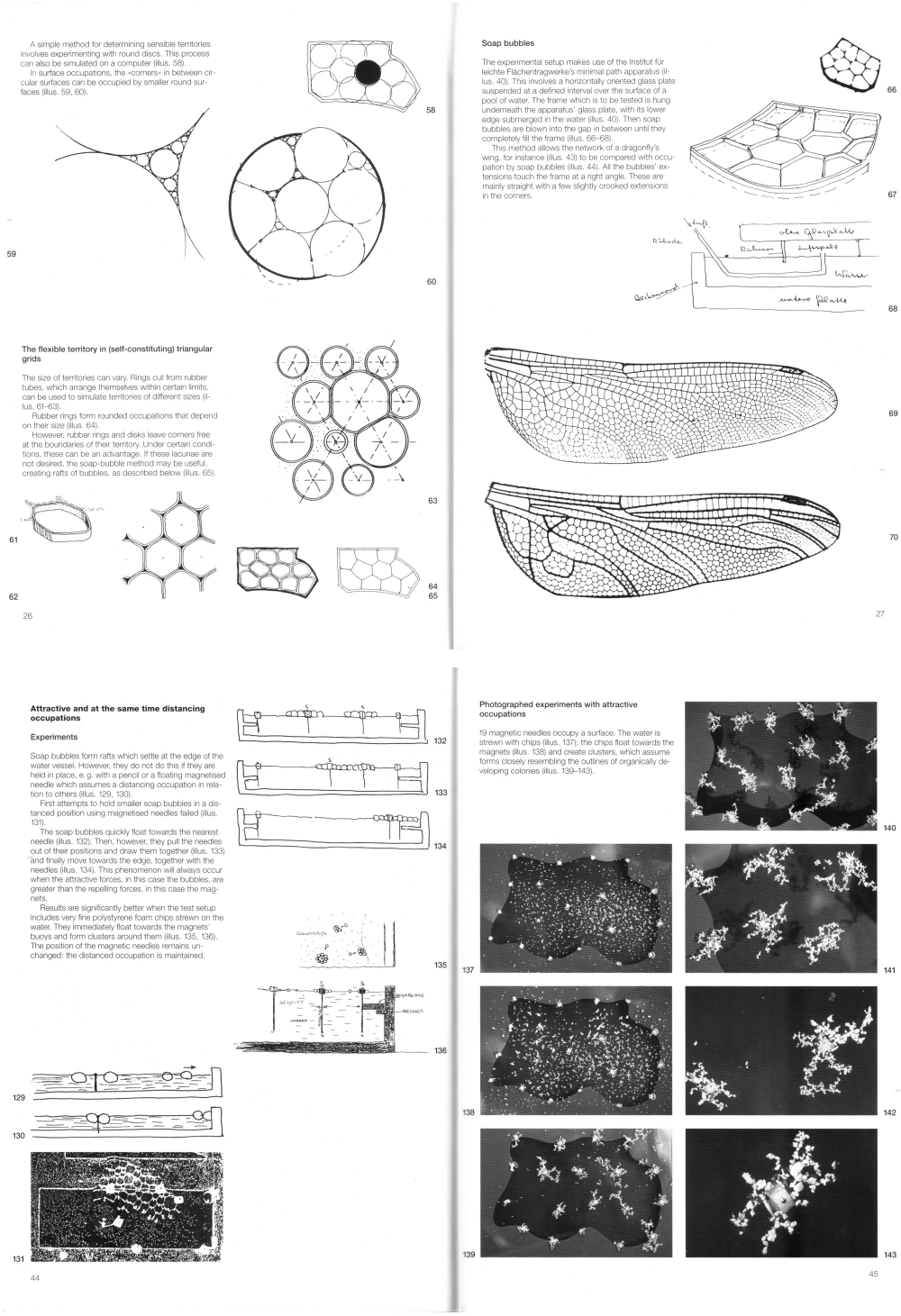

Figure 51. Excerpts from "Occupying and Connecting," Frei Otto.

Top: Experiments with soap bubbles and rubber rings to study flexible territories; *bottom:* Experiments on attractive occupations; water strewn with chips over a surface occupied with magnets. [Frei Otto. Occupying and Connecting, 2009: 26-27, 44-45.]

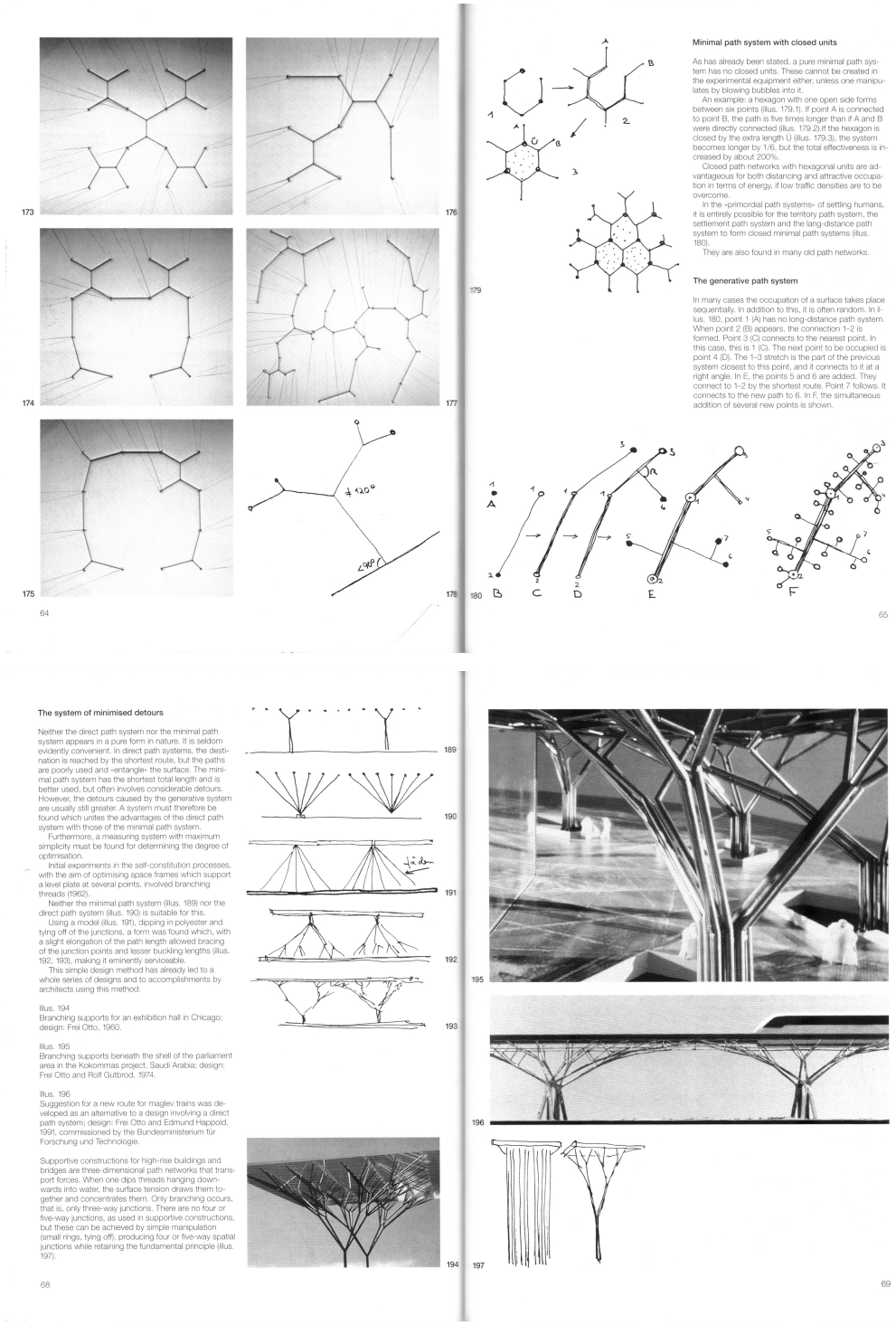

Figure 52. Excerpts from "Occupying and Connecting," Frei Otto.

Top: Experiments with minimal path system; *bottom:* Experiments with the system of minimized detours and branching constructions.

[Frei Otto. Occupying and Connecting, 2009: 64-65, 68-69.]

Otto's investigations are commonly addressed to his understanding of nature as a source for discovering the principles of complex order, yet his studies with nonliving nature and structures expanded the scope of his research, such as producing catenary arches by reversing hanging chains, soap-film experiments for acquiring minimal surfaces, and inquiries into urban settlements, occupation patterns and optimized path generations.[301] His form finding models presented an introduction to studying emergent behaviors in architectural and urban form. Schumacher considers Frei Otto "as the sole precursor of parametricisim" and claims that his research "taught us to recognize, measure and simulate the complex patterns that emerge from the processes of self-organization."[302] While Schumacher developed a conceptualization of "parametricist urbanism" in respect to the notion of "relational fields" based on Otto's models regarding growth processes of settlements and occupation patterns, Achim Menges, and formerly the Emergence and Design Group, advanced Otto's approach in studying material behaviors of self-organizing systems by adopting and promoting mathematical and computational models in design and design education.[303]

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[301] Frei Otto. Occupying and Connecting: Thoughts on Territories and Spheres of Influence with Particular Reference to Human Settlement. Stuttgart; London: Edition Axel Menges, 2009.

Also see, "Frei Otto In Conversation with the Emergence and Design Group," AD | Emergence: Morphogenetic Design Strategies. Guest-edited by Michael Hensel, Achim Menges and Michael Weinstock of the Emergence and Design Group, vol. 74, no. 3, May/June 2004: 18-25.

[302] Patrik Schumacher. "Parametricism," 2009: 18.

[303] See, "Kartal-Pendik Masterplan" (2006) by Zaha Hadid Architects. Schumacher explains that masterplan design is developed with "Maya's hair-dynamic tool to achieve a parametrically tuned bundling of the incoming paths into larger roads enclosing larger sites." The approach simulates Frei Otto's model of minimized detour net. Schumacher, "Parametricism," 2009: 20.

Also see, the morphogenetic experiments of Achim Menges with the Emergence and Design Group; Michael Hensel, Achim Menges and Michael Weinstock, AD | Emergence: Morphogenetic Design Strategies. vol. 74, no. 3, May/June 2004; Michael Hensel, Achim Menges and Michael Weinstcok. "Introduction to Emergence: Morphogenetic Design Strategies," republished in The Digital Turn, 2013: 160-164; Achim Menges. "Polymorphism," republished in The Digital Turn, 2013: 165-182.

Research in form finding radically materialize the concept of part as a physical entity, which does not necessarily have a specific formal or spatial extent or restricted by such properties, and acknowledge both the part itself and the interactions within parts as a "behavior" rather than a "relation," whereas the form directly equates to the emergent whole. The studies in computational design are broadly exhilarated by emergence, yet the phrase of "form finding" remains controversial as form can hardly be assessed the object of research considering the deep interest in discovering computational processes of design and the restricted definitions of design problems oriented toward the experimental use of hybridized materials with electronic tools and industrial machines that become available by the advancements in technology.[304] Although the products of form finding offer spectacular experiences, they are heavily defined and judged by their structural competences, or by the efficiency of their material construction, and rather rendered as novel works of the collaboration between computational design, engineering and construction.

What remains unaddressed is the conceptual and theoretical production of form, which is suppressed by its pretentious materiality. Emergence suggests a bold transposition in mereology and radically deflects the concepts of part and whole as well as their long-trusted relationality. Although various concepts have been borrowed from philosophy in general, and from Deleuze in particular, such as fold, assemblage, becoming, body without organs, and so on, these concepts are barely disciplined for architecture. All associated concepts of emergence are preferably manifested within and by the processes of design, while theoretical implications of the theory of emergence on the definitions of part and whole are neglected by leaving the concepts untouched for soon to be left behind. This study argues that the concepts of part and whole are fundamental for re-formalizing disciplinary

[304] See the work of Achim Menges, particularly his ongoing research by ICD/ITKE Pavilions at the University of Stuttgart (2010-2017), which turned into an annual architectural event: <http://www.achimmenges.net> [Last accessed in August 15, 2017].

approaches in architectural design following the theory of emergence. It is true that the discipline of architecture has incorporated emergent models of analysis, design and practice, but it failed to *flatten* the concepts of part and whole. Architecture restored itself by assimilating and smoothening part and whole with a mereological nihilism or by diluting them with an aggressive disjunction. Consequently, the disciplinary products of an architecture where part and whole are flattened, and thus become mereologically transposable, are yet to be discovered. By flattening the concepts of part and whole, both the lexical and the formal vocabulary of architecture can be expanded.

Following the deflection introduced by emergence, the theoretical approaches in architecture tend to oscillate between the formalization of "part-to-part interactions" and "wholes made up of wholes". While the former consciously avoids the concept of whole and the very idea of mereological composition, the latter rejects the ontology of "being part" and thus the very notion of parthood. Both approaches impend mereology by expelling one of the concepts for the sake of keeping the other one "discrete." Discreteness is a concept that goes hand in hand with flatness; it is the mereological threshold where emergence sustains its flatness.

Stan Allen's renowned "field conditions" embrace the formalization of "part-to-part interactions" for constructing a framework to study the emergent phenomena and suggests a transition "from the one toward the many: from individuals to collectives, from objects to fields."[305] His conceptualization of the term "field" is predominantly architectural and aims at disciplining the implications of emergence for architecture and urbanism. Allen remarks "field conditions cannot claim (nor does it intend to claim) to produce a systematic theory of architectural form or composition" and suggests that:

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[305] Stan Allen. "From Object to Field," in The Digital Turn in Architecture, 2003: 63. First published in AD Profile 127 | Architecture After Geometry, vol. 67, May/June 1997: 24-31.

> [A] field condition would be any formal or spatial matrix capable of unifying diverse elements while respecting the identity of each. Field configurations are loosely bounded aggregates characterized by porosity and local interconnectivity. The internal regulations of the parts are decisive; overall shape and extent are highly fluid. Field conditions are bottom-up phenomena: defined not by overarching geometrical schemas but by intricate local connections. Form matters, but no so much the forms of things as the forms between things.[306]

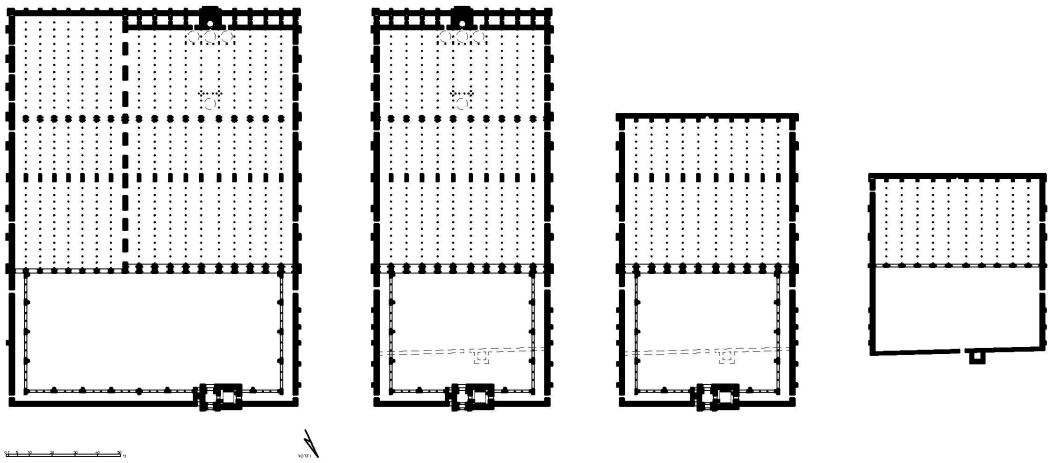

Figure 53. The evolution of the Mosque-Cathedral of Cordóba by "part-to-part interactions".

Allen refers the mosque-cathedral as a "field configuration," where the local syntax of parts is fixed and parts are treated as independent elements combined additively to form an indeterminate whole. [See, Stan Allen. "From Object to Field," 2003: 65-66; The plan drawings are retrieved from <archnet.org> Last accessed in April 20, 2017]

Although Allen does not directly use the terms flatness and discreteness, he implies flatness by the contextually distributed, yet locally intensified connections and discreteness by the reconciliation between the part as an individual and the field as a collective and as an unbounded aggregate of parts. Studying various forms of combinations, constructions, distributions, effects, and behaviors, he claims that "[t]he organizational principles proposed here suggest *the new definition of 'parts,'* and alternative ways of conceiving *the question of relationships among those*

[306] Ibid.

parts."[307] What Allen achieves is not a new definition of parts but rather their tasks, which contextually imply wholes without sacrificing its discreteness or allowing the possibility of the whole to undermine, bend, or curb its identity. Field is a theorization of the flat whole for Allen, yet the concepts of part and whole are not flattened in his field conditions; parts remain as parts while their operationality is redefined to flatten the ontological priority of the whole.

Allen's *"From Object to Field"* laid the groundwork for the changes in the discourse of parts and wholes in architecture following emergence theory. Diverging from Allen's formalization of part-to-part interactions, Wiscombe embodies an understanding of wholes made up of wholes. Wiscombe is one of the prominent figures in contemporary architecture concentrated on emergence as a tool for developing architectural systems beyond part-to-whole relationships, rather than enforcing advanced computation for the sake of emergent form. Considered independent from the augmented computational exercises of form finding, he argues "emergence offers an explanation of how new things become manifest, as whole objects with their own irreducible properties."[308] Wiscombe embraces the object-oriented philosophy of Bryant, and thus, a flat ontology to explore the architectural possibilities where "everything is a whole object and not a part of something else, and everything exist equally but differently, then vertical stratification between parts and wholes become impossible."[309] Acknowledging the problematical connotations of the term "element," he proposes "whole-to-whole relations" rather than "part-to-part relations." Wiscombe articulates the basis for a flat ontology of architecture as followed:

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[307] Ibid. 70 [Emphasis added].

[308] Tom Wiscombe. "Discreteness, or Towards a Flat Ontlogy of Architecture." Project, Issue 3, Spring 2014: 35.

[309] Ibid.

> Architectural elements are pulled apart and de-stratified so they can be reassembled to produce a refreshing chunkiness and tension. In order to achieve this effect, architectural elements must interact – *empathize* with one another – rather than remaining fully autonomous. Things can nestle, squish, or envelop other things, as long as they do not fuse together or damage one another. Elements in play must therefore have enough resilience and character that they do not become immediately subsumed by other elements and fall back into a default hierarchy.[310]

Based on the idea of "wholes made up of wholes," Wiscombe develop models where architectural elements can empathize with one other: (1) figure-in-a-sack, (2) implied outer shell and (3) supercomponent.[311] The figure in a sack dwells on the relationality between the container and what is contained over the metaphor of sack, which "gathers things together into a loosely coherent form without dissolving the things' discreteness"[312] and where the figure and sack remain independent, yet have the capacity to affect one another. The implied outer shell acts is an enclosure, a veil that hovers around or above the inner objects without totalizing or concealing them. Finally, Wiscombe assesses the supercomponent model as a variation of the figure in a sack, where objects can be nestled into one another or vacuumed together toward an implied new object without loosing their autonomy. What delineates a continuity within the discipline of architecture is that, as Wiscombe contends, these models are not unprecedented; the figure in a sack model finds its precedents in Jean Nouvel and Philippe Starck's unbuilt Tokyo Opera and Coop Himmelb(l)au's UFA Cinema

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[310] Ibid. 37.

[311] Ibid. 39.

[312] Ibid. 35. The philosopher Tristan Garcia uses the analogy of a "sack" to address the conundrum of how something can be a component of a thing and be a whole thing at the same time. Wiscombe also refers to Graham Harman's "universe made up of objects wrapped in objects in objects wrapped in objects." See, Harman, "Object Oriented France: The Philosophy of Tristan Garcia," Continent 2.1, 2012; 6-21, also available at <http://continentcontinent.cc/index.php/continent/article/viewArticle/74> [Last accessed in August 15, 2017]. Moreover, Deleuze and Guattari's "the wolf and/as the pack" provides different models for theorizing flatness and discreteness. Also see, Gilles Deleuze and Félix Guattari. "1914: One or Several Wolves," A Thousand Plateaus, 2011: 26-38.

Center, the implied outer shell model has as its precedents Bernard Tschumi's Le Fresnoy and Le Corbusier's Heidi Weber Museum.[313]

Figure 54. Models for wholes *empathizing* with wholes, Tom Wiscombe.

[Tom Wiscombe. "Discreteness, or Towards a Flat Ontlogy of Architecture," Project, Issue 3, Spring 2014: 36.]

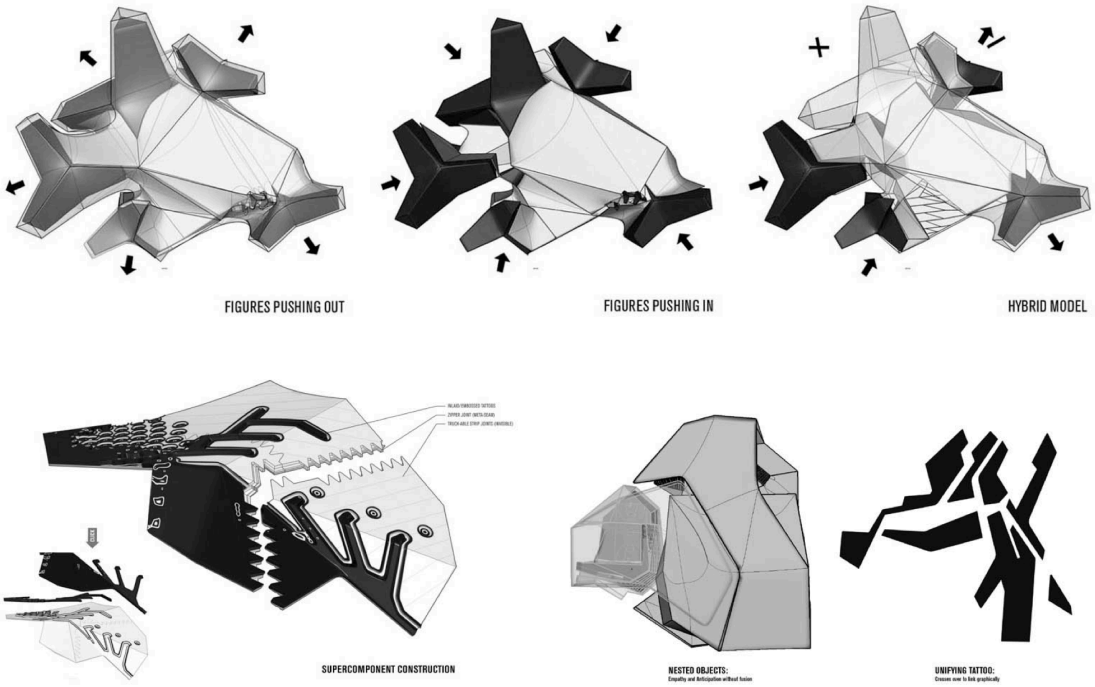

Figure 55. Diagrams for constructing supercomponents and nested objects, Tom Wiscombe.

[Tom Wiscombe. "Discreteness, or Towards a Flat Ontlogy of Architecture," 2014: 38, 42.]

[313] Ibid. 39.

Wiscombe adopts an understanding of flat ontology of architecture by introducing the idea of "wholes made up of wholes," where wholes empathize with one another to create new whole without obscuring into that emergent whole. He critically withdraws the concept of part and embraces the terms "element" and "component." Wiscombe's instrumentalization of "architectural element" is a tool to flatten the concept of whole as a mereologically operational element beyond its preconceived priority as a desired or emergent end product. The conceptualization of the term "element" does not only suggest a historical continuity within the discipline of architecture but also reasserts the epistemological primacy of architectural element by re-considering it as a whole. Although Wiscombe avoids the conception of "part-to-part relations," what enables the mereological re-conceptualization of the whole is its flattened and thus expanded operationality in becoming a "contextual part" or a "circumstantial part" to act as an architectural element that can interact with other wholes and create a further whole. Thus, the whole can be assessed as a mereological element that is contextually transposable into an architectural part without relinquishing its discreteness, and, yet again, without being compelled to become a perennial architectural part.

Both "part-to-part interactions" and "whole of wholes" elevate the understanding of part and whole as mereological concepts that are powerful in emergent flatness. Allen and Wiscombe's studies contributed to the expansion of architectural vocabulary of form by means of flattening of the concepts of part and whole. The epistemological niche in the assessment of architectural form is ready to be occupied and an awareness of "flat form" reclaims the epistemological and methodological potential of part and whole to cultivate this niche with fresh theories and disciplinary practices. The conditions of being part and being whole are not ontologically predetermined in flat form; the concepts of part and whole become circumstantial and contextual, and thus, mereologically transposable. As the part and the whole are liberated from their ontological responsibilities, the mereological contents of both expand with their epistemological terrain. Where the part and the whole are flattened,

the ontological priorities, epistemological primacies, theoretical functionings, operational capacities, analytical competences, noematical strengths, practical efficiencies of the two are evened out and architectural values of part and whole are compensated. It is possible to question or anticipate architecture, where “parts are not parts for a whole and the whole is not a whole for/of parts,” as a “flat discipline” following the becoming of its disciplinary products – the flat forms.

CHAPTER 6

CONCLUSION

This dissertation constructs a mereological framework for architectural form. Starting with the assumption that architectural form is a "disciplinary product" within which epistemological tendencies, historical styles, design approaches, theoretical discourses, material practices, modes of representation and production, and aesthetic judgments have been accumulated, this study assesses architectural form as "a field for cultivating architectural knowledge." Yet, the assessment of form as a disciplinary product does not necessarily refer to any material or visual existence of form as a corporeal entity, the very idea of form as peculiar to architecture can become intelligible through theoretical concepts, analytical definitions, perceptual and intentional readings, noetic or tectonic configurations, contextual or historical criticisms and so on.

This study observes an epistemological niche that is pregnant with theories regarding the assessment of architectural form. As the disciplinarity of architecture, which is identified with the processes, surfaces, acts, figures, and objects of design and heavily symbolized by the critical vocabularies, has start to diverge from its representations, the epistemic content of forms remain unaddressed besides the rigorous attempts to formalize the processes and the emerging admiration of its elusiveness. This study suggests a particular understanding of architectural form by reconsidering it as a disciplinary product historically, theoretically, conceptually, and materially molded by the urges and challenges to define the concepts of part and whole and their relationality. It asserts that part and whole did not only contribute to the unity of architecture as an art of building from the brick to the wall and from the wall to the façade, but also to the construction of its historical identities and theories, all of which eventually absorbed into a "strange" composition of digital data. The

philosophical questionings of part and whole and the emergence of theories that critically re-conceptualize the two by challenging their preconceived dependency and relationality have dominated the fields of architectural theory and design as well. The reduction of architectural form into intensities, flows and networks is not only a prelude to the dissolution of the physical object but also a critical intervention to architecture's disciplinarity. Despite all the deflections from conventional practices and assumptions of architectural design, the currency of the concepts of part and whole sustains the epistemological niche for the cultivation of architectural form by the theories and practices of part and whole. It is the claim of this study that the theoretical and operational uses of parts and wholes are critical for the assessment of architectural form as well as the processes and acts of their making.

To theorize "part" and "whole" as tools of cultivating and disseminating architectural knowledge, this study introduces "mereology" as a ground theory upon which further epistemological frameworks can be constructed by introducing disciplinary concepts that will nourish its readings and applications. Deriving from the ontological definitions and questioning of the concepts of part and whole and the philosophical underpinnings of mereology, the study theorizes an "architectural mereology" as a comprehensive framework to re-situate and discuss the epistemological and methodological approaches to architectural form.

The difficulty of bringing together architecture and mereology is manifold. Considering the obscurity of the disciplinary boundaries of architecture and the philosophical intricacies and immanent ambiguities embedded in the meaning of form, it is not easy to delineate the boundaries of form in architecture or to achieve a consistent categorization of approaches that aims to formalize it. On the other hand, although mereology does not intend to acknowledge part and whole as historical concepts, the injection of mereology into field of architecture cannot be performed without any recourse to architectural history considering that "part" and "whole" also embody histories as architectural terms. The ubiquity of the terms of part and whole

makes it difficult to delimit the study to a particular historical moment or even to the discipline of architecture. Not only the architectural abundance but also the ontological vicissitude of the concepts of part and whole overwhelms the confinement of the research.

Based on the philosophical meta-narratives of mereology, two grand concepts, namely "foundedness" and "flatness," that underlie the ontological questionings and epistemological approaches to the concepts of part and whole are distinguished. Following the distinct, yet not opposing, mereological models that foundedness and flatness indicate, the study establishes the concepts of *founded form* and *flat form* to construct a mereological framework for architectural form. Founded form and flat form address two paradigms with mereological peculiarities that diverge in theories and practices of part and whole. As part and whole as architectural concepts embody histories of their own, it is controversial to construct a mereological framework of architectural form without acknowledging their architectural historiography. While this study benefits from architectural history to construct the mereological framework, it is neither confined with the definitions of part and whole in architecture nor obliged to accept the assumptions and conventions of the discipline.

The inquiry into architectural form negotiates between the fields of architecture and mereology through founded form and flat form. These divergent mereological form-paradigms enable the interrogation of part and whole as architectural concepts but assure that they are neither enclosed by nor suppress their architectural historicity. Founded form and flat form formalizes an *architectural mereology* that *cultivates* part and whole from the courses of architectural history toward a means of architectural epistemology. Through architectural mereology, part and whole operate as mereological instruments to establish an understanding of architectural form as an epistemic entity not only by enabling the examination of architectural form physically or visually but also by facilitating the appropriation and dissection of architectural form philosophically. However, parts and wholes are not necessarily

explicit in/as architectural forms; they are always in a flux regarding the multiplicity and vicissitude of their definitions and relationality. In this regard, part and whole are not merely to be found but to be *cultivated*.

What mereology focuses on can be defined as a philosophical questioning and ordering of parthood. Accordingly, founded form and flat form propose mereologically malleable and permeable models primarily based on the ontological instability of parthood, which does not intend to conflict with or refute one another. The epistemological tension settles in-between founded form and flat form provides a theoretical basis for the construction of a mereological framework for architectural form and sustains a critical awareness of the theories, processes and acts of its knowing and making by disclosing the changes in the mereological operationalities of part and whole.

Although the contingencies of the philosophical extent and the ontological innocence of mereology presented methodological challenges in the formalization of architectural mereology, the mereological framework constructed upon founded form and flat form does not only acknowledge the epistemological and methodological approaches to architectural form but also expands the possibilities for architectural design. Regarding the implications of architectural mereology for future research, first and foremost, founded form and flat form can be accommodated in design studio to advance the pedagogical potentials of part and whole in architectural education. Mereology provide a theoretical basis for the formalization of design exercises. Not particularly for architecture but for basics of design in general, founded form instructs the concepts of part and whole in reference to the notions of dependency and relationality, which continues to include the notions of identity and unity. In this regard, while founded form is fundamental to establish an understanding of the very concept of design, flat form is critical to disclose the space of possibilities defined by part and whole. Thus, flat form could be employed as an experimental methodology in design by which the dependencies of part and whole

are suspended and their relationalities are resolved. Operating particularly through the concepts of emergence and multiplicity, flat form also serves for elaborating the concept of design.

It is significant to acknowledge that founded form and flat form contribute the understanding of "parthood" and "wholeness" by articulating the definitions of part and whole and the conditions of their beings. The concepts of parthood and wholeness emphasize the operationality of part and whole by augmenting their abstract contents. Accordingly, founded form and flat form should also be employed as epistemological and methodological approaches in understanding and developing parthood and wholeness as creative interspaces of design, through and within which the very nature of part and whole are redefined. As part and whole tend to be acknowledged as static concepts to determine "what," parthood and wholeness unfold the embedded dimension of "how." In this regard, founded form and flat form propose "design approaches" to study part and whole with their ontological vicissitude and relational instability. Therefore, the mereological framework constructed by this study is not confined to architecture but also applicable in other design disciplines. The scalessness and the contextlessness of the concept of part and whole denote an expanded field of implications for future research in/by design and mereology.

As mereology is neither committed to *abstracta* nor *concreta*, it presents a topic-neutral theory. Combined with the ever-present hesitancy of theorizing form in architecture, the task of intertwining together two far-reaching fields with immanent ambiguities becomes challenging. Yet, the mereological framework constructed by this study is particularly motivated by the philosophical intricacies of mereology and form. It encourages the proliferation of studies concentrating on the interaction between mereology and design disciplines for producing transdisciplinary knowledge.

Although the primary aim of the study is to theorize architectural form and the major contribution is the mereological framework constructed by founded form and flat form, the epistemological and methodological competences of these paradigms can be experienced beyond the act of design. Founded form and flat form suggest analytical and noematical models to be adopted in historical and formal surveys. The epistemological tension in-between the two can also be revisited to scrutinize the development of theoretical criticisms and linguistic discourses in architecture.

As last but not the least, the mereological framework constructed for architectural form contributes both to the lexical and formal vocabulary of architecture by generating new concepts such as "founded form," "flat form" and "successor form;" by reconceptualizing familiar concepts such as "division," "element," "inflection," and "resolution;" and by introducing marginal concepts such as "transitivity," "mereological nihilism," "part-wise," "whole-wise," and "flattening." Following the course of mereological approach formalized by this study, not only the on-going formation of architectural vocabularies in digital age can be situated with an awareness of form, but also the critical vocabularies formalized throughout the history of architecture can be expanded.

As architecture has been focusing on an "archaeology of the digital"[314] to redefine its conventions, practices and foundations, it also struggles to identify and thus to archive the diversity and the elusiveness of its products. The nomenclature is significant for all modes of understanding and documenting and the formation of critical vocabularies have always been significant for architecture. This study argues mereology as a methodology in "nomenclature," powerful in the analytical and

[314] "Archaeology of the Digital" is a research project initiated by CCA in 2013. There have been three exhibitions displaying the phases of the development of a strategy for collecting and preserving digital archives at CCA: first exhibition is the "Archaeology of the Digital" in 2013, second is the "Archaeology of the Digital: Media and Machines" in 2014 and the third is entitled "Archaeology of the Digital: Complexity and Convention."

noematical decompositions of form as well as in the creative and generative processes of its making. The vocabulary that this study initiates by formalizing an architectural mereology present a critical and methodological attempt to respond the abundance of formal exaggerations, conceptual borrowings, lexical fabrications and hybridizations, and immediate abbreviations augmented by the digital.

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CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Türkay Coşkun, Seray
Nationality: Turkish (TC)
Date and Place of Birth: 23 May 1988, Seyhan
E-mail: seraytrkay@gmail.com
Gsm: +90 536 465 34 35

EDUCATION

Degree	Institution	Year of Graduation
Ph.D.	METU Department of Architecture	2017
M.Arch	METU Department of Architecture	2011
B.Arch	METU Department of Architecture	2008

WORK EXPERIENCE

Year	Institution / Firm	Enrollment
2015-Present	Studio Nüve	Founding Partner
2010-2017	METU Department of Architecture	Research Assistant
2007	Özer / Ürger Architects	Intern Architect

PUBLICATIONS

Edited Books

2014 Studiolog | Arch 401-402 Architectural Design Studios 2012-2013. Eds. Ayşen Savaş, Agnes van der Meij, Seray Türkay, M. Pınar Uz. Ankara: METU Press, 2014.

Conferences

2017 "Architectural Drawing: An Inquiry into the Formation of Architectural Design and Its Visuality," Conference Presentation and Proceedings, ARCHDESIGN '17 IV. International Architectural Design Conference by DAKAM, İstanbul / Turkey.

2013 "Constructing the Image of Architecture: The Orthographic Set" Conference Presentation, Fourth International Conference on the Image, Chicago / USA.

2011 "Cinnah 19: Adaptation of a Codified Style" Conference Presentation and Proceedings, "Theory for the Sake of Theory" ARCHTHEO '11 International Theory of Architecture Conference at Mimar Sinan Fine Arts University, İstanbul / Turkey.

HONORS AND AWARDS

2011-2017 TÜBİTAK(The Scientific and Technological Research Council of Turkey) National Scholarship Programme for Ph.D Students

2013 Honorable Mention at National Competition: Adıyaman Center for Active Living

FOREIGN LANGUAGES

Turkish (mother tongue), English (advanced skills), French (reading skills and basic speaker)