Abstract

This dissertation reconsiders “organic architecture” in Italy in the 1960s by interrogating Bruno Zevi’s use of the term in his *Towards an Organic Architecture (Verso un’architettura organica)* and examines the work of Italian architect Rinaldo Semino (1937-) to posit an alternate definition for the trope, “organic.” Semino’s work focused on the interaction of small, prefabricated units (“cells”) as components that would aggregate into larger architectural structures—a methodology that prizes a simple rationality derived from the study of natural forms. I employ the term “alternate organics” to distinguish this particular method and design approach—which derives its core meaning from a careful study of rule based, or computational processes seen in nature—from the term’s more general use that relies upon a fixed final form or style. Semino is, thus, a lens into others working in a similar manner, and a means to grasp a methodology that coalesced in postwar Italian architecture, which began with the economic miracle of 1958-63 and ended with the economic crisis of 1973. It was a period of startling changes in postwar Italy. Population boom and mass migration from the countryside and small towns to large cities created crises and reactions that were much discussed in the 1950s. By the 1960s, these discussions had clustered into the theme of the *grande numero* (“the Greater Number”). This dissertation considers some reactions to the *grande numero*, such as national, corporate, and international competitions that stimulated and supported architectural responses; technological developments, such as the computer and the photocopier as well as new materials; and new disciplines such as cybernetics and systems theory, that influenced how issues were philosophically investigated, for example, in the concept of “open work” in art (as the *arte programmata* movement), in architecture and urbanism (which considered newly designed, prefabricated components as an open system that could produce a megastructure-scaled project), and in new architecture (on the scale of territory). This dissertation considers how technofilia had its
critics and consequences in the visionary response to a crisis in postwar Italy, and prompts us to think more deeply about our current technological reverie.
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Figure 107 The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene Programmare l'arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra. (Johan & Levi, 2012); unpaginated but equal to pages 73-108.


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Preface: Alternative Organics

In this dissertation, I present an idea about an organic method of architectural design and computation that is not tied to hardware or software. It is about technology, but not with the intention about claiming a prehistory of a particular use of computers in Italy in the 1960s (though there is a case to be made about this point). Rather it is an idea about combinatorial thinking, of seriality, permutation, indeterminacy, and openness as concepts, that precedes and transcends specific material histories. I also posit that computational code is not outside nature and natural systems, but deeply embedded in the generation of form.

My method is to look deeply at a single image in order to open up a complex story, unpacking the layers of signification in the image, reading through a particular time and place, in order to create a narrative: a story made of the confluence of multiple events and artifacts.

I begin by being “troubled”—by an image created by architect Rinaldo Semino in the mid-1960s, which is a lens used to identify a design methodology that is influenced by attention to the geometric organization of the structure of natural form. By identifying these attributes, I open up a larger discussion about the period and environment in which he produced this work. I then look to find other architects who have a similar working method. It is not my intention to define these architects as emblematic of an as yet undefined style or movement, nor do I want to group them together as a collection of what is increasingly gaining attention in the art world, the “outsider architects.” In fact, in most cases, there are only a few projects out of the architect’s oeuvre that are germane to my thesis. Yet the work I have selected to study is not a random selection.

Semino and a number of the other architects were operating at the margins of the dominant movements in architecture in the postwar period, that is, the rationalists associated with the MSA in
Milan, or the organicists affiliated with the APAO in Rome. They also operated outside the influence of architect/critics Bruno Zevi and, in a very different way, of Manfredo Tafuri. I recognize the importance of Zevi and Tafuri, and I try to consider each in specific ways without partisan leanings. Tafuri's discussion of the complicity of architecture in the project of capitalism is an important critique that is felt through this dissertation, which traces the beginning of the postwar economic boom in circa 1958 to recognized problems and failures and the impossibility of architecture to be critical, as seen in the 1968 Milan Triennial, or in the clarity of the problems seen in the 1973 oil crisis, worldwide recession, and concomitant demise of the New Left.

I focus on the earlier part of the 1960s, just about twenty years after the end of World War II, when optimism about architecture’s ability to address the needs of explosive population growth was still pursued in earnest. Architects held a conviction that architecture did in fact matter, and that applied expertise could make a difference in the life of “the people.” But many of the architects were so bent upon doing good that they were unaware of their unwitting complicity in the capitalist project from which architecture is inseparable. This blind spot towards the dangers of capitalism is rightfully called into question later in the decade in Tafuri’s “Per una critica dell’ideologia architettonica,” essay, in Contropiano 1 of 1968, which later became the basis for his book Progetto e utopia in 1973. The increasing unrest and changing role of architecture is signaled in the occupation of the Milan Triennial in June 1968, and other events.

The overall dates (1958-1973) reflect the outside dates of the economic boom and later recession. They are also roughly the dates of the Italian journal Zodiac (published 1957-1973), the opening of the new building at the Hochschule für Gestaltung in Ulm (HfG Ulm) in 1955; some of these consonances are discussed within. The mid 1960s also signal a change that can be traced in the magazine Casabella from 1965-70, the years when Gian Antonio Bernasconi was editor. In
Bernasconi’s *Casabella*, housing and the changing status of architecture-city-territory (begun under the previous editor Ernesto Nathan Rogers) are central topics, as is a direct discussion of the necessity to industrialize building. Such industrialization was needed in order to address the postwar population boom and the demand for housing, as many flooded from the countryside to the larger cities.

In his essay of February 1969, “Metaprogetto sì e no?,” contributing editor Alessandro Mendini signals a shift in concerns. He spoke of the recent report by the Rome based F.A.O. (Food and Agriculture Organization of the United Nations) which presented the quantitative data of exploding populations around the world. He cited this data and questioned what would be the implications in the industrializing and modernizing of the Italian peninsula, something that had already been of concern for nearly a decade. He emphasized the necessity of producing a vast quantity of housing to accommodate this expanding and relocating population. For this task, architects must be prepared to investigate construction at an industrial scale. Mendini does not overtly discuss this concept in this article, which had already been introduced by Konrad Wachsmann as an area of study in the late 1950s at the HfG Ulm School. Instead, Mendini alludes to the question of mass housing by including an illustration in this article of a tiling pattern study from produced at the HfG Ulm. The piece is prescient of Mendini’s move towards the non-plan and other radical strategies that have recently been investigated in diverse articles, conferences, and publications and are more identified. This project stakes out an earlier period to the period of the early 1970s and that advent of Radical design. It is critical to understand and honor the dedication of the architects and frame this larger shift toward utopian projects, irony, or a return to classical neo-rationalism (the Tendenza starting in 1973), or the move towards anarchic movements which swept Italy in the late 1970s.
Mendini’s writing is significant to this dissertation because he discussed the approach, an organic approach, of building up housing and other structures through accumulation of smaller units or component parts or cells, an approach which is discussed in many other articles in this period. Mendini’s concept of organicism echoes my approach and is, along with Semino’s work, the seed from which my study grows. The variation of the urban fabric in historic towns was an example that architects looked toward to design housing so as to counter the alienation of the quality of life in repetitive self-same housing blocks. This organic approach invited user participation. Architects sought to design for a healthy relationship between the architectural unit and its boundaries, its accretion into ever larger housing units, blocks, cities, and ultimately the entire territory.

This idea of an alternate organics unites all of the projects I examine. Furthermore, I link this idea to what Mendini alludes to as the rules, or the semiotic significance that relates form and idea. The beauty of an idea is that it transcends other categorical denominations.
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Institute in the Fall of 2012 organized by Bill Menking on “Rome Matters.” In the minutes before the event began, I described to Pippo the overall ideas in my dissertation and he immediately understood the various ideas that I tried to bring together. His expertise in the Italian postwar and his intellectual (yet playful) rigor has been both an inspiration and a grounding of my scholarship. His curatorial work at the MAXXI, Museum of Contemporary Art in Rome is a synthesis of academic rigor, visual acuity, and challenging of the boundaries of our discipline that I find inspiring.

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This led to my work “Organic Italy? The Troubling Case of Rinaldo Semino, architect.” being included in *Perspecta* 43, “Taboo,” edited by John Capen Brough, Seher Erdogan, and Parsa Khalili.

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Bruce Parent, this is for and because of you.
Introduction

C’era una volta in Italia

The work of Rinaldo Semino was published in the Italian magazine *Zodiac* number 22 of 1973, in which editor Maria Bottero published his projects along with other architects and engineers such as Robert Le Ricolais and his colleague at the University of Pennsylvania, Peter McCleary, as well as Serge Ketoff, Félix Candela, Michäel Burt, Gernot Minke, Keith Critchlow, and fellow Italian, Renzo Piano. Bottero’s motive for collecting their work within the pages of the last issue of *Zodiac* was that the designers published in this issue referred to the influence of various scientific writings regarding growth and morphology in nature as an inspiration for their work.\(^1\) Rules regarding growth and configuration in prefabricated elements were inspired by studies of the space-packing properties of the platonic solids, and could be extended, through analogy, to the design of three-dimensional space frames. Some of the influences cited by Bottero in her “Introduction,” on the part of all of the designers are English biologist D’Arcy Wentworth Thompson’s text of 1917, *On Growth and Form,* the drawings of Lord Kelvin on “Molecular and Crystalline Theory: On Homogeneous Division of Space,” in his *Mathematical and physical papers* published in London 1882-90; the drawings of radiolarian by Ernst Haeckel, the work *Morphologie* by E. Monod-Herzen and others.

Semino posited in his projects and accompanying text a different approach to organic architecture than was traditionally held in the history of Italian modern architecture. He used organic principles derived from natural organization and translated these ideas to an architectural approach in which he designed a simple constructional unit, and joined these elements to produce a series of projects built

\(^1\) The original run of *Zodiac* numbers 1-22 were published from 1957 to 1973 in Milan by Edizioni di Comunità, part of the Olivetti Foundation. The journal was relaunched by Bruno Alfieri (who was involved in the first journal from 1957) and R. Minetto as *Zodiac: An international review of architecture* (Milano: Rizzoli International Publications) from 1988 until 1999 (vol. 1-21, 1988-1999).
up from these elements for projects that range in scale from a proposal for a large-scale housing project to projects at a mega scale, which he termed “macrostructural,” projects, so large as to blur the distinction between architecture and territory. His project for a shipping container transfer structure for the port of Genoa, if built, would have operated at the scale of landscape, and his proposal for a bridge crossing the Strait of Messina, was proposed at the scale of a new interterritorial region. Semino was as convinced of the feasibility of each scale of project as he was certain of the design and feasibility of construction of the base element.

2 The “macrostructure” is an interesting concept because it represents some kind of “common ground” between the neo-rationalists and the late-organicists in postwar Italy. This is seen in many of the competitions of the 1960s and there may be comparisons made between a rationalist approach as in Gregotti’s Zen housing projects and Sacripanti’s, though of entirely different formal expressions, there remains a common approach toward the idea of the organic nature of the macrostructure.

3 For a recent study of prefabrication see the proceedings of the conference 23-24 June 2011 at the Ecole Polytechnique Fédérale de Lausanne, Faculté d’Environnement Naturel, Architectural et Construit (ENAC): Franz Graf, ed. Architecture industrialisée et préfabriquée : connaissance et sauvegarde, = Understanding and Conserving Industrialised and Prefabricated Architecture (Lausanne: Presses polytechniques et universitaires romandes, 2012). International Conference organized by the Laboratory of Techniques and Preservation of Modern Architecture (TSAM) of EPFL. See papers: Antoine Picon, “Industrialisation of the Building: a technical and political project”; Tullia Iori, “Prefabricated Architecture “made in Italy”; Steeve Sabatto, “From Clips to Corners: operability of construction systems devised by Konrad Wachsmann during the Cold War under North American government agency supervision”; Francesca Albani, “Post-war Experiments in Italy: the QT8 District in Milan—realisation, events, perspectives.” Their purpose as stated included a “historical panorama of architecture imagined as a technical object,” and then how the “industrialization of building generally and prefabrication in particular led to the advent of mass housing and helped to disseminate it worldwide.” See also the various meetings and proceedings of the Docomomo conferences.
These enigmatic images (Fig. 0.01), printed as a large fold-out in Semino’s essay in *Zodiac* 22, are labeled as “details of the plan, section detail, and longitudinal section of a proposal for a 3km long steel bridge across the Strait of Messina” were drawn for a 1969 national competition. They are arresting; there are striking formal similarities to contemporary architectural design, in which designers use algorithmic scripting in three-dimensional modeling software programs to produce complex form through iterative changes in a base unit.\(^4\) It is valuable to explore this earlier, prescient work both in relation to contemporary design techniques and in its own right.\(^5\)

\(^4\) I saw this image for the first time in the Fall of 2005. Prior to beginning the Ph.D. at Princeton University I had written a book and several articles and chapters regarding the use of the metaphor of “organic architecture” in relation to contemporary research in digital computation, fabrication, and materiality. This work was presented in my *New Flatness: Surface Tension in Digital Architecture* (Basel: Birkhäuser, 2000). I continued this discussion in an essay “Digital skins: architecture of surface” in *SKIN: Surface, Substance and Design* in connection with the exhibit held at the Cooper Hewitt Design Museum (New York: Princeton Architectural Press, 2002) and in “Seminal Space: Getting under the Digital Skin,” in *RE: SKIN* (Cambridge, MA: MIT Press, 2006), ed. Mary Flanagan and Austin Booth, and most recently in my essay “Stupid Little Automata,” in *Architecture and Culture: Journal of the Architectural Humanities Research Association*, (London: Bloomsbury, 2014, Forthcoming). Startled by the similarity of Semino’s drawings to recent research, this initial encounter with his drawings has developed over the subsequent years into the historical research presented in this dissertation.

\(^5\) This connects with Semino’s exposure to G. Samonà at the University of Venice and Samonà’s studies of the città-territorio which was underlying the study of the Strait of Messina territory and I posit influences Semino’s Strait of Messina bridge project. Semino starts with the bridge and then breaks it down into its elements, using repetition, reflection and other geometric studies.
Rinaldo Semino had published his work periodically in Italian magazines and published results of his urban analyses, and most recently in a more theoretical overview of his work in Progettazione e didattica nell’architettura: argomenti e confronti (Joshua Libri, 1995), but none of these titles were readily available, nor was Semino well known at all. Semino generously gave me a copy of his published works in our first meeting in January 2006 in Parma, where he lives after having retired from the University of Genoa. This dissertation will consider Semino’s published works, but it is also a record of annual meetings between myself and Semino beginning in January 2006 in which we have had many opportunities to discuss his work.

In our early meetings, we discussed at length his studies of building elements, joint and connector designs, maquettes for “automorphic” structures (structures of individual elements with complex joints between elements that would allow the structure to expand and contract, bearing some similarity to the recent investigations by Chuck Hoberman), and of the influences that he cited on his work from the 1960s on: D’Arcy Wentworth Thompson’s On Growth and Form, the Ulm School, Konrad Wachsmann’s work, his studies with Franco Albini and then Carlo Scarpa both at the University of Venice, and the urban design studies of Saverio Muratori—all of which he has been investigating in various iterations for the last four decades. One cannot say that these various influences are necessarily compatible (which I speak about in more detail later), but the way in which Semino has negotiated these various influences is uniquely his own.

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Unlike his contemporary Renzo Piano, (also born in Genoa in 1937) Semino has not produced an enormous and important body of built work in his career. Yet his decades of work on urban analysis, teaching, and research into elements and their connections has yielded a body of work which deserves attention. I treat Semino’s projects and writings in detail by examining his working methodology and isolate examples of where he borrows from science and other organizational principles, which is what I propose as an alternative organics. I look at other architects and engineers who had worked using a similar methodology. I also have let his work become the catalyst to establish and document a particular time and place: Italy from the late 1950s to the early 1970s, the milieu in which he worked. Ultimately my goal for this dissertation is to highlight the resonance of Semino’s work of the 1960s (and which he still pursues in his studio) with analogous studies of today.

What has evolved is a dissertation in which I look at Semino’s work as a case study in a much larger context of postwar, post-economic miracle Italy.7 In support of this strategy, various threads are woven though this work: one is clearly inspired by examining the national and international competitions Semino participated in as shown in Zodiac which reveal the current state of material development, such as steel, and trace the evolution of various national state agencies and private industry such as ANAS, the Ferrovia dello Stato, Finsider, Italsider, or professional organizations such as In/Arch, etc. in addition to an international competition sponsored by the European Coal and Steel High Commission (CECA) which regulated the free movement of raw materials and finished goods between the member countries France, Germany, Italy, the Netherlands, Belgium, and Luxembourg, a predecessor to the European Economic Community.

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7 The miracolo economico in Italy is generally defined as the postwar period from 1958-1963.
It is also revealing to examine the architectural or urban project for which the competition was established: steel component parts; a design for a flexible system of high density, prefabricated housing that would use steel as the principle building component; a container transfer station for the port of Genoa (an important hub for steel manufacturing); and finally a three-kilometer long bridge to connect the mainland to Sicily for car and rail service to facilitate a high speed connection for the recently expanded national highway system that was developed for a fairly new consumer commodity: the automobile.

A number of themes can be inferred from his work which have a larger import on postwar Italian architecture culture and larger implications in society, culture, economics, politics, and aesthetics. These themes, broadly speaking, are organicism in Italian architecture, an organic metaphor versus an organic analogy, and the role of technique and reproduction. The advent of the electrostatic copy machine serves as an example of the way in which a new material technology went hand-in-hand with intellectual questions about seriality and reproduction, and how these ideas and techniques were investigated in architectural and artistic practices, product design and engineering and in design criticism. Programmed art (arte programmata) was a far-reaching movement of artists who investigated the open work of combinatorial possibilities, and other aspects that were important in the early 1960s. This movement in turn, and often with the same artists and critics participating, influences my parallel investigation in prefabricated architectural components and the idea of “Industrialized Building.” This idea may be seen contemporaneously in design competitions, building manuals, and in the archive of projects of architects of the time. The dissertation then closes with a discussion of the political nature of the Greater Number, which was the theme of the 1968 XIV Milan Triennial, an exhibit in which Semino participated under the curatorial project of Renzo Piano, entitled Changing Form in Architecture.
The Tissue of Structure Rinaldo Semino

Chapter One “Crescita e forma/On Growth and Form: The Tissue of Structure,” looks at Semino’s work in detail, guided by the original competitions seen in Zodiac, his working methodologies, his inspiration from nature in many studies, and at the remarkable models of joints, connections, extensible structures and the like which are the heart of his practice. Semino guides us in this study in his quasi-autobiographical book, a parable in ten lessons entitled Architettura: una scienza collettiva.

Semino does not identify his work as having an organic approach. This is my reading, and in doing so, it is necessary to look to the larger meaning of organicism and establish my definition of “alternate organics,” which is responsive to, but distinct from, other versions of organic architecture that held currency in Italy in the late 1950s and early 1960s, and which were not clearly defined.

One can see in Semino’s work evidence of a systems idea of organization, one that takes its inspiration from concepts of organization in biological studies as well as in language and relates to many of the themes such as Umberto Eco’s The Open Work. Semino’s work, by developing a system of parts, establishes a different take on the term “organic” as an ensemble and organization of parts that are aggregated to form a whole. His work suggests parallels between the design of individual architectonic elements and the self-organizing rules of their accretion into larger bodies. Rather than a top down approach to design, his work applies a bottom up approach, offering a strong counter reading of “Organic Architecture” in Italy. In this way, the organization of individual building elements through a set of rules that might be seen as akin to a genetic code would govern the accretion of elements into increasingly larger units, and eventually into total works of architecture.

His process echoes concerns towards systems and technology that were of immense interest in the 1960s regarding modularity and prefabrication in building systems. Here, the discussion is more
theoretical and proposes that while the projects become ever larger in scale, they are, at their core, formed of the accretion of these smaller units. Semino used the accretion of individual elements to propose large scale macrostructural projects which addressed the idea of seriality, aggregation, boundary, and the scale of territory.

It seems the goal of Semino’s work was to develop complexity that one would see in the simultaneous action of city building and the patterns that evolved over time in cities and to posit a new approach that could happen in a shorter time span, eliciting complex designs and perhaps raising a comparison to this design approach as akin to a natural process. Semino consistently investigated prefabricated elements in his designs and, while their use seems very much a contradiction, his work may be seen as organic and goes far into investigating the notion of the organic as an organization that allows for change and chance in the modularity of the elements to produce structures of three-dimensional complexity.

**Other Alternative Organic(ists)**

*Other Alternative Organics* further defines the characteristics of what is being termed an *Alternative organic* approach and discusses the projects of various architects working in Italy in the 1960s with variations of these themes. In simple terms, the criteria for selecting these architects has to do with their working methodologies which focused on natural systems of organic growth as an inspiration for the evolution of highly developed rules-based design. Some of the architects and engineers discussed in this chapter are Mario Galvagni, Vittorio Giorgini, Leonardo and Laura Mosso, Sergio Musmeci, Pier Luigi Nervi, Manfredi Nicoletti, Nizzoli Associati, Renzo Piano, Maurizio Sacripanti, and Luigi Pellegrin. This is not to say that the work of these various architects was ever recognized as a movement, nor were they all of the same generation, nor even geographically related.
Rather, their work is linked by their focus on organizational principles, and their inspiration by natural models.

A future expansion of this section will also treat the work of a number of architects who are generally considered to have designed “organic architecture” and an analysis of why their projects do not fit into this designation. I would like to treat some projects of Giovanni Michelucci, Leonardo Savioli, Leonardo Ricci, and Carlo Scarpa. One figure, in many ways similar to Vittorio Giorgini, is Marcello D’Olivo, whose built work often seems more aligned with the geometries I associate with “organic architecture,” but whose working methodologies and influence from natural systems makes him an enigmatic character. D’Olivo is emblematic of the vissicitudes and difficulty in stylistic categorization. The aim of this entire dissertation, in fact, is to dispel such myths and to establish an open analytical method with which to interpret the formal, constructional, and political concerns of architectural research as a link between the past and present.

**Organicism as metaphor**

Chapter Two, in the section “Organic Architecture and Natural Laws,” introduces a theoretical approach to architecture based in the abstraction of natural laws. Critical to the analysis is the clarification of the distinction between an organic analogy, that is, branching structures in city streets as being morphologically similar to branching in a tree, and an organic metaphor: a process, as organization, or a rule set, that would allow for the organization of smaller elements into configurations of greater complexity. The organic metaphor represents a systems approach to architecture that is key to this dissertation. A crucial understanding is that this is an isomorphic principle, thus having expression and being an underlying organization in all sorts of phenomena from art to architecture, urbanism, language, society, and so forth. Implied in this migration of idea through media is that various scales, from the cell to the organism, from the individual living unit to
the city, are organized, and exhibit organic properties if they are understood in their organization, regardless of form and scale. Mathematical formulae, geometry, and code are non-representational (non-embodied) carriers of this information that may then affect the formal organization of any work, whether natural or human-made.

This metaphor is then examined by looking at the evolving distinction between cells and crystals prior to D’Arcy Thompson’s *On Growth and Form* (first published in 1917), and how these metaphors were important throughout the twentieth-century. The use of the crystal is examined in relation to Bruno Taut and the Crystal Chain Group, and a discussion of the dual status of Ernst Haeckel’s understanding of radiolaria as both crystalline in their skeleton and cellular in its enclosing protoplasmic sac gives a historical lens to the various biological metaphors that were prevalent.

**On Growth and Form**

In the second part of Chapter Two, “On Growth and Form,” examines in detail the effect that D’Arcy Thompson’s *On Growth and Form* had on artists and architects after its reissue in 1942. Its release sparked intense interest for postwar artists and architects. Thompson viewed form as a result of forces internal to the organism which are then mediated by response to its environment. His work ushered in a new approach for thinking about dynamic and changing form, which was strikingly different from previously static models of form. Form could now adapt and change over time in relation to changing internal needs and in response to external or environmental forces.

This chapter then discusses the 1951 exhibit at the ICA in London *Growth and Form* and the documentation of the symposium *Aspects of Form, a Symposium on Form in Nature and Art* of the same year. While this exhibit and symposium are outside of the central focus on Italy, they are important events which document the far-reaching interest in Thompson’s text *On Growth and Form* in Italy.
Architect Luigi Moretti used images from Thompson’s *On Growth and Form* to illustrate an article, “Structure Comme Forme/Structure as Form” (1954) in a version of the *Paris Review* that was produced exclusively for international travelers between the United States and France aboard United State Lines ships. The four page bi-lingual (French and English) article by Moretti reveals an interesting link to D’Arcy Thompson. Moretti used complex logical descriptions to describe the dynamic way that form is understood and is constituted in perception. It is its “oscillatory movement, its dialectic” in what he described as the identification of forms palpitating in the area of structure or of form, which is his definition of form. He then described the fundamental elements of form as “parameters,” rule-sets that connect the forces that affect form with the final resultant form. Moretti’s work on parametric architecture is an important connection between the observation of natural phenomena and the abstraction into parameters that would then be manipulable in creating new form.

**Organic architectural ideas in Italy**

Chapter One began with a section entitled, “Macrostructure as Organism in the work of Rinaldo Semino,” in order to interrupt the trope of “organicism” and make space for an alternate understanding of “organic architecture” in postwar Italy. This assertion is meant to challenge the traditional historical narrative that limits organicism in postwar Italian architecture to a set of architects and concerns that served as foils to Fascism and support for a new democratic Italy. In the immediate postwar years, Bruno Zevi’s book, *Verso un'architettura organica* (1945), and the ensuing discussion through the Association of Organic Architects (APAO) and the magazine *Metron*, were seminal in providing a “democratic” model for organic architecture, one that took its inspiration

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8 The serial and rule sets will be explored as an “organic” method.
from Zevi’s experience in the U.S. during the war, and was a response to modernist architecture that had been, in Zevi’s opinion, corrupted in Italy by its adoption in the architecture of Fascism.

Zevi’s work set guidelines for architecture, in part inspired by the work of Frank Lloyd Wright and Alvar Aalto, in which formal tropes that defined the Fascist project, such as strict symmetries, “modern” materials and monumentality and such were dismissed in favor of “organic” organizations, asymmetrical organizations, and “naturally-inspired” structures. Zevi, the Rome school, and in part, the work of many architects who worked within the doctrine of the Florentine “organic” school such as Leonardo Savioli, Giovanni Michelucci, and others, constitute a key architectural response to the postwar crisis in Italy. Though distinctions can be found among these groups and individuals, their and subsequent histories of postwar Italian architecture share in the use of the term “organicism” to distinguish these architects and their project from both prior and contemporary movements in architecture.

The third chapter “Organic Architecture in Italy: two historical paradigms,” then, closely examines Zevi’s “organic” in order to allow for an alternate reading to that proposed by Zevi, opening up the idea that there are multiple views of what constitutes the organic in the postwar period. Although Zevi and other members of the APAO were not the first to employ this term, the association between this group and this term is sufficient to confuse or invert the semantics of the term. Consequently the terms “organic” and “organicism” often reference a movement in architecture rather than a threshold concept for the processes, relationships, and principles that govern nature. Science, both natural and social, stands in this threshold concept of the “organic.” To investigate and manipulate the autonomous forces in nature, this dissertation begins with the intent to re-invert the semantics of the term “organics” so that the term references this threshold concept. This dissertation questions how this term was productive in architectural design historically and is of
renewed interest in contemporary practice. Importantly, a key element in the semantics of the organic is “context” or environment, principles of relationships governing both internal structures and the relationship to the environment. “Organic” in postwar Italy describes the problem, the scale, and context that creates and limits an organic response. In the “Larger Number,” housing, locations, and time are the locale of the problem, and the site in which a solution must exist.

In *Verso un’architettura organica*, Zevi brought his experience gained from his wartime exile in the United States to bear upon an idea of organic architecture, connecting natural growth with the evolution of architectural design. He wrote, “the American’s attitude is…more evolitional and closer to natural growth—in a word, organic: the exterior forms are derivatives of the interior space,” and was certainly referencing the work of Frank Lloyd Wright.\(^9\) This reference is also seen in the statement that “the exterior is a product of the interior,” something that Zevi used in contrast with modernism, stating that his “houses develop from an interior nucleus and they open ‘like plants,’” and that the building is expansive and “brings the interior out into the open air….\(^10\) While his point is interesting, it constrains his argument to one that defaults into formal analysis and analogy, versus what may be understood as the more robust idea of organic architecture that Zevi discusses clearly in the Italian language original edition. In the Italian original, Zevi discussed the propensity in prefabrication in the United States to enable the growth of a house, room by room, over time, a concept which was then extended to have the incremental growth and may be seen as an new organic approach. However, in the English translation, this critical section of Zevi’s original text was diluted and certain aspects of his original argument eliminated and changed, which is unfortunate as this section is key to understanding industrially produced building components as the raw material of an alternate organic architecture. The poor translation permits a description of

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organic architecture that does not rely upon the tropes that were characteristic of this movement (geometrically based, crystal-like plan formations, fragmentation, skewed axes, indigenous materials, connection with the site), which stood in for the manifestation of democratic ideals.

Instead, the English translation looked toward prefabricated housing types in which a kit-of-parts could be brought together in myriad configurations. This perspective is distinct from the idea of prefabrication as a rational use of materials and methods, but it does point to its potential to emulate the interaction of constituent parts in an organism. It is, by extension, an image of the “open work” a term coined by Umberto Eco in 1962, that gives form to the semantics of the “organic” as a threshold concept that references the complexity of material and relationships in nature. This complexity and openness forms the theoretical center of this dissertation and is what is posited as an alternate “organic” in Italian postwar architecture. The “open work” and the emphasis on the organizational in prefabricated and modular studies was a crucial concept that was extensively investigated by leading architects and writers of the time. The open work mirrors the issues of constituent elements and relationships that create forms and structures, whether biological, chemical, physical, social or architectural. In other words, while Zevi was still operating with the notion of an organic analogy rather than an organic metaphor, and while the problems of translation kept key concepts from English-language readers, Zevi’s core notion of open work gives rise to the deeper notion of organic metaphor.

Seriality and Permutation

Chapter Four, “Electrostatic Attraction: Reproduction, Seriality, Permutation,” examines the unit and its relations to other units as an artistic movement which focused on seriality in art and literature.

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in early 1960s Italian design culture. The chapter begins with a discussion of the evolution of print media and the introduction of the electrostatic photocopier, the Xerox machine, in 1959. In the hands of a few artists, the potential of such technological developments was understood and explored in a subversive but culturally productive way. A pivotal moment/event/artist in the U.S./Continental discussion is examined by a discussion of the American artist Mel Bochner’s installation *Drawings And Other Visible Things On Paper Not Necessarily Meant To Be Viewed As Art* of 1966 which set a precedent for presenting xerox photocopies within a gallery setting and restated the questions of the original and copy. This provocation, already signaled more than thirty years earlier by Walter Benjamin exalted the loss of the “aura” of the original work of art (and artist as genius), paralleled other artistic movements in Europe such as the Zero Group and other artists who worked in Italy with seriality and permutation. These loosely overlapping circles of artists are often associated with the Arte Programmata movement which may be seen as a continuation of the Arte Concreta movement (MCA) of the 1950s in both artists such as Bruno Munari or Enzo Mari were also instrumental in the Arte Programmata discussion. This creative work was in both theory and practice in opposition to other movements such as Abstract expressionism and the Informale movement which privileged the original work of art as a unique and dramatic external expression of the interior life of the artist. Yet the larger question of the unit and its relationships remained to be developed in these explorations.

Key in the discussion is Umberto Eco’s book, *Opera Aperta* (The Open Work) and his article for the exhibit *Arte Programmata*, both of 1962, in which he investigated the idea of seriality as a movement away from subjectivity. Eco, in examining concepts of logic, spoke about core theoretical issues regarding information and communication through various expressive media, from music to poetry and the visual arts, as well as mathematics and analytical logic in philosophy. He firmly anchored the
critic as the key figure that would interpret the work of contemporary art(s) in relation to larger philosophical movements and advocates for a move away from subjective expression in the arts. In his 1968 book *La Struttura Assente*, (The Absent Structure), Eco’s contribution to the problem of the “Larger Number” is his explicit argument about the role of semiotics in the arts, philosophy, and culture. Language, rules, permutation, and the signifying unit are common themes that relate a “ground up” organization from the smallest unit to the most complex utterances. Other important critics discussed are Gillo Dorfles, Giulio Carlo Argan, Abraham Moles, and Germano Celant among others.

The late 1950s and early 1960s was a period in which Italian architects genuinely believed in the possibility of technology to improve the quality of life. Modularity and building systems were explored in their capacity to rapidly erect housing for increased needs and the idea of “openness” was a way to check the power of urban planners in order to allow for the input of individual freedom within an organic and dynamic system. This is by extension also a study of the megastructure, or the *macrostruttura* as the term is often used in Italian.

The techniques of cybernetics, organizational theory, system theory, componenting, and fabrication had a strong influence on specific architectural proposals as operational techniques with which to deal with the complexity of dealing with large numbers. The term *Large numbers* in regard to architecture has a specific valence: that of the architectural response to the housing crisis in the postwar period. This problem had extraordinary implications for architecture in terms of the correspondence between idea and technique: prefabrication of dwelling units was a common theme,

12 This is also echoed in Jean-Louis Cohen, *La coupure entre architectes et intellectuels, ou les enseignements de l’italophilie* (Paris: École d’architecture Paris-Villemin, 1984), where, as Cohen discusses, the architect is a part of the committed intellectual world.
and the basic organizing principles between the individual cell and the whole were paramount.\textsuperscript{13} While it may seem that the term “Greater Number” and mass housing would be in direct conflict with a notion of “individual freedom,” this dissertation proposes that an attention to the smallest unit can lead to greater complex structures, both built and societal, in which the emergence of the larger organism reflects the individuals within. Key to this definition is that the smallest unit is not linked to the Modernist notion of the minimum dwelling unit, but rather is a tectonic unit, programless, structural, and in its combination, a space-making, space-enclosing unit, that may accrete into larger configurations at various scales. To traverse this territory, the interrelated chapters that follow treat the more theoretical aspects of the idea of the “Open work” in philosophy, aesthetics, and building in Italy, before looking in more detail at architectural and urban projects. Systems, modularity and the prefabricated component (unit)

Chapter Five, “Systems, Modularity and the Prefabricated component,” continues the discussion from the previous chapter. A key article that is discussed is “Architettura industrializzata,” published in the Italian magazine \textit{Marcatré} in 1965 in which the topic of discussion between critics Gillo Dorfles and Enzo Frateili and architects Vittorio Gregotti and Roberto Orefici centered around the work of Konrad Wachsmann and “Industrialized Architecture.” Wachsmann, who taught at the Hochschule für Gestaltung (HfG) at Ulm, Germany, replaced the “Architecture” curriculum during the late 1950s with the new department of “Industrialized Building.” This radical rethinking of architecture was disseminated in various modes in Italy through publication in the magazine \textit{Ulm}, which had a large readership in Italy, as well as to the actual physical presence of Wachsmann in Rome and then Genoa. Theorists and designers active at Ulm such as Abraham Moles, Enzo Frateili, Giovanni Anceschi among many others who crossed between the art and architectural

\textsuperscript{13}Used here as if the basic living unit.
worlds and were widely published and physically active in Italy, increasing the reach of the work of the Ulm school.14

“Industrialized Architecture” was an area of research in which architecture was made up of manufactured component parts that are brought together to make a whole building system. It also raises the theoretical question of openness and indeterminacy, not only in the designs themselves, but in the political idea of diminishing the importance of the role of the architect as sole designer, opening up the building system to the input of the end user. In this kind of design, smaller industrially produced building elements were studied and overall guidelines were written on how they were to be brought together for an efficient solution to myriad design problems. This building work was an extension of the discussion regarding seriality as it was applied to the notion of *componibilità* (componenting) and prefabricated building elements.

This work can be examined directly in the various illustrated building manuals of both the pre- and postwar period. A system approach in architecture is seen in modular or prefabricated construction and will be discussed in terms of open and closed systems, concepts which are borrowed from system theory and the scientific disciplines. Through this discussion, I extend the concepts that I have already discussed in terms of art practices, or in the philosophical terms of Umberto Eco. Thus I am able to assign precise meaning to these abstract concepts through examining their application in the design of modular construction systems.

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Il Grande Numero, Italian urbanism and architectural competitions

The initial discussion of Semino’s work is an entry for the discussion of postwar Italy and the economic, political, and social implications that industrialization had on architecture and planning that forms Chapter Six, “The New Dimension and Il Grande Numero (The Greater Number)”. Rampant industrial development in the northern “triangle” of the large cities in the Po Valley (Genoa, Milan, Torino) drove issues of scale and urbanism and grew to impact all levels of Italian society. The main characteristic of migration in the 1950s and 1960s was from the agricultural countryside and small regional towns and villages to the major cities throughout the peninsula such as Naples, Rome, Milan, and Turin. There was a division between the north and the south and disproportionate allocation of postwar subsidies (such as ERP/Marshall Plan funds): the often poor and industrially undeveloped Southern regions, the mezzogiorno, suffered not only from damage and occupation from the war, but from the eroding of social structures and economic base due to a large waves of emigration toward the cities in search of work. In turn, the mass influx of people to the major cities led to a crisis in housing in the quickly growing cities. The need for a comprehensive planning program became clear, in order to cope with the uncontrolled building explosion and the unprecedented need for utilities and infrastructure.

Major studies and competitions were launched in relation to the evolving plan from the late 1950s on to address the effect that postwar prosperity was beginning to have upon burgeoning industries and population movement towards the cities. These changes in society and urbanism were a result of the postwar miracolo economico (Economic Miracle) in Italy in the years 1958-1963, a period, despite a recession in 1963 that ended the boom years, which continued throughout the mid-1960s until the collapse of economies with the 1973 Gas Crisis and the 1973-74 Stock Market Crash.
The notion of the “Larger Number” or the “Greater Number,” (Il Grande Numero, Le Plus Grand Nombre) was a critical issue in this period. The “Greater Number,” a key concept addressed in the CIAM IX conference of 1953 held in Aix en Provence, was reactivated in mid-sixties architecture culture and is a term that is often used in discussing the shift in Italy from an agricultural to an urban/industrial society which was characterized by serious housing shortages and rapid growth in cities. How could an “organic” model as seen in the tessuto or existing urban fabric that evolved over centuries be modeled in rapid new housing quarter designs so as to avoid the inevitable alienation in the creation of housing projects through the repetition of identical modules?

The first years of the 1960s saw the emergence of theories of city-territories (città-territorio) by architects and urban planners as a strategy to address the simultaneous planning of the overall scale of a territory that could be conceived of as a scalar juxtaposition in which decisions made on the local level in terms of housing and urban fabric would have a cumulative effect on the design of cities and the connection of cities (or a concept of conurbation) would extend to physical manifestations on the territorial scale. This chapter also examines the role of U.S. Economic Recovery Program

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15 The architects from Morocco and Algeria who presented the detailed studies of daily living conditions in the North African bidonville brought a focus on the importance of public spaces. The change in the notion of the term “habitat” is important in that it was no longer seen in a similar functionalist aspect of the minimum dwelling unit, but seen as a complexity that was a result of the informal growth of spontaneous dwelling, offering organic analogies of growth that may be seen as akin to biological growth. Importantly, form and function were inextricably linked with social practices that may be seen in a different way in Zevi’s definition of “organic.” A direct influence on this work may be seen in Adalbert Libera’s project for housing in the INA-Casa complex in Tiburtina, Rome (1950-54). Other variations may be seen in Libera’s housing for the Olympic Village in the Flaminio district of Rome (1957-60). There are also direct parallels in the work of Giancarlo de Carlo.

16 It is striking to note here, that this concept was developed in 1962, only 16 years after the establishment of the various “regions” in postwar Italian unification. Giuseppe and Alberto Samonà proposed that the Strait of Messina should be conceived as a region, as a new concept, seen in theory and in practice in the competitions. The term “conurbation” (conurbazione or agglomerato urbano) was coined by Patrick Geddes in 1910 to describe connected cities, or an urban agglomeration.
(known as the Marshall Plan) funds in the growth of industrial sectors, such as heavy industry and steel production that directly affected the housing industry and architecture and urban design.\textsuperscript{17} The challenge in Italy from the U.S. point of view by the Marshall Plan planners was to develop a consumer society in a country of predominantly working-class agricultural workers known for their frugality, as well as to suppress the appeal of communism.\textsuperscript{18} The early and mid-years of the 1960s could be characterized as the moment of the emergence of a consumer society euphoric with the possibilities that development and technology promised. This uncritical (yet planned) reception of the fruits of technology began to change at the end of the decade replete with social, economic, and political crises in planning strategies. Chapter Seven “The Metaprogetto yes and no?” examines this period in terms of the ambivalence toward industrialization of architecture: advanced techniques were needed to meet the housing crisis, yet the increasingly technologically-oriented society was growing ever more estranged from fundamental human considerations. In 1968, the XIV Milan Triennial of Design with the theme, “The Greater Number” (\textit{Il Grande Numero}), an exhibit, but more than that is discussed as an important episode that from its planning which began in 1966 to the occupation of the exhibit on the day of its opening embodied the crises of the period.


Chapter 1: Crescita e forma/On Growth and Form: The Tissue of Structure

Macrostructure as Organism in the work of Rinaldo Semino

The work of Italian architect Rinaldo Semino (1937-) represents an alternate expression of organic architecture in postwar Italian architectural culture that is not tied to the the colonization or even stigmatization of the term following the publication of Bruno Zevi’s *Verso un’architettura organica* (*Towards an organic architecture*) in 1945. Semino’s experimental work from the mid-1960s to early 1970s is representative of a design approach taken by a number of architects in Italy at the time: that is, principles would be abstracted from the observation of natural systems as a starting point for experiment and design. In this sense then, the organic became a methodology, not a movement or a style, and is nested in architecture, engineering, aesthetics, and in politics as an experimental method. This chapter will discuss Semino in some detail, and then nine other architects and engineers will be introduced whose projects share a working methodology that was inspired by studies of natural systems and scientific methods, and who open up larger issues in architecture and culture that are raised in the projects that are examined in subsequent chapters.

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20 This chapter represents the beginning of a larger monograph that I will be developing on the work of Rinaldo Semino and the other alternate organicists. There are also plans to develop this into an exhibit in Italy.
Semino designed modular structural elements and systems that were intended to be machine fabricated and then assembled to make a whole out of the constituent parts. His work was inspired by metaphors that he borrowed from natural science in which a form was conceived of as a result of a dynamic response to both internal organization and external pressures. Semino’s work pointed to an alternate organic architecture, one that does not literally imitate biomorphic, crystalline, or other natural forms. As a whole, his work challenged the assumption that organic architecture must resemble natural form and proposed an architecture that is not only modern and industrial, but also organic, in that the architectural parts were brought together in ways that are syntactical and organizational. In short, the organization implies the organism of architecture.

His work serves as a case study in the exploration of an alternate use of the term organic architecture which has been dominated by the many interpretations of the vague and open-ended term “organic,” first proposed by Bruno Zevi and taking on many afterlives. Thus, Semino will serve as a threshold figure for a number of other lesser known figures in Italian postwar architecture culture who did not get caught up in the literalization of organic metaphors. These more marginal figures (with a few exceptions) shared an ethos, a way of working, and the sheer excitement of utilizing scientific method to make constructions, installations, architectural components, and systems that were experimental, in that they exhibited a creative playful act using organic and scientific principles to inspire design processes.

This dissertation is not a monograph on Rinaldo Semino. He was introduced as a discussant by the architectural theorist Maria Bottero who published his work in Italian magazine Zodiac number 22 of

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21 Define the terms modular, prefabricated (which may be low-technology, or advanced manufacturing) and industrialization of building components.

22 In discussing “organic architecture” with relation to Rinaldo Semino’s work and other work of the 1960s, I will employ terms that are familiar in the lexicons of two disciplines: semiotics (morphology, syntax, grammar, etc.) and in biology (cells, tissues, organs, etc.).
1973. Bottero provided an important model for thinking differently about scientific methods used in architectural and engineering practices. Her writing from the period has deep resonance for contemporary architecture and is an inspiration to this dissertation. While looked at primarily in a historical context here, both Bottero and Semino are still active and continue to be part of the ongoing interest and current discussion of the overlap of architecture and science and natural laws.  

As a point of departure, three unbuilt projects by Semino which were published in the 1973 issue will be examined. These projects are used to frame the larger issues of the time. In this issue of *Zodiac*, entitled “Light Structures,” Bottero began the issue with an anthology of the work of Robert Le Ricolais and then curated the remainder of the volume with the work of nine other international architects and engineers, in whose work she identified an interest in morphological research and inspiration from the methodologies of the natural and physical sciences, akin to the interests of Le Ricolais. The studies of light structures in a period marked by environmental crises of an unprecedented scale were seen as energy- and material-saving responses to the environmental impacts of building. The different approaches were characterized by the innovative structural use of manufactured building components whose organization into efficient structures was inspired by looking at analogous natural (both organic and inorganic) structures.

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23 The transatlantic dialogue that Maria Bottero developed with the University of Pennsylvania is the subject of a new, expanded research project for which I have received a Graham Foundation for Advanced Studies in the Fine Arts 2014 Research and Development Grant for the project *An Alternate Organicism in the journal Zodiac, 1965-1973*. The grant will enable me to continue my discussion and interviews with Maria Bottero. I received a Vice Provost for the Arts Faculty Development Grant from the Center for the Arts at Temple University, Philadelphia where I am an Assistant Professor in the Tyler School of Art since Fall 2009. The grant was for the academic year 2012-2013. General orientation about the importance of the discourse between Maria Bottero in Milan as editor of *Zodiac* and her interest in Robert Le Ricolais, R. Buckminster Fuller, Louis I. Kahn, and Anne Griswold Tyng at the University of Pennsylvania. There are also overlaps with *Via 3*, the journal of architecture of the University of Pennsylvania. Articles: Maria Bottero and utopia, Robert Le Ricolais and the boundary, and David Bohm, “On Creativity.”
In the introduction to this issue, Bottero posited that research into the laws governing inorganic material and systems might be extracted to apply to growth in living organisms and to architectural and structural design. Bottero explained her intentions:

I should like to underline the present-day validity and extreme interest of his [Robert Le Ricolais] research, which offers as a parameter of reference, enquiry into the structure of matter and of nature. The morphological examination of the laws which govern the organization of non-organic matter may in fact lead to attempting to find analogous laws governing the phenomenon of the growth of living organisms and of the functioning of the human mind itself. The work of the biologist D’Arcy Thompson has been exemplary here, because it deals with the morphological-structural study of living organisms, starting from their mathematical and physical aspects; it has proposed the natural configurations of matter to designers, both as a source of analogous inspiration for physical-structural research... as well as inspiration for a method that, in the search for formal definition, may be transposed to the processes of knowledge themselves.  

Bottero used Thompson as a starting point for a broader interest in natural systems and pointed to the importance of experimental morphological design research. She explained:

Morphological research lies on the borderline between physics and biology and the expressive linguistic field. This is justifiable if one considers that, as Chomsky says, thinking and therefore language arise from the “interaction between a particular and complex system, given biologically—that is the human mind, and the physical and social world.”

She opened up a discussion between natural form and language, a radical proposition that allows for connecting diverse modes, the physical and the intellectual. She refined the organization of this issue of *Zodiac* by dividing it in two sections which linked a theoretical approach to the work in a critical and thoughtful way. The second part of this volume is dedicated to “Close Packing” as seen in the work of Keith Critchlow, Paul Marchant, and Michaël Burt. This work was inspired to some degree by Thompson’s discussion of the space packing of cellular elements that is found exhibited in beehives, soap films, and other polyhedral constructions, based on minimal surface in nature. However, such “close packing” is quite different from the first set of projects. These projects emphasized the geometrical over the algorithmic and represented much more of a notion of the perfection of symmetrical arrangements in non-organic models in nature, such as crystal formations as inspired by the work of Lord Kelvin in his “Molecular and Crystalline Theory: On Homogeneous Division of Space,” from his *Mathematical and Physical Papers of 1982-90*. The image from Kelvin accompanied Bottero’s “Introduction.”

The first part of Bottero’s “Introduction,” which is the focus of this chapter, began with an extensive survey of the work of the well-known engineer Robert Le Ricolais and a discussion of his structural principles by his younger colleague Peter McCleary. She continued with examples of other space frame and grid structures that were expressive of the forces within the structure. This theme

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25 Bottero, “Questo numero,” v. [English translation on page 238] Original text: “La ricerca morfológica si trova al confine fra il campo della fisica e della biologia e il campo espressivo linguistico. Ciò è giustificato se si considera che, come dice Chomsky, il pensiero, e quindi il linguaggio, nasce “dall’interazione fra un sistema particolare e complesso, biologicamente dato—che è la mente umana—e il mondo fisico e sociale.”

Chapter 1: *Crescita e forma*: The Tissue of Structure 63
can be seen in the work of Félix Candela, Serge Ketoff, Gernot Minke, Renzo Piano, and Rinaldo Semino. Taken as a whole, this group shared an underlying interest in D’Arcy Thompson’s *On Growth and Form* in that it provided them with an approach toward understanding and analyzing the dynamical aspects of form.\(^\text{26}\)

*Crescita e Forma: la geometria della natura*, as Thompson’s *On Growth and Form* was translated in 1969 into the first Italian edition, resonated with architects in Italy during this period, and it marked a new approach to organic architecture.\(^\text{27}\) This important book investigates how surface tension, cellular divisions, membrane boundaries, and other structural characteristics reveal the material structure of nature, and how form negotiates the demands of the dynamical forces of the physical world, as well

\(^{26}\) The term “dynamical” versus “dynamic” is intended to refer to the mathematical concept in which changes in a system are understood as changes in state in relation to time, but there is a dependency on each state and possible future states are related to the current configuration. This is reminiscent of algorithmic planning of linear sequences of change, but with the introduction of change and recursivity, the system may be more complex. This is perhaps used in a less than scientifically rigorous manner, but it is used metaphorically to establish the idea of architecture as a system in change. Throughout the dissertation, various case studies will look at the various possible configurations of dynamical systems in architecture, their possibilities and their problems as theoretical systems, or mathematical systems, and then manifest in building components. All of this is meant to challenge the very static nature of architectural form. Often it is a question of scale. The very mundane question of construction of an individual dwelling, when brought together at the scale of a neighborhood or the city, moves into another order of complexity with descriptions that speak of the organic growth of the fabric of the city, in English, or *la crescita organica del tessuto della città*, in Italian as an example.

\(^{27}\) To the best of my knowledge, this is the first Italian language translation of the Abridged 1961 English language version. D’Arcy Wentworth Thompson *On Growth and Form, An Abridged edition*, John Tyler Bonner, ed. (Cambridge, Eng.: Cambridge University Press, 1961) [345 pages]. Italian translation: D’Arcy W. Thompson *Crescita e Forma, la geometria della natura* (Torino: Editore Boringhieri, s.p.a., September, 1969) [356 pages]. Because both the Abridged and Unabridged editions are so copiously illustrated, I believe that copies of the book may have circulated widely and have been an inspiration to architects in Italy even with problems of language, surmountable through a reading of the images. During a talk I gave recently at the Politecnico di Milano via Skype, I was asked by a professor in the audience (whose name I did not hear) if I knew that the 1969 Boringhieri translation was not the first edition that was published in Italy. I have not found evidence to support his claim, and thus offer that the dissemination of Thompson’s text in Italy may have been through magazine articles, reprints in textbooks perhaps, or in foreign language editions. I will pursue this matter further.
as the invisible and fleeting forces embedded within material itself, very much of interest in contemporary architecture. Semino was deeply influenced by this text during the period of the late 1960s. In fact, Semino’s interpretation of the natural analogies in Thompson’s work can be read as generating the syntactical and organizational principles of his work. Bottero’s article highlighted Semino’s understanding of organic form, one that is not equated simplistically with a particular style. There is no doubt that Semino interpreted the scientific text thoughtfully and critically. She explained that the significance of Semino’s work is that his research provides architecture with:

A new basis as a spatial constructive technique through principles and laws drawn from an attentive observation of nature.

In Semino’s case, his:

Close attention to vegetal and organic tissue structures have lead him to develop a series of base-constructive elements that aggregate in automorphic structures in increasing levels of complexity.

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29 Rinaldo Semino, in conversation with the author, February 2007 and March and June 2008. I have found photocopies of images from Thompson’s books on the verso of sketches in Semino’s files, however, they are isolated to the images which correspond to both the English and Italian text and therefore I am unable to date or find the original source. Semino owns a copy of the 1969 translation so I am assuming that this was his first exposure to Thompson. I brought him the recently reissued Unabridged English version.

30 Bottero, “Questo numero,” vii. Translation into English on page 238. Original text: “Rinaldo Semino porta avanti, nei tre progetti presentati, lo studio di un elemento costruttivo-base che si aggriga in strutture automorifice second livelli scalari di crescente complessità.” Bottero mentions the influence of natural elements and vegetal tissues in the following: “Anche se spesso parziali, le ricerche sopra menzionate si iscrivono tutte nella fiducia di re-impostare l’architettura come tecnica costruttiva spaziale, secondo principi e leggi tratte da una attenta osservazione della natura: dalle strutture dei radiolari (Le Ricolais), alle superfici minimali delle pellicole delle soluzioni di sapone (Le Ricolais, Minke, Bürt), alla struttura dei cristalli (Le Ricolais, Bürt, Critchlow), alla struttura dei tessuti vegetali e organici (Le Ricolais, Semino). Queste ricerche sono essenzialmente teoriche e non hanno ancora trovato un campo d’applicazione nella prassi costruttiva corrente: ciò non toglie che si debba riconoscere tutto il concreto valore di stimolo e di indicazione di nuovi possibili modi di strutturazione dello spazio.” This point is key, as the 1960s progressed the use of component parts in automorphic systems was pursued in all manner of
Here the major distinction is clearest: Semino’s projects proposed a static construction of elements, yet the elements themselves were changing and reactive to variations in surface and position in the overall structure. In Semino’s architecture the element itself was (and is) of utmost importance. Each unit was studied exhaustively as a key to how the unit element would be brought together in a larger assemblage. In Semino’s conception the structural element was not only a structural space frame that is then clad or infilled with elements to create surface enclosure; the elements themselves were both structure and surface. Because the elements work together as a whole, even a force applied at one point is distributed among the different cellular elements. The structure is an assembly of a series of interrelated, similar parts that act together as a whole. This structure may be seen as a concrete example of a system in action. While seemingly static, the forces operating in the structure are dynamic; in fact, it appears in fact that the whole is more than the sum of the parts.31

Rinaldo Semino’s unrealized projects, developed in response to national and international competitions for large-scale housing complexes, transportation hubs, and industrial zones during and just after the postwar economic boom of 1958–63, reflected his interest in industrially produced component systems in architecture: he built up complex structures from simple, elemental units. His work in this period focused on the tectonic of the individual unit and the inherent morphological predisposition for accretion in a particular and geometrically precise manner. In short, Semino used dynamic models of organization found in nature as operational techniques with which to design complex macrostructural projects.

industrialized architecture and was the constituent part of the idea of the metaprogetto, which is discussed in the Chapter Seven.
31 This relates to Wachsmann, Makowski and other aspects of the space frame developed in this time period: opposite idea of organic that we see in Zevi which is more Aristotalean…thus no piece could be removed…this is more of an idea that there is no overall sense of perfection (something which Bruno Zevi himself said, but confuses his argument).
Semino described “The Structural Idea” of the macrostructure in the introduction to his eponymous article:

The study aims at identifying suitable structures for realizing the macroarchitecture in which man will probably concentrate certain of his activities, examples of which, some of them utopian, are not lacking.

Technical possibilities today offer us only two examples of macrostructures: suspension bridges and dams and in the near future will give us vast shell or suspended roofs; structural systems today, do not permit us to realize, for example, multi-story macroarchitecture…it is probable that in the future it will be necessary to construct macroarchitecture of industrial, social, and commercial concentrations in restricted territorial zones.32

His approach was to create a very basic structural element that created a flat area by setting two cupped plates in opposition. By combining this simple element in various geometrically rigorous ways in both drawing and model studies, he proposed the evolution of a macrostructure.33 In this

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32 Rinaldo Semino, English translation as “The Structural Idea,” Zodiac 22 (Milano: Edizione di Comunità, 1973): 148. [English translation on page 253]. “Lo studio è rivolto ad individuare strutture adatte a realizzare quelle macroarchitetture in cui probabilmente l’uomo concentrerà alcune sue attività e di cui non mancano esempi ed utopie. Attualmente la tecnica ci offre due soli esempi di macrostrutture: I ponti sospesi e le dighe e in un futuro abbastanza vicino ci darà la possibilità di avere delle grandi coperture a guscio o sospese; I sistemi strutturali di oggi non ci danno nessuna possibilità di realizzare ad esempio delle macroarchitetture a più piani. Il sistema che regola gli insediamenti industriali oggi sta dilagando nelle pianure e nei fondi valle minacciando l’ambiente; considerato che le pianure non sono infinite, che la loro vocazione primaria è l’agricoltura e che non è possibile sconvolgere oltre l’ambiente è probabile che in futuro sia necessario costruire delle macroarchitetture di concentrazioni industriali sociali e commerciali in zone limitate del territorio.”

33 In fact, will be further investigated, it is actually the geometry of the initial element that contributes to the larger organization, much as the packing of the hexagonal shapes in a honeycomb, in coral colonies, or other natural structures. (During this period Semino proposed the idea of a macrostructure as a building type that was built up from smaller component parts and was a distinct idea from a megastructure. This is discussed in Chapter Seven regarding situating Alessandro Mendini’s discussion of the metaprogetto taken from G. Mario Oliveri, his colleague at Nizzoli Associati, and an important contributor to the discussion of prefabrication and advance building components and building systems in the same period that Semino is working in the late 1960s).
way, the elements first are made at a microstructural scale and combine to make a potentially infinite variety of macrostructures.

The projects presented in Zodiac 22 (and discussed in further detail in Chapter Seven) are all constructed from variations on the same base unit, which are subject to scale changes and produce increasingly large projects. The studies for the base unit received an award of third place for the IN/Arch-Finsider competition, which was sponsored by the Istituto Nazionale di Architettura (Italian Institute of Architects), and one of the largest steel manufacturers in Italy, the company Finsider.\(^\text{34}\)

Figure 2 Left: Rinaldo Semino, IN/Arch Finsider competition in Zodiac 22, (1973): 154-5. Right: Photo of model by Rinaldo Semino by author, 2008. Courtesy of Rinaldo Semino.

\(^{34}\) The competition for In/Arch-Finsider had the theme “Elementi di struttura per lastre isotrope,” and was published in L’Architettura. cronache e storia 148 (1968): 643, 655 and Zodiac 22 (1973), and was included in an exhibit of the projects in Rome at the Palazzo Taverna in January, 1968. All of these projects were also published in connection with an award for his Thesis project at the University of Venice. Rinaldo Semino, “Ricerca di elementi strutturali per la costruzione di macroarchitettura,” Sintesi delle Tesi premiate al Concorso UISAA 1969-1970 per laureati in Architettura ed Ingegneria (Ufficio Italiano Sviluppo Applicazioni Acciaio, Milano) an insert into the magazine Acciaio 9 (1971): 21-26. These projects are examined in further detail in Chapter Seven.
The first project, shown below, was developed in response to the theme of the steel housing unit in response to the CECA competition of 1965. In this project, Semino developed a module that used a doubled dome construction to separate and support two floor slabs, creating a complex framework within which different apartment typologies could be developed. The project is notable for its attention to the innovation in the development of the cellular unit, modifying structural organizations in seashells and vegetable shells. In this project he developed the concept of the automorphic, wherein a structural element at the microscale would then influence the macrostructure or macroscale reading of the relationship of the whole to the part.


In another IN/Arch-Finsider competition, Semino again used steel to develop an innovative, deep slab structure which was to be composed of smaller repetitive units for the design of a multi-level shipping container structure that was to extend over the water in the port of Genoa. This project addressed environmental issues of the day, leaving the flat land in the river valleys in mountainous Genoa for agricultural use by proposing a multi-story container structure over the water so as to not spread laterally over the land. This project would have also operated at multiple scales, from the

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35 The competition was entitled, “Unità di abitazione in acciaio.” It is discussed in further detail in Chapter Seven.
microscale of its flexible and adaptive unit, to the macroscale, where the structure would have been used as a protective barrier for the port of Genoa.

Figure 4 Left: Rinaldo Semino, IN/Arch Finsider competition for Genoa container port in Zodiac 22, (1973): 152-3. Right: Photo of model by Rinaldo Semino taken by author, 2008. Courtesy of Rinaldo Semino.

Semino’s most fascinating project was a road and rail connection between Sicily and the Italian mainland in response to a 1969 ideas competition sponsored by the Italian highway transportation agency ANAS. Made up of twenty-five-meter concrete cellular units that link together and float on the water of the Strait of Messina, tethered only on either side, the structure was likened by Semino to the floating ice that makes up the frozen expanses at the Arctic Pole. Nature offers an analogy for a system whose structural capacity allows for both the continuity of its coverage and its break-up into smaller cellular units. Semino’s project, like sea ice, would both float and provide transversal resistance to the force of the strong sea currents and wind. He envisioned the bridge as part of a city-region, which would contain the administrative center for the new region connecting the mainland and Sicily, crossing boundaries between the two and establishing a “Strait of Messina Territory.”  

36 The metaphor of sea ice, an extensive system of smaller pieces of ice operates as a networked structure and is a metaphor that will be discussed later in relation to the issue of the “Greater Number.”
Hence, Semino’s importance to contemporary architectural research revolves around his work’s organic approach, which is not formal, but procedural, performative, and operative. His work was prescient in relation to contemporary architectural investigations into emergence and self-organizing systems through the use of computation. Furthermore, Semino’s architecture exhibits integrity and a unity of the constituent parts. It is an architecture that does not merely appear organic; it is an architecture that performs organically.

Semino’s projects emphasized the element itself: each individual unit is studied exhaustively after which point the element was brought together in a larger assemblage with other elements. The structural element was not only a structural space frame that is then clad or infilled with elements to create surface enclosure, but the elements themselves are both structure and surface. While other designers emphasized the importance of the joint, Semino’s joints were not really the conjunction of various linear elements in space at a point, but his work studies the connection and jointing of one surface to another.
A major distinction becomes clear in the different biological models of growth cited by Le Ricolais and Semino in this issue of *Zodiac*. In the section by Le Ricolais “Essai sur des Systems Reticules a 3 Dimensions,” he described the reticulated structure of the singular radiolarian by Édouard Monod-Herzen as a model. Semino was guided by similar references, but was drawn to coral colonies, foam, cross sections of plant stalks, and other natural models. In the collage used as the frontispiece for his article, Semino arrayed a line of images of complex multicelled natural examples, separated by a traverse section drawing of his steel housing project from a series of details of models he had produced.37

Figure 6 Robert Le Ricolais, his text is illustrated with images of radiolarian reticulated structures above by É. Monod-Herzen and in lower right is a proposal for his own approach for a structural reticulated structure, *Zodiac* 22, (1973): 21

37 This image is a reproduction, in negative, of one of the panels that Semino had presented for his thesis at the University of Venice. This image is shown with the following caption and image credit: Rinaldo Semino, “Ricerca di elementi strutturali per la costruzione di macroarchitetture,” in a special issue “Sintesi delle tesi premiate al Concorso U.I.S.A.A. 1969-70 per laureati in Architettura e Ingegneria,” in *Acciaio* 9 (1971): 21. It is reproduced in negative as the image which accompanies his essay in *Zodiac* 22. It is notable that in the different scales of microscopic organisms, and proposals at a very large scale are called out by him as “images of the passage from one dimension of structure to another” (Immagini del passaggio da una dimensione di struttura ad un’altra).
The inspiration to interrogate the relationship between scientific analysis of organisms and other natural systems and architecture in this dissertation is guided initially by Bottero’s theoretical frame. Expanding upon her investigations, this dissertation takes on the task to understand an organic approach in architecture which will be understood as a working process that looks towards natural models of growth used in the evolution of form. Beginning with Rinaldo Semino, this chapter will continue with a short discussion of particular portions of D’Arcy Thompson’s *On Growth and Form* and its influence on Semino’s design process and will continue with a further analysis of Semino’s biography and working methods. The remainder of the chapter will bring together a short description of other architects and engineers working in Italy in the 1960s in whose work one may discern a parallel interest in scientific methods and geometric analysis in the design of architectural form.

In D’Arcy Thompson’s book, *On Growth and Form*, the chapters on “The Forms of Tissues or Cell-Aggregates,” “On Magnitude,” “The Rate of Growth,” and “On Form and Mechanical Efficiency,” provide important analogies which were adopted by Rinaldo Semino in his design process. The geometric organization of rules that guide the aggregation of individual units seen in the examples of cells in living tissue, in soap bubble and foam geometry, in the packing of individual hollow cells in
honeycomb, all give visual expression to the dynamic forces internal and external forces that govern form. By extension, these became models for social organization and for the proposal of physical models of building large scale buildings which Semino termed macrostructure. Many architects during the 1960s were entranced by the power of the simplicity of the singular element when aggregated according to simple geometric rules, which had the capacity to create extremely large scale, complex structures from simple elements. This was a way of emphasizing the analogic aspect of natural by its application to architectural form. Other architects including Yona Friedman in France and Giancarlo de Carlo in Italy understood the political aspect of the organic model. While their work was in some way an analogic model of organization of similar individual units or elements, the idea that an internal pressure of the organism can influence the overall form became a political metaphor as well. In their projects, the focus on the individual inhabitants is clear: inhabitants might occupy living spaces in a larger megastructure and change its overall form, dynamically over time, much as an organism evolves.

Philosopher of science and physician Georges Canguilhem (1909-1995) questioned the notion of the various manifestations of the biological object. His importance for this discussion is that he cautioned us to not think of organisms solely on the basis of mechanical and technical models. He cautioned against the reductive tendency of conflating an organism with a machine. He proposed that an organism must be understood as it is in a continuous dialogue with its milieu and rather than being a complete and perfect form it has an ontological status which is more than the sum of its parts. He stated, “A living body is an animate and organized body. It is animate because it is organized.” In biological organisms, cells accrete to form tissue, indicating a simultaneous existence

of multiple orders of scale and identity in the cell, tissue, and hence, the organism. This discussion can be extended to speak to the large scale, multi-celled “macrostructures” designed by Rinaldo Semino and the political climate of the 1960s in which these structures were proposed.

**Biological metaphors and biographical stories**

Rinaldo Semino, in our first meeting in January 2006, spoke about the importance of D’Arcy Thompson’s *Crescita e Forma* (*On Growth and Form*) to his work. Semino’s projects from 1965-1973 demonstrate various attributes that may be tied to Thompson’s work. What is difficult about contextualizing Semino in Italy of the 1960s is that he had always worked in a rather solitary manner, not participating in larger groups or discussions, except when his work had been included in exhibits and publications, which took place when others recognized his work. I would say that Semino’s unspoken importance has to do with his work possessing an emergent quality regarding a new kind of organic sensibility that developed in various countries through the 1960s that is vastly different than what would be characterized in Italy after 1945 by Bruno Zevi as “organic architecture.”

As historians, it is customary to write in the third person point of view for all academic writing. This is an easier task when writing about a person or subject that has occurred or lived in the past. This is the natural point of view to take when someone is long deceased and when one is consulting an archive of materials that are organized in such a way as to be an accessible and stable source of information about past events and personalities. It is under negotiation when writing about someone who is alive and active in the present moment being asked to discuss the past.

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This is what is at stake here. At this point, I need to leave the shadow of third person and speak in first person about Rinaldo Semino who I will continue to give voice to in second person subjective and objective cases.

I titled this section “Biological metaphors and biographical stories,” as I have had to depend on my semi-annual discussions with Rinaldo to piece together his biography. Though I have asked many times, he does not have a traditional curriculum vitae, though he had given me a bound photocopied set of his publications which also included a list of publications and of a few buildings he had built in practice with others. The built projects do not reflect his experimental work. Dates and places of study are memories for him. They are alive, but not recorded, archived, or detailed, as are his projects. Thus I must rely on his biographical stories, as the biographical implies the “relating to or telling the story of a real person’s life.” As the historian I have the responsibility to write a biography of the person I am studying, as a biography generally implies “the story of a real person’s life written by someone other than that person.” I am that person, yet I am writing about someone who is asked to reflect on his own place in a historical moment forty or so years ago. As Tomás Maldonado said wisely, when asked to reflect on his tenure at the Hochschule für Gestaltung at Ulm twenty years after his departure in 1984:

There is a rule that in this case and in all other occasions I think it wise to respect: to not constrain a protagonist to assume the role of the historian. In my opinion, the protagonist, might be, though is not always, a useful chronicler of the facts that he has lived in first person. It is rare however when he can become a reasonably trustworthy historian of the same facts. The reasons are rather obvious. The protagonist, whether or not he is aware of it, always searches to give a reading of the facts that are favorable to him, or better, favorable to his passions, and to his own interests. So the fragmentary annotations that I present here

39 Merriam-Webster dictionary.
certainly reflect my passions and interest of the time, but also, and maybe above all, my actual passion and interest towards that experience."  

I must say that Maldonado’s position resembles Rinaldo Semino’s. He has maintained a passion for his work over nearly a half-century with the frustration of never having his personal vision built at full scale. Yet these roadblocks have not stopped him. When we last met two years ago, I did not have time to visit him in Parma and he agreed to meet me at the train station at Bologna before I traveled further north. Rinaldo arrived as always, ready to work, two new models in a bag. We sat in a café near the station for a few hours while he explained how he thought that he had finally resolved his system of an extensible structure made up of smaller component elements that has been the mainstay of his studies since the 1960s.

It is that passion and dedication that I respect and admire in his work. He becomes for my work a kind of everyman in a sea of other architects and designers whose work was never the center of attention, not great luminaries of their time, nor fastidious archivists of their own production during their life. But his is a mind that is alive. He is also someone whose early work is now the subject of a historian/architect, and in that sense by closely studying his work, considering any date or fact to be

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40 Tomás Maldonado, “Ulm rivisitato,” in Maurizio Sabini and Giampiero Bosoni, eds., Il contributo della scuola di Ulm/The Legacy of the School of Ulm, Rassegna, anno 6, 19/3 (Milano: C.I.P.I.A., 1984), 5. “Vi è una regola che, in questa e in tutte le occasioni, mi sembrerebbe saggio rispettare: non costringere un protagonista ad assumere il ruolo dello storico. A mio avviso, il protagonista semmai può essere, e non sempre, un utile cronista dei fatti da lui vissuti in prima persona, raramente però può diventare uno storico ragionevolmente affidabile dei medesimi fatti. E le ragioni sono piuttosto ovvie. Il protagonista, consapevolmente o meno, cerca sempre di suggerire una lettura dei fatti a lui favorevole, o meglio, favorevole alle sue passioni e ai suoi interessi. In quanto protagonista di Ulm, io non faccio eccezione. Le frammentarie annotazioni che presento qui di seguito rispecchiano certamente le mie passioni e i miei interessi d’allora, ma anche, e forse soprattutto, le mie attuali passioni e interessi nei confronti di quella esperienza.” [Translation mine]. I use this quotation in Chapter Five in the section “Limits of the Ulm model,” but think it is important in this context as well.

41 Bruce Parent with whom I was traveling had documented this meeting in photographs and a short video.
relative though important, he has presented (and presents) to me the embodiment (though often inchoate) of the ideas that were circulating in Italy in a particular moment in time.

Semino has stubbornly yet passionately worked on the design on component parts, self-organizing structures, and intricate joints with a loyalty to the lessons of D’Arcy Thompson. His obsession with the joint and element has, like Konrad Wachsmann and others, caused him great problems in losing the larger picture. Semino doggedly pursued the design of architectural structures, not merely the illusion of a structure. Yet he has not built any of these structures for myriad reasons, some of which are due to lack of funding or university support for his research, but partially due to, in my opinion, his introverted character that may have held him back. This is merely speculation, and perhaps as they say, time will tell.

Some of his work, in particular the Bridge at the Strait of Messina, is truly inspired. Though not without problems, it embodies the ethos of architecture as a natural form and relates to the then-current architectural discourse on the idea that architecture is territory, the concept of città-territorio.

By being so motivated and animated by the scientific writings of D’Arcy Thompson, Semino is representative of a loosely connected group of designers, connected through their interest in organic and natural systems, who produced work which I believe can expand the understanding of the term organic architecture both in relation to the period of the 1960s and as well as for today.

To take the metaphor further I would like to highlight the organic aspect already inherent in Semino’s name:

*Semino*: The word *semino* [1838] is the diminuitive form of the word *seme* [1205] or seed. A seed is an organ of dispersion characteristic of the species “Spermatofite.” A seed may or may not be embedded in a fruit and is derived from a modification of a fertilized egg and contains an embryo and a reserve energy source. Other meanings of the word *seme* or seed
are, the stone in a fruit such as a cherry, in biology, the word for sperm or the male generative element (*elemento germinale maschile*), a race, or descendents of a people, in a figurative sense, a seed can stand for the origin, principle, or cause, as in spreading the seeds of discord.

To seed or to *seminare*, or to seed a terrain with grain. In a figurative sense, to seed to disperse here and there, to let fall, to disseminate.\(^{42}\)

When I mentioned this connection to Semino in one of our numerous conversations, he laughed and said that it had never occurred to him. But at a distance of over forty years from the time that Semino had made his drawings, this metaphor seems striking to me. All of his projects use cellular elements to build up accretions of larger projects. The singular seed proliferates to form a new organism. He, Semino, is a seed. *Zodiac* 22 the shell or husk or fruit which contains the seed, one of many husks hanging from a branch of which there are many branches, competitions, exhibits, magazines, of a tree that is 1960s-70s Italian architecture culture, that of post-economic boom population explosion characterized by the idea of the new dimension, the Greater Number.

As Rinaldo Semino has recounted to me, he was born in Genoa, Italy in 1937, the child of a goldsmith. Semino studied at the Politecnico of Milan and then at the University of Venice where he received his degree in 1970. Semino initially studied under Franco Albini in Milan and was influenced by Albini and his dedication to industrialized architecture and the prefabrication of building components. Semino’s studio project was for the design of a prefabricated school that he produced under Albini’s supervision and was influenced by a rational approach to the emerging science and technology of prefabrication. Albini was not receptive to his work (in fact Semino did not receive a passing grade in Albini’s course), and Semino transferred to continue his studies at the IUAV at the University of Venice with Carlo Scarpa after 1964. He related to me that he did not

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\(^{42}\) As defined by the Zanichelli, Zingarelli *Vocabolario della Lingua Italiana*, 2004. [Translation mine]

Chapter 1 : *Crescita e forma*: The Tissue of Structure
work in a formal manner like Scarpa at all, but Scarpa had faith in him, and allowed him to pursue his own approach to the development of his thesis. He completed his thesis under the supervision of professors G. Davanzo in architecture and G. Macchi in engineering. Throughout this time, he studied with Giuseppe Samonà as well (though he was not able to give me further details). Semino was at the IUAV at the University of Venice in a dynamic environment but he was not able to take full advantage of the emerging discourse at the IUAV as he was in Venice infrequently, commuting as needed from Genoa. He pursued his thesis project with Scarpa who was very open to the project which was already under way. He concentrated his efforts on the development of a new cellular structural system, which he described as a membrane system the basis of which he used in the projects published in the Zodiac issue. In addition to the influence by the universities and professors with whom he had studied, Semino also told me that he was deeply inspired by Konrad Wachsmann who had worked in Genoa for several years (on the Finsider headquarters which is discussed in Chapter Seven), Richard Neutra, Sigfried Giedion, the Ulm School, but most of all by the structural studies of D'Arcy W. Thompson’s, On Growth and Form which he owned in its first Italian translation, Crescita e forma: la geometria della natura, published by Boringhieri in 1969.

43 Semino did not relate this to me but is cited in the article published as a result of winning a competition for his thesis. See next page: “Sintesi delle tesi premiate al Concorso U.I.S.A.A. 1969-70 per laureati in Architettura e Ingegneria,” in Acciaio 9 (1971): 21.
45 Based on interviews at the University of Parma on January 27, 2006 and in Semino’s studio in Genoa on February 2, 2006. Semino’s interest in Wachsmann’s work is also cited in by Enrico D. Bona, ed., in his Introduction to Tra Progetto e Tecnologia, (Genova: Istituto di Progettazione Architettonica, Facoltà di Architettura di Genova, 1991), 9. Semino had told me that he did in fact have a chance to meet Wachsmann when he was a student. He visited Wachsmann’s office in Genoa and said that he saw a model of Wachsmann’s project for the hangar there, which left a lasting impression on him. I am not certain if Semino was aware of Thompson’s text prior to 1969, though he does own a copy of the original 1969 edition. Thompson was published in ulm 12-13 (March 1965) and Semino might have been aware of his work.
Figure 8 Rinaldo Semino, “Ricerca di elementi strutturali per la costruzione di macroarchitetture,” in a special issue “Sintesi delle tesi premiate al Concorso U.I.S.A.A. 1969-70 per laureati in Architettura e Ingegneria,” in Acciaio 9 (1971): 21. This is a panel that Semino developed for his thesis. It is reproduced in negative as the image which accompanies his essay in Zodiac 22. It is notable that in the different scales of microscopic organisms, and proposals at a very large scale are called out by him as “images of the passage from one dimension of structure to another” (Immagini del passaggio da una dimensione di struttura ad un’altra).

This intersection of his professors, universities, and the various influences Semino cited are telling regarding larger issues in the Italian architectural field, and can reveal some significant insights into a particularly Italian version of “organic architecture” versus “rational architecture.” Semino is a hybrid figure, one who does not fall into either camp of producing either rationalist or organic
architecture.\textsuperscript{46} Perhaps he has been able to synthesize in his work in what historian Federico Bucci would think of as a fusion in a new Italian direction of modern architecture, something that Moretti had proposed a decade earlier in the magazine \textit{Spazio}. Moretti was able to overcome the standard Rome-Milan stalemate and have his magazine breach the divide: “Not by chance, in the magazine \textit{Spazio}, the relationship between Rome and Milan is unusual in that it puts aside the polemic between organicism and rationalism in the name of a single, ‘Italian’ direction in modern architecture.”\textsuperscript{47} Moretti’s framing can be used to situate Semino’s work.

Categorizing Semino into either of these poles is not possible; rather, his work exhibits a different sensibility, a different approach to the “organic” that is not formal, but procedural, performative and operative. I have resisted terming this approach as an -ism. I have consciously described instead a working methodology that takes inspiration from natural principles and scientific method as an “alternate organic,” approach, producing studies which are in effect examples of “alternate organics” when seen together. A design in this light is an alternate organic when the whole is constituted, ground up from a systematic coordination of its parts, rather than the classical model of the perfect whole being constituted of a coordinated series of parts from which none may be removed without adversely affecting the whole. So this chapter and this dissertation is then simultaneously inspired by Semino’s citation of \textit{Crescita e forma} (\textit{On Growth and Form}) and of his models, sketches, and drawings. There also emerges a focus on the individual element (cell, crystal, beehive, soap bubbles, or architectural elements) that is then formed into larger agglomerations. Because of small changes to

\textsuperscript{46} While I do not extensively discuss the evolution of rationalist architecture, I discuss the issue in some depth in Chapter Five in the section on Architectural Manuals. I discuss Luigi Moretti in contrast with Bruno Zevi in Chapter Three.

the underlying geometry that binds the individual elements together (either from internal or external forces), another concept emerges from organization: that of parametricism and pattern.  

Caught up in the increased interest in urbanism during the late 1960s (which is discussed in more detail in Chapter Six), Semino was Professor of Design at the University of Genoa until 2005. Retired, he now lives in Parma and is conducting research on new materials in collaboration with engineers at the University of Parma and continues to produce drawings and studies.

Rinaldo Semino’s research work is published in the following small books: Tra Progetto e Tecnologia (Between project and technology) in 1991, Progettazione e didattica nell’architettura: argomenti e confronti (Design and pedagogy in architecture: arguments and comparisons) in 1996, and in line with his increasing interest in design pedagogy, a parable in ten lessons on architectural design entitled Architettura: Una Scienza Collettiva in 2004. Semino taught architectural design and urban design and published his studies in a co-authored book Studi sui processi formativi dell’edilizia Genovese (Studies on the formative processes of building in Genoa). The first essay, “Ipotesi sulla delimitazione e sullo sviluppo dell’insediamento romano a Genova” is authored by Maria Figoli and the second,  


49 Rinaldo Semino, Tra Progetto e Tecnologia, (Genova: Istituto di Progettazione Architettonica, Facoltà di Architettura di Genova, 1991). Presentazione di Enrico D. Bona; Progettazione e didattica nell’architettura: argomenti e confronti (Genova: Joshua Libri,1995); Sistemi Autoconstruibili: per il progetto di strutture estensibili (Genova: Joshua Libri, 1996); and Architettura: Una Scienza Collettiva (Firenze: Alinea editrice s.r.l., 2004). Semino graciously had given me a copy of these books prior to our first meeting in 2006.
“Formazione e evoluzione dei tessuti edilizi dall’alto Medioevo ad oggi” (The formation and evolution of the urban fabric from the late Medieval period to today) is by Semino.⁵⁰

Semino does not have a curriculum vitae, but he provided me with a bound copy of all of his publications with an index both of his scientific research and his research done in connection with his teaching urban design at the university. The first publications are patents that Semino holds for an adjustable chair, designed in 1966 and a second for his prefabricated steel component, in 1967 which became the basic building block or cell for all of his imaginative large scale projects.⁵¹

Additionally, the results of the IN/Arch-Finsider competition in which he earned a Third place prize was published in L’Architettura. Croniche e storia; his related thesis project “Ricerca di elementi strutturali per la costruzione di macroarchitetture,” (Research on structural elements for the construction of macroarchitectures) was published as the result of a national competition for new graduates in architecture and engineering in the magazine Acciaio; and his studies regarding steel component elements were published through 1974 and again in 1985.⁵²

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⁵⁰ Rinaldo Semino and Maria Giovanna Figoli, Studi sui processi formativi dell’edilizia Genovese. The first essay, “Ipotesi sulla delimitazione e sullo sviluppo dell’insediamento romano a Genova,” is authored by Figoli and the second, “Formazione e evoluzione dei tessuti edilizi dall’alto Medioevo ad oggi” is by Semino. (Firenze: Alinea editrice s.r.l., 2005).

⁵¹ 1963, Brevetto per “Poltrona con schienale regolabile,” Pur in una scala di ridotte dimensioni rappresenta una applicazione esemplificativa di alcune caratteristiche meccaniche delle strutture a gusci contrapposti. 1965, Brevetto industriale per “Elemento prefabbricato per costruzioni, specialmente adatto per strutture portanti.” In questo brevetto sono espresse le caratteristiche principali degli studi di forma, resistenza, modulazione e costruibilità che hanno caratterizzato gli studi successivi.”

After 1974, he did not publish until 1983. As he related to me, he was occupied with teaching and after 1983 the majority of his publications relate to urban design and analyses of the urban fabric with occasional competitions and two new patents in 1985 and 1986. In part, one can deduce from his publication record that while he was occupied at the university with research and design projects relating to the urban scale, he was simultaneously studying and evolving modular systems, components, automorphic structures, and most interestingly, he was part of a 1989 Round table on Architecture hosted by the European Space Agency on the theme of “Research for Modular Aggregations to Design Dwelling Structures for Space.” What is interesting about Semino’s overall research is that whether he was working at the small scale of the individual unit, or at the city scale, he visualized form composed of multiple elements that could be brought together, to aggregate as form. His studies for typological elements for housing in his studies of Genoa emphasized this, as the tessuto edilizia or the building fabric which makes up the urban fabric, from the single room to the single family house, multi-family dwellings and the arrangement of housing in blocks, neighborhoods and ultimately the scale of the city. This sketch shows the relationships between the different scales. The cellula (cell, unit) is identified with an interior environment, has modular qualities and can be arranged flexibly and is extensible. The unità (unit, individual dwelling) has characteristics of a micro- and a macro- environment, and has a dual relationship to society and to nature. The blocco (block) is polyfunctional, has common services and open space. The quartiere (neighborhood) implies larger distances and the need for transportation systems and the città (city) implies larger social overlaps, activities and larger distances between elements. But the outside arrow connects the larger scale with the smallest scale of the cell unit, which is at the small scale, an interior space, confirming his idea of the relationship between the micro- and the macroscale being the “passage from one dimension to another.”

In this sketch I found in Semino’s documents he shows the relationship between the cell, the unit, the block, the neighborhood and the city as an overall constructive system. The arrows show the complex level of interactions between the different elements at every scale. (no date). Courtesy of Rinaldo Semino.

**Architettura: una scienza collettiva, Rinaldo Semino’s parable as thesis statement**

In this slender volume, an extension of his more straightforward books that outlines his design pedagogy, Rinaldo Semino wrote ten lessons for architectural design in *Architecture: A Collective Science*. Based upon his teaching in the Second year Design course at the University of Genoa, Semino playfully takes us through a dreamscape of his architectural visions. His voice is not dominant, and in the introduction he begins by speaking in second person about the professor who was about to begin his lecture:

In that moment he was thinking of what he had been wanting to write for a long time already: about his research, teaching methods, without taking into consideration who his writing was intended to reach.

He had no idea about how to begin. He had the distinct sensation that he could only perceive fragments. He then thought that it could also be a problem of the technique of communication. He continued with the memory of writings in which the author is the actor, who inserts himself within the narrative and the characters and with whom he could speak.
Thoughts like this exist, they propagate, become, through dialogue, the space within which one moves; they are the object and communication. Little by little they take form, between the characters action is developed, in their emotions ideas are developed.\textsuperscript{54}

This person, of whom the author (Semino) is writing is in fact himself as an observer, voicing his doubts, seeing himself from the point of view of the students. This same observer (Semino/not Semino) then focuses on a young woman in whose eyes he sees a glimmer of interest, comprehension, and even passion for the subject at hand: architecture. He observes a young man who enters the lecture hall, and although he has clearly entered the wrong lecture, is compelled by the discussion regarding architecture, and drawn into conversation with the young woman as she looks for a seat.

Semino uses the character of the young female student as his muse, to voice questions regarding subjects that in his eyes have been overlooked by the Modern Movement. She says to the young man:

I think architecture needs to respect the environment, take into consideration place, adapt itself to that which is already built…\textsuperscript{55}

Semino’s use of the dialogue between the characters and his own presence and simultaneous absence is an intriguing introduction to what will be his lessons on architecture. Throughout the text, hypothetical questions are interspersed, which are in a sense attributed to the potential student

\textsuperscript{54}Rinaldo Semino, \textit{Architettura: Una Scienza Collettiva} (Firenze: Alinea editrice s.r.l., 2004), 7. [Translation mine throughout]

“In quel momento stava pensando a ciò che aveva intenzione di scrivere già da un po’, ma cosa più importante, a come sino a quel momento gli era sembrato di scrivere sulle sue ricerche, sulla didattica, senza aver tenuto in considerazione a chi i suoi scritti fossero destinati. Non aveva idea di come cominciare. Aveva la netta sensazione che si percepissero solo frammenti. Pensava adesso che potesse essere anche un problema di tecnica della comunicazione. Andava con la memoria a scritti in cui l’autore si fa attore, s’inserisce tra i personaggi e con loro può parlare. I pensieri così esistono, si propagano, diventano, attraverso il dialogo, lo spazio entro cui si muovono; sono l’oggetto e la comunicazione. Pian piano prendono sostanza, tra i personaggi si sviluppano azioni, nelle loro emozioni si svolgono le idee.”

\textsuperscript{55}Semino, \textit{Architettura: Una Scienza Collettiva}, 8.
in the audience, but are really his own voice, of doubt, of giving historical precedent to his own point of view (as if the student is asking a question of the professor on the basis of past lessons). It is an antimanifesto. A dialogue of openness, it is an indication of Semino’s inquisitive and playful nature.

The slim volume is in fact a very concise manifesto (though I’ve just referred to it as an antimanifesto) of Semino’s beliefs in architecture, in that the word *manifestare* in Italian means to show, to express, to demonstrate. His ideas of architecture manifest themselves in the dialogue.

In the introduction to the course, Semino begins the text in first person:

> In these lessons I will look to explain to you how…

and quickly switches to his position of observer:

> He says, articulating the first words as if they were of heavy import, “Architecture is characterized, in its taking form, in its ways of living, ideas, images, and construction. These represent ways of living, ways of thinking of inhabitable space and of the potential of built form, of becoming form, and that in revealing themselves (*nel loro manifestarsi*) they are the keys to the process of design.”

In the “1st Lesson: Definition of the Method and of the Instruments of Analysis,” Semino quickly introduces concepts which are key to his approach toward architectural design: knowledge of the profession, the logic of construction materials and techniques as fundamental to good design, the more practical nature of the field. It is in the next sentence in which he discusses a concept that is at the center of his research, that of the corner (*spigolo*), the line at the intersection of planes and surfaces that represent the node of architectural composition and the resolution of which is architectural expression. Architecture, or rather, the “building organism” he continues to explain, is

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56 Ibid., 11.
generally understood as made of building elements, of volume, of surfaces, of materials, construction technology, of having a structure and the like. It is here where Semino stakes out his position (which he has developed since the 1960s) regarding architecture: rather than architecture being made of diverse elements and a juxtaposition between structure and surfaces, he proposes a unification of one and the other. This unification will be one of the major themes of Semino’s work.

He sets out a presupposition that would seem to be at the basis of a conventional understanding of architectural composition: that buildings are made up of various scales of elements that may be characterized by dimension, morphology and type, and that they are related by various rules that are synonymous with the idea of a system. He then uses the abacus as a metaphor for organization, as it represents in part or all possible combinations. Semino uses the abacus to describe the organization of the individual elements and their infinite combinations.

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57 Ibid., 13.
58 Semino covers similar material in his other books in a very straightforward academic style: Tra Progetto e Tecnologia, (Genova: Istituto di Progettazione Architettonica, Facoltà di Architettura di Genova, 1991). Presentazione di Enrico D. Bona; Progettazione e didattica nell’architettura: argomenti e confronti (Genova: Joshua Libri,1995); Sistemi Autoautostruibili: per il progetto di strutture estensibili (Genova: Joshua Libri, 1996); and Architettura: Una Scienza Collettiva (Firenze: Alinea editrice s.r.l., 2004). In this book, with the strange change of voice and use of Socratic dialogue is in fact very much like speaking with Semino, and while he is often in a dream-like reverie regarding his ideas about architecture it also reveals his passion and commitment to architectural research and architectural education.
59 Semino, Architettura: Una Scienza Collettiva, 15-16.
He states that the individual elements are classifiable according to codified criteria:

- rhythmic or serial aggregations,
- hierarchical or serial superimpositions,
- two-directional grid systems,
- aggregations that may exhibit qualities of symmetry, mirroring, rhythms, each capable of becoming the matrix of the entire composition.\(^{60}\)

The salient terms for his working process are that the individual elements may enter into diverse relationships, and that form is made through the aggregation or accretion of the individual parts linked together through a series of precise operations, or as he describes it, as a combinatorial game, a:

\[^{60}\text{Ibid., 16.}\]
sort of combinatorial alphabet, a series of words in succession that constitute a phrase, a period, a thought… (and that) in this context there are rules of aggregation.\footnote{Ibid. The actual text reads: “Come se si proponesse una sorta di alfabeto combinatorio e una serie di parole in successione per comporre una frase, un period, un pensiero. In questo ambito si riconoscono regole aggregative al di fuori delle quali si rischia di non disporre del linguaggio necessario alla comunicazione.”}

Figure 11 Rinaldo Semino and Mariapaola Gerbaz, “Didattica in un laboratorio di architettura,” in Agorà: Argomenti di Architettura e Urbanistica. Special issue on “Città: Centro-Periferia,” (1989): 76-7. The authors cite Adolfo Natalini from Figure di pietra (Milano: Quaderni di Lotus, 1984) in which Natalini spoke of the creation of space as a dynamic space where the configurations of the elements may change.

Having described what is at the core of his curriculum, the open combination of simple elements to create complex structures at the room, building, and urban scale, Semino continues his lesson.

Assuming voice of the professor, he explains that:

building elements are also similar to the “urban organism” that the same spatial configurations can be understood at the scale of building and of the city. The concepts of
high, low, tight, wide, close, far, in-between, in, above, below, inside, outside, behind, in front of are ideas that are tied directly into the position of the human in space. In architectural design the factors which are used to determine where certain elements will be configured in space and what scale. This how the abacus is used to…  

At this point, Semino interrupts himself with his second person voice in an imaginary scene that is reminiscent of Edwin A. Abbott’s *Flatland: A romance of many dimensions*:  

I could just feel the difficulty of someone who was listening to this…

Interrupting himself the professor remembers that he has not yet told the *Parable of the two men and the boxes*. Wanting to improvise and to speak less professionally, he began to tell story:

There were two small boxes on a table, and according to two interpretations, they may appear the same or appear as objects that bear no similarity to each other, depending on one’s point of view.

A large man began to play with the boxes, he moved them, alternately placing them vertically, then with distance between them, then close to each other, as if he was playing a game. He tried placing them in different positions and observed the results.

At the side of the table there is another man, a very small man, who the large man had not yet seen. The smaller man could only see the profile of the boxes, but because he was so small, they seem like buildings. They seemed very far away.

Curiosity drove him to draw nearer. From a distance the different shapes fused together as if one continuous block. But when he was very close he realized that there was a space between them. If he looked at one, to see another he had to turn around. Something was not right.

While he began to move towards the shapes to get a better look at them, he thought they would be very different. He felt very insecure in such a vacuous space and he felt

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62 Ibid., 17-18.
overwhelmed. The space was so large and empty that he could not tell where the space ended.

At this point, startled, he felt the presence, specifically the breath of the enormous man. Rather than being frightened, the small man asked the large man:

“Don’t the shapes seem so far away. Wouldn’t it be better if they were closer together? I traveled this great distance to see these forms from up close…but…”

The small man then felt something brush his shoulders and as he was turning, he saw the box, that had been behind him, now in front of him.

The box was made of a series of panels made of a beautiful smooth, glossy material. It was rectangular and it had a very pleasing form.

The small man asked the large man to modify the distance between the boxes, varying the spacing, choosing the various elements according to his point of view. He thought to himself that he had tried experiments like this in the past, but wanted to investigate how he could use the panels to create a much smaller, tighter space between the boxes.

He turned again to speak to the large man, confidentially as if they were friends:

“Listen,”

he said,

“I’d like one of these boxes more or less over there,“

and he indicated the position with a gesture.

“Nooo!!! Like that I’ll be squashed, I didn’t say here…but there…”

he gesticulated frantically. The boxes had created a narrow alleyway and the small man wanted to push the walls apart to create more space. He struggled out of the narrow space and then seeing it from outside, he saw it for what it was: a claustrophobic, dark fissure.

“Excuse me,”

he heard the large man ask,

“You could have gone inside.”
He had not realized that there were apertures through which you could see inside the space. He entered into the space, his curiosity piqued. The first impression that he had was that it was a large empty space. What he imagined as a very dark, claustrophobic space revealed itself to be open on the opposite side. He could see all the way to the horizon.

Figure 12  Rinaldo Semino, Model of the accretion of individual cellular elements in a cup shape connected to one another creating a flat surface on the top and the bottom. The interior space is a vaulted space and open from one end to the other. Brushed aluminum, Each element 3” x 3” x 1” approx. (Overall 9” x 3” x 1” approx). Date unknown. Photographed in Semino’s studio in Genoa by author in 2010.

Semino uses this story as a device to imagine spaces that are not known in daily life, his own or that of most people. This reverie is a way of imagining another kind of space, one space, not divided into small constrained rooms. It was not a space that was broken up but had smooth, undulating walls on which the light from outside was reflected. A space which opens out horizontally for a view to the horizon…these thoughts made Semino (as narrator) very happy.

Figure 13  Rinaldo Semino model against the street in Genoa.

He continues his parable of the small and the large man (and gives an indication of the occupation of the prefabricated elements that are key to Semino’s work). This parable is the perfect prelude and gives an indication of the importance of the repeatable unit, the use of a folded plate to create a boundary, that function is not ascribed to each unit brought together but function is determined by a fluid occupation of the space, that is changeable. This fluidity is perhaps connected to a modernist notion of open plan, but it is merged with a fluid occupation that bleeds between the boundary walls: there is no skeleton or skin, but an interlocking of membrane boundaries. He continues:

The small man continued to explore the different spaces, so different from anywhere he has ever lived or any public building he has visited. He left one of the spaces and entered another which was very different in form.

At first glance it seemed that the construction had a huge entryway, located at the center of the wall, but it became clear that it was actually two bent planes one just past the other. He continued to walk through the space and in fact, as he moved to the other side he began to see many other prismatic forms.

He was distracted by seeing all of these forms all together, but he could now discern that some of the prisms were empty and you could enter into them, while others were arranged one after the other as if to suggest an exaggerated spatial perception. Others were solid on all sides. But it didn’t seem that they were arranged randomly, but in a way to indicate routes, as if they were ideally connected by a spatial system that they held in common.

It must have been that the large man was having a good time by surprising the small man by manipulating the various elements. He may have wanted to continuously move the elements just to see how many possible combinations were possible. He was excited by the multitude of spaces created from the arrangement of these elements.65

Semino then continues to write from the point of view of the professor again:

65 Ibid., 19.
Sitting back after this long story, the professor feels that this story, no matter how fantastical, was actually a rigorous demonstration of the fact that in design the multiple solutions of a composition should be evaluated, selected, and their role in creating a unified composition understood.

This is when the professor realizes that he was making many of the students nervous. How can one decide upon a design in light of so many possibilities? Some students have already left the lecture hall; others remained pondering whether they should take another class where the professor would give the students a straightforward project and a prescribed process to follow. Somehow it seems that this parable through which the professor discussed the intangible aspects of combinatorial design composition was lost on the majority of the students. Encouraged by the students who had not left the room, the professor returns to expand upon the example of the abacus.

I left off saying that the abacus as a series of elements…

I introduced the abacus because it can be interpreted as a series of diverse elements ideal for the research of possible combinations that can be configured.\textsuperscript{66}

It is here that Semino speaks in his own voice and his own direct descriptions of his work that then guides the remaining lessons.

When working with elements (component parts) different ways of composition may be considered an underlying structure may be a series of structural lattices or grids derived by the same system that become ‘spatial organization’, or a series of building elements organized by a structural frame, or a series of families of elements made up of dwelling units, perhaps a series of bordering elements, a series of building elements that reveal the richness of possibilities of the aggregation of the elements in the organization of building fabric.\textsuperscript{67}

He then returns to complete his analogy of the underlying structure in the organization of the parts to the abacus.

\textsuperscript{66} Ibid., 20.
\textsuperscript{67} Ibid., 20.
The abacus is like a large warehouse in which we can search for the compositional relationships in the position between the typical building units. The abacus has a predisposition of certain characteristic combinations…but it still doesn’t attribute meaning to the project…[the analogy] is a mental structure, some combinations are predictable, but to others, only if there is a genetic-formative signification that ties in the act of making, such that it includes the innate propensity to always look for the new, the different that may exist.68

In all of the lessons, Semino moves between the various voices, of himself as professor, using the lesson directly to record his thoughts. He then slips into the other “characters” and voices laid out early in the book. In the Second Lesson, he discusses the genesis of ideas for design in the mind of the designer and the use of drawing to test the mental image against the development of the reality of the idea. He used another story, “The story of a man who had to design a door,” to continue his dialogic method of exposition of the elements that comprise the design process, from initial inspiration to the development of the material systems of construction.69

In the subsequent lessons, he examines more recent events in architecture which had followed the enormous changes in the nineteenth century in socio-economic conditions, the organization of production, the introduction of new modes of living and building and important modifications in the organization in how architecture was designed. Other changes had to do with the relationship of the house to the urban context and the organization of an urban fabric (tessuti urbani) made up of various building types. The changes in building materials resulted in changes in fabrication systems and technologies and paralleled changes in the conditions of urban mobility, in the means of communication and an new awareness of the global impact of technology.70

68 Ibid., 21.
69 Ibid., 25.
70 Ibid., 29.
Throughout Semino’s career, his interest in the constituent elements of building was merged with an investigation into the morphology of urban form. This merging became even more pronounced as he began his teaching career at the University of Genoa and even after his retirement, in courses he taught when he moved to the University of Parma. It is also clear in his recent publication co-authored with Maria Giovanna Figoli and published by the Faculty of Architecture of Genoa in the Department of Architectural Design and Construction (DIPARC) entitled *A Study of the formative processes of Genoese housing types*. Semino’s essay “Formation and evolution of urban building fabric from the late Medieval period until today” is an insight into his interest in both historical processes and focus upon the building unit, the housing block as constitutive of the urban fabric throughout his work. It also highlights out his interest in the common building elements and their variability in multiple possible combinations, and how the accretion and changes in urban form over time provide clues as to the use of variation in a homogeneous system.

Semino discusses this history in the “Fifth Lesson” in which he analyzes contemporary housing types while looking to the past for inspiration especially in the idea of elements that are combined

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71 After retiring from the University of Genoa, Semino continued to teach design studios and architectural composition at the University of Parma in the Undergraduate department of Industrial Design in Architecture and Building Technology. (Laurea in Disegno Industriale d’Architettura e Tecniche dell’Edilizia)

72 Rinaldo Semino and Maria Giovanna Figoli, *Studi sui processi formativi dell’edilizia Genovese*. The first essay, “Ipotesi sulla delimitazione e sullo sviluppo dell’insediamento romano a Genova,” is authored by Figoli and the second, “Formazione e evoluzione dei tessuti edilizi dall’alto Medioevo ad oggi” is by Semino. (Firenze, Alinea editrice s.r.l., 2005).

73 Semino and Figoli, 35. This heading is actually in the essay by Figoli, but is a crucial concept that both authors are proposing in terms of variability in urban design and the importance of historical analysis of built form.
according to various aggregative principles.\textsuperscript{74} Here he reveals his long term interest from the early 1960s in the notion of città-territorio.\textsuperscript{75} He writes:

Cities today are an example (of typological variation at different scales from building scale to city scale) and in this sense it seems that the realm of composition is used as an idea of “type” that already exists….that cities are not only designed based upon a reading of the history of housing (building) as its basis, but the verification of an operative approach, that connects the dimension of architecture to building, to the order at the urban scale to the territory.\textsuperscript{76}

And he makes a claim that is at the center of his work and theoretical writings:

I would like to emphasize that we should be aware that when the typological and technological connections lead to innovations, at that point, even the compositional system also redefine its rules.\textsuperscript{77}

He then identifies the multifamily housing typology as an:

organism capable of modifying itself by using the constitutive elements in multiple configurations.\textsuperscript{78}

Here is where we can see the trajectory of his work, from the design of the smallest constitutive building element, to their accretions at the scale of the multi-family dwelling, to large scale buildings that take on the characteristic of infrastructure to the largest aggregation at the scale of territory.

While this lesson begins in the genre of the academic lecture, Semino returns to his interior voice (in italics) and mused upon his own design research, that of a genetic-generative typology.

\textsuperscript{74} Ibid., 35.
\textsuperscript{75} This refers to the 1959 publication of L’urbanistica e l’avvenire della città by his professor at the University of Venice, Giuseppe Samonà. It is also deeply important in the concept of the città-territorio, which will be covered in detail later in this dissertation.
\textsuperscript{76} Semino, Architettura: una scienza collettiva, 35.
\textsuperscript{77} Ibid., 35.
\textsuperscript{78} Ibid., 37.
Leaving the lecture hall, he muses to himself about how to make this clear to the students. He returns home and reflects….

Where he finds the objects of his life: drawings, and mainly models of structures. Some ended up in boxes, others lying around. His research in this area remained without a true affirmation, his ideas were too radical and the strained efforts to mediate them and adapt them to the existing economic and production system did not have any practical or applied results. They remained his historical research on structural systems, related to architecture, research that could not fathom why he had not found practical applications for his ideas and they had remained merely proposals.

He began again to work with his latest model of an extensible structure, very recent research, that was still being developed and [whose feasibility] hadn’t yet been verified. He had not received any university funding for this research. He remembered that when he had arrived at the present configuration he was elated with joy, it seemed to him that he had found the form of utopia itself: to have been able to find a solution to render a tetrahedron extensible. He succeeded in arranging (scomporre) the tetrahedral forms in superimposed floors, with only one movement the extension of the form, creating a structure made of tetrahedrons that stressed under load to arrive at a definition of its form and possibility of movement.

He thought to himself, that would very much like to be able to speak about these ideas as built work. 79

In this poignant confession, written in 1995, one hears a similar refrain to that which Rinaldo Semino described to me when we first met in 2006 and again at our last meeting in July 2012 that he has not been able to fully test his ideas.

In Architettura: una scienza collettiva, Semino states that at the end of the nineteenth and at the beginning of the twentieth century, there was a loss of the organic rapport between construction, linguistic, morphological, and typological systems. New materials, and by consequence the elements necessary for construction, held a certain logical correspondence between the function and its form, opening

79 Ibid., 39-40.
up a new phase that would supercede decorative aspects and move towards a new logical functionalism. More recent material and structural explorations from the 1960s to the present should be studied. New materials should never be used to simply repeat historic formal types but should be used radically change architectural form. As examples, he lists ultrathin prestressed concrete, corrugated metal sheet, plywood, thin curved membranes, and sheets, but, he laments that the natural evolution of their development is thwarted by the blind vision of maximum profit on the part of the building industry, which invariably favors traditional materials and methods rather than supporting research into new technologies and systems. He believes this lack of vision is true despite the fact that there is recent research into new building envelopes and skins that encourage a more organic approach to the architecture in the coordination of all of the parts was occurring. He believes that the prefabrication industry should invest in the development of innovative construction elements and the recent uses of new materials such as thin shell reinforced concrete, steel whether in tubular, sheet or cable form, and fiberglass materials lend a propensity towards innovative forms: a real connecton between new technologies and form. The module itself becomes the matrix, as can be used in modular structures to generate novel architectonic spaces. The module is connected to the modern mode of industrial production of elements produced in series. His agenda is to look at the possibility of variation in composition as a mode to resist banal repetition and to introduce novelty in design research. It is through the investigation of various solutions to design problems and the search for diverse options that he characterizes as the contemporary significance of his research. He also believed that the dialogue between the arrangement of formal elements in design is key to architectural expression and for him is a reflection on the significance of contemporary

80 Ibid., 41. The discussion here is a summary of Semino’s Italian text for Lesson 7 on materials and structural technological systems, pages 41-47.
81 Ibid., 42.
82 Ibid., 47. This is key: inherent matrix, the code is not extraneous but is in the form, in the material.
83 Ibid., 53-54.
architecture to contemporary culture. He also ascribed significance to the creation of very large building envelopes through the development of systems of smaller elements. In his “Eighth Lesson,” Semino succinctly described iterative processes through the interactive themes he isolated as critical to design: spatiality, materials and structures and the skin or the epidermis of a building:

In other words, one can read particular references to history and architectural types in building constructions that are attentive to a clear use of categories in the organization of series of architectural components. And other series may consist of contradictory combinations, and others may be highly innovative combinatorial strategies.

But how are iterative or serial aggregations evaluated, why should one always work to attain novelty and variation? Semino cites a text by Italo Calvino Lezioni Americane or Six Memos for the Next Millennium:

“the imagination as a repertory of what is potential, what is hypothetical, of what does not exist and has never existed, and perhaps will never exist but might have existed.”

Semino continues to quote Calvino:

84 Ibid., 51.
85 Ibid., 57.
86 Minna Proctor, “Reflexive Reflections: Italo Calvino’s Game of Mirrors” Bookforum, Summer 2003. http://www.bookforum.com/archive/sum_03/proctor.html (Accessed Aug. 10, 2011). “The Italian writer Italo Calvino was in the middle of preparing Six Memos for the Next Millennium for the Charles Eliot Norton Lectures at Harvard when he died suddenly in 1985. It's intriguing to imagine the delight he might have taken in the prospect of telling an American audience that ‘lightness’ and ‘quickness’ can perfectly coexist as literary values with their apparent opposites ‘multiplicity’ and ‘exactitude.’ What a perfectly Continental and postmodern proposition all those opposing ideas intermingling. And the Memos were for us; the Italian title of the book translates as ‘American lessons.’ Don't doubt that he intended to stun us, or at least startle us, for the U.S. was to Calvino ‘monotonous,’ ‘anonymous,’ ‘deadly boring.’ ‘Deep down now that I know the terrifying dullness of American life,’ he wrote, ‘I understand more the people who come to live here, just as I understand more the way they love Italy, which previously got on my nerves.”
“the imagination is a kind of electronic machine that takes account of all possible combinations and chooses the ones that are appropriate to a particular purpose, or are simply the most interesting, pleasing or amusing.”

Of this definition, Semino states, “I see a parallel to the discussion I’ve introduced about the abacus.” Semino’s short discussion of the parallel in his metaphor of the abacus to the idea in Calvino’s writing about language as a combinatorial game, leading to the computational strategies of the mind, of making, and ultimately of the use of the computer in architectural design.

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87 Italo Calvino, *Six Memos for the Next Millennium* (New York: Vintage International, Vintage Books, A Division of Random House, Inc., 1993, 1988): 91. The entire quote is: “Still there is another definition in which I recognize myself fully, and that is the imagination as a repertory of what is potential, what is hypothetical, of what does not exist and has never existed, and perhaps will never exist but might have existed. In Starobinski’s treatment of the subject, this comes up when he mentions Giordano Bruno. According to Bruno, the *spiritus phantasticus* is ‘mundus quidem et sinus inexplebilis formarum et specierum’, that is, a world or a gulf, never saturable, of forms and images. So, then, I believe that to draw on this gulf of potential multiplicity is indispensable to any form of knowledge. The poet’s mind, and at a few decisive moments the mind of the scientist, works according to a process of association of images that is the quickest way to link and to choose between the infinite forms of the possible and the impossible. The imagination is a kind of electronic machine that takes account of all possible combinations and chooses the ones that are appropriate to a particular purpose, or are simply the most interesting, pleasing, or amusing.”

Automorphic structures

Semino offers yet another way to think of the complexity of three-dimensional space filling. He reveals how it is possible to create three-dimensional space grids composed of individual cells, differentiating and producing complexity out of an initially simple system. Inherent in a study of these systems is the tension between their implication of infinitely extensible Cartesian space and the need at some point to end the system and create a boundary. So, does a space-frame structure need to be merely a rectangle, arbitrarily bounded because of the more arbitrary programmatic needs of total enclosure needed or site constraints, or can there be a more intelligent approach towards the decision about the ultimate form without relying on an arbitrary boundary? Semino’s vision is different from I.M. Pei’s New York City conference center, where the gridded ceiling spaceframe becomes obedient to some preconceived formal, iconographic exterior shell. Nor does he imagine the individuation of elements in a dome by R. Buckminster Fuller. The individuation of each cell has to do with the reinforcement of the overall form of the design of the space-enclosing geodesic dome. What is at stake is if a cellular structure, through its own self-individuation, can be both an intelligent system at the micro-scale and directly impact the morphology of the whole. The cell would possess the iconicity of a body, but not a body that is preconceived, but rather evolves from its differentiation.

I see Semino’s work invoking the way that the cellular system of the space-truss actually begins to exhibit changes in individual cells that allows the surface to become thickened and occupied and that a definite form/body is formed. It is this concept that I call the “tissue of structure.”

The space frame strategies in Semino’s work can be organized into a taxonomy around the cellular structure. The “tissue of structure” taxonomy may include questions regarding the relationship of the cell to the whole, the issue of scale, and the repetition of elements at various scales. This kind of
structure does have a clear line of demarcation between inside and the outside, but operates as a “thick skin” or tissue. Some of the photographs and photocopies found in Semino’s files, and images of some of his models that study the cellular composition of complex surfaces, reveal these tissues.

Figure 14 Rinaldo Semino, photographs (of photographs) of natural structures of starfish. No date.

Figure 15 Rinaldo Semino, photographs (of photographs) various model studies. No date. Courtesy of Rinaldo Semino.

These kinds of aggregated structures are indicative of megastructural projects of the 1960s and open up a much larger question regarding the relationship of architecture to territory that was a central concern in the early 1960s in Italy (the subject of Chapter Six). Fascinating examples of built macrostructures are evident in Genoa, projects which act at the level of landscape, or territory. A macrostructure which is made up of individual units or cells can emphasize the natural features by following and exaggerating the contours lines, as in the sinuous Forte di Quezzi (1956) residential quarter in the hills above Genoa by Luigi Carlo Daneri, or the ziggurat-type complex (1980) just to the north of Genoa by Aldo Rizzo, nicknamed the lavatrici, the washing machines.
On the reverse side of a sketch for a joint detail by Semino, circa 1969, is a photocopied collage of various radiolarian and hexagonal beehive structures from the Italian version of Thompson’s text.

Figure 16 Rinaldo Semino, sketch for a joint on verso photocopies for D’Arcy Thompson, Crescita e Forma. Xerox of radiolarian, bone structure, and cross section through the bone in a vulture’s wing from Crescita e Forma. Courtesy of Rinaldo Semino.

It is striking to note the use of the serial image in Semino’s working practice and how it mirrors the larger concerns of technology and modularity. He had access to a photocopier, from what he remembers, from about 1965 on, and produced complex architectural drawings by collaging copies of the drawings of smaller base elements. His original drawings, in pen or pencil on vellum, are quite small and are drawn with section cut lines that indicate planes of reflection. He would make multiple photocopies of the drawing and then, through rotation, accretion, mirroring, and scaling, would assemble the cut copies on a larger sheet of paper with clear tape. These larger collages were then run through a diazo (blueprint) machine to produce large scale drawings (copies). The drawings illustrate how Semino used a base sketch of the connector in isometric projection taped the pieces together to form a larger collage. He would then copy this collage again to produce a drawing.
Figure 17 Rinaldo Semino. 1985 circa. On the upper left is an original pencil drawing on vellum [A4 format] for a view of a connector piece that would connect metal tubes to create a 3d space structure. The drawing on the upper right shows a plan and elevation view. It is interesting to note how Semino has scaled and rotated the original drawing to produce copies. Courtesy of Rinaldo Semino.
His process echoes concerns towards systems, technology, modularity, and prefabrication in building systems that were of critical interest in the 1960s. Perhaps what is unique to the 1960s would be the philosophical change in regard to a dramatic increase in goods and materials in a postwar Europe. Affluence and the economic boom had enormous implications for architecture. Transience, mobility, and fluidity were concepts that are intrinsically linked with modularity. The proliferation of modularity and the indeterminacy in the infinite ways in which elements could be brought together as symptomatic of a new “ephemeralization of man’s links with things that surround him.” What are the economic, social, political, and formal implications of the culture of a plug-in, clip-on, dynamic architecture and how do these affect urban development? These are question that have emerged from looking at Rinaldo Semino’s work that will be discussed in the following chapters.

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In this article, “New visions in technology,” Semino revisited some of the microscopic images of natural structures which he had shown in his thesis. Semino wrote about the new structural systems that would be made possible because of technological advances that supercede the historic methods of construction and structural systems which he had written about in his books. With the fairly recent use of new materials such as reinforced concrete and steel in both structural members and in sheets, new structural types could be imagined, structures made of structural cellular elements, space frames, pneumatics, folded plate structures, and hardened thin shell membranes. It is exactly in this area of study, Semino said, that a close observation of natural structures (both regarding the evolution of form and the mechanical-physical aspects of form) that provide images and forms that
in fact show what may be possible in architectural form in light of new ways of thinking of structural elements, of new technologies, materials and systems of production. He was most excited about using an aggregation of unified singular elements to produce continuous surfaces as sheets or membranes.

Figure 20 “Orizzonti nella Tecnologica” (New visions in technology) in the special issue of “Architettura e industria,” *AL Architettura Liguria: mensile Ordine Architetti Liguria*, Number 8, (June-July, 1988): 16-19.

This kind of experimentation and simultaneous technological developments as seen in the images of microscopic organization of living organisms was inspirational to Semino at the macroscale. These images helped him to imagine a new networked macrostructure, simultaneously designing the microscale of the material characteristics of the individual cells, the individual elements that are at the scale of the habitable room and the whole. This aspect of the design of structural systems that are both microscalar and microscalar, Semino stated, is characteristic of the time.
Looking past trilithic, stereometric systems of weight bearing masonry construction, Semino believed that experimentation in new ductile and deformable materials optimized for their stability and resistance would change the entire notion of structural systems, of inhabitation, and of the tissue of structure of buildings and the city.  

Semino proposed a system of alternate organics.

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Other Alternative Organic(ists)

Figure 21 Book covers illustrating the range of other Alternate Organicists.

Semino’s work kept interesting company in the pages of the 1973 volume of *Zodiac*, no. 22, which focused on morphological research in architecture. One can especially see in the work of Robert Le Ricolais, Peter McCleary, Gernot Minke, Serge Ketoff, Michael Burt, Paul Marchant, and Keith Critchlow a dedicated interrogation of the morphological structure of material and of nature. All of the projects revisit architecture in terms of the technological construction of space by looking very carefully at nature. Natural models of organization are key to the research: the structure of microscopic organisms such as radiolarians, minimal surface of films like soap bubbles, crystal structures, and the structure of vegetal and organic tissues. Most of these works remain theoretical projects but I maintain that, when viewed through the development of these themes as evidenced in

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91 *Zodiac* 22, 21.
other architectural publications of the time, they worked towards practical solutions in new materials (plastics, metal alloys) and in a rethinking of the possibilities of componenting and systems designs.

This may also be extended to a number of other architects and engineers who were working contemporaneously to Rinaldo Semino in Italy. These architects shared a common interest in natural systems and scientific method. The term Alternative Organics will be used to further define the characteristics of what is being termed an alternative organic approach in the projects of various architects working in Italy in the 1960s. In simple terms, the criteria for selecting these architects has to do with their working methodologies which focused on natural systems of organic growth as an inspiration for the evolution of highly developed rules-based design. Some of the architects and engineers discussed in some detail in this chapter are Mario Galvagni, Vittorio Giorgini, and Sergio Musmeci. I discuss Pier Luigi Nervi’s collaboration with the Stress Analysis Laboratory of the Milan School of Engineering from the 1930s on as a precedent to making invisible forces visible and then introduce Luigi Moretti’s use of parametric analysis for the design of sports stadia of which I speak in more depth in Chapter 3. Mentioned only by name but absolutely crucial to my future work will be to examine projects by Manfredi Nicoletti, Nizzoli Associati, Renzo Piano, Maurizio Sacripanti, Luigi Pellegrin, and Leonardo and Laura Mosso, in order to develop my concept of alternate organics in Italy in more detail. By bringing these architects together, I do not intend to imply that the work of these various architects was ever recognized as a movement, nor were they all of the same generation, nor even geographically related. Rather, their work is linked by their focus on organizational principles, and their inspiration by natural models. This section of Chapter 1 is the starting point of a much larger project that I will continue to pursue in the future.
Mario Galvagni

Mario Galvagni (Milan, 1928-) studied painting at the Accademia di Brera in Milan and in 1953 received his architectural degree from the Polytechnic of Milan. Galvagni described his work as being at the intersection of the disciplines of painting, architecture, and physics. This crossover, he stated, allows him to work on the representation and interconnections of the space of the object as the concentration of and condensation of energy. In architecture in particular, this condensation of energy is apprehended by perception as one moves within architectural environments. The idea of interaction is important and is considered a four-dimensional inhabitation of space. In theoretical physics, or what he termed the philosophy of nature, are the origins and the magnitude of energy of the idea of place. This is not static but fluctuating in space and time. This connection to natural and scientific properties is what is considered as an alternative organic approach.

Lara-Vinca Masini describes Galvagni’s solo path in the period of reconstruction as set against what appeared to be the choice between a rational approach to design inspired by the International Style or on the other hand by organic architecture proposed by Bruno Zevi who linked his approach with the work of Wright. She sees Galvagni having following a different path that was more linked to the visual arts and the physical laws of nature. This was carried through in a method that was tied to artisinal craft at the scale of the building. These concerns set Galvagni’s work at odds with the technological advances of building and prefabrication. His work is considered in this context because of his stated inspiration from scientific principles, although his work is formally

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undisciplined in the enthusiasm of representing the dynamic physical forces at work. At times this would be at the scale of the individual building or at other times at the territorial scale.

In Galvagni’s early work is best presented in a series of projects for Laminar architecture that he developed during the period 1948-1951. Galvagni positioned this work in opposition to what he thought of the volumetric development of form characterized by the beginning design courses at the Bauhaus. In contrast, he proposed structures made of taut laminated layers of form. This mode of working he stated was to indicate the “flexible potentiality working with very thin precompressed reinforced concrete forms.”

This was intended to be an extension of the landscape in which the movement from the horizontal to the vertical as a series of overlapped and parallel layers. Laminar structures are present in nature and are revealed in geologic formations, in the structure of minerals or in scales in fish but laminar structures are also observable in liquids flowing in dynamic motion. Laminar flow in liquids is evidenced by parallel movement in superimposed layers. This may be seen in the flow of water around obstacles or how the invisible movement of layers of air are revealed in wind tunnel studies.

Figure 22 Mario Galvagni projects for Laminar architecture 1948-1953 on the riverbank of the Verbano river in Arona, Novara. In Mario Galvagni and Lara-Vinca Masini, Mario Galvagni: La ricerca silente (Milano: Libreria Clup, 2006): 39.

Galvagni’s projects for laminar architecture are somewhat literal but are important in that he had proposed an architecture not based on the distinction between the skin and the skeleton of the

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93 Masini, 11.
architecture, but where structure and skin are one, a shell structure, or what is known in Italian as a *stuttura a guscio*. Galvagni was interested in what he termed the plastic possibilities of concrete and referred to the work of Le Corbusier, Kenzo Tange, Oscar Niemeyer, Félix Candela, Pier Luigi Nervi, and Riccardo Morandi as early influences in this first project. But this project is not rigorously executed, and did not work with the insistent repetition of the self-similar elements that are seen in his later work.

Galvagni though defended these projects as being integrally related to the geologic formation of the site: linking the site and the building in an organic process.94 Yet, the form is gesturally composed and informal. He followed a process that is seen in another project in which he combined his sculptural and material exploration.


94 Ibid., 12.
In his project for Casa Fossati, Lesmo, Milan, 1963 which he described as “the diagonal tension of physicality,” Galvagni first worked sculpturally with the brick as a manufactured product made of naturally derived materials embedded within the the soft clay that represented the integration with the site. He then used this study to rationalize the diagonal geometry to the roof, which is set on the orthogonal base and articulated in separate sections, just as seen in the brick/clay assemblage. This project is indicative of the problem of using “nature” as a model, if one is only to represent relationships in the study.

This approach is particularly weak in the project for the Casa Acerboni at Torre del Mare of 1958 in which Galvagni liberally and without an underlying set of rules for their disposition used a series of circular forms in plan and as additive elements for balconies and balustrade that point out the problems with a biomorphic or undisciplined use of form to impressionistically relate the new architectural form to the landscape. Somewhat more successful, and more in line what was understood in regard to organic architecture, was the integration of the plan and massing of the vacation houses for a cliff over the sea in Torre del Mare. Modeled in clay, one can see Galvagni’s concept of the architecture at one with the landscape, in effect growing out of the material of the cliff itself. The plan on the left which shows the offices for the vacation complex connects the sculptural and loose curves of the walls to the site as a kind of crystallization of the natural contours of the landscape. In a much smaller inset, one can see the orthogonal spaces of the residential units themselves, a repetition of self-similar modular units that identify what he termed a kind of “relation between the local morphology of the landscape and formal matrices.”

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95 Ibid., 47.
In a second project for vacation apartments at Torre del Mare, 1954-56, Galvagni nested the apartment units in line with the “movement” of the cliffs. Here he investigated the relationship of the project with the local landscape morphology and change in scale of the actual apartment units. He emulated, albeit in a rationalized architectural language, the landscape in which the project is situated.

Galvagni pursued a number of projects at a larger scale, using the scientific concept of a whole organism or geological formation being created from the aggregation of individual elements or laminate layers. He termed these as part of the “Episodes of dimensional architecture: the Continuous City,” undertaken between 1954-1964. Among these projects, many are resolutely expressionistic in their relationship to the freedom that he found in working with clay and abstracting from the actual landscape as seen in his project developed through a series of clay “morphological studies” for Bellagio, Como. This project is non-functional and is described as
“Dimensional architecture of the Continuous City.” In another expressionistic series of projects that he dubbed “Environmental Interactions” (Interazioni Ambientali), his conical and loosely defined curved project was meant to be an interaction between his project and the Bergeggi island.97


Figure 26 Mario Galvagni. “Luminous Fragmentation and light conveying structures,” as these elements create in their repetition the project for the Giomein hotel complex in Cervinia-Breuil,

96 Ibid., 64.
97 Ibid., 70.

Perhaps the project which best connects Galvagni to an idea of alternate organics (and to the exclusion of his more expressionistic formal projects) is the project for is for a hotel complex at Cervinia-Breuil, Aosta of 1964-67, in which he grappled with the repetition of individual self-similar forms of the room which were then integrated with the landscape. This is a “building” which is understood at the scale of the territory and has introduced very simple moves to repeat the unit and produce a complex structure.

Galvagni’s work falls between stylistic categories. His work does not display a methodological rigor that will be evident in other projects, but is of sufficient interest to discuss as a transitional figure, whose work in the early 1950s and through the 1960s began to display an interest in the territorial scale and the use of principles derived (too loosely perhaps in Galvagni’s case) from nature and scientific principles to guide the design process.

**Vittorio Giorgini**

Vittorio Giorgini (1926-2010) was an Italian architect who, writing in 1968 spoke of the idea of a “universal conscience” and of the mutation of humankind’s relationship to the earth. He saw this in relation to a new period marked by technological developments and of a global awareness that was brought about for the first time by space travel and the concept of the earth as a whole. He called this a great revolution, a scientific revolution.98 This in turn led to a freedom of thinking and an openness toward new areas limited only by curiosity of the individual in the realm of comparative analysis, new branches of research, new ways of seeing from the infinitely small scale to the infinitely large scale. Progress lends a sense of continuously increasing acceleration of change. The way to

98 Vittorio Giorgini, *Strutture soniche: Ipotesi per un habitat più naturale* (Ferrara: Centro attività visive, Palazzo dei Diamanti, 1968), unpaginated, but first page of printed text.
check this progress is what Giorgini posited as the hypothesis of verifying the methodology of the
design process.\textsuperscript{99}

\textbf{Figure 27} Vittorio Giorgini, \textit{Strutture soniche: Ipotesi per un habitat più naturale} (Ferrara: Centro attività
visive, Palazzo dei diamanti, 1968), fold out insert to catalogue.

In his essay that introduced his 1968 exhibit at the Palazzo dei Diamanti in Ferrara, Giorgini argued
for the possibility to pursue complex curved structures in his architecture. But, he mused, unlike the
freedom one has in painting or sculpture to experiment with complex curvature, in architecture, “the
construction of a curve, even if it is highly symmetrical, is costly.”\textsuperscript{100} This is where Giorgini looked
to the fascinating and stimulating examples to be found in natural structures which were increasingly
accessible through the advanced technological imaging possible through photographs taken with the
aid of the electron microscope. He had been inspired by such images and this may be seen in his
work exhibited at his gallery \textit{Il Quadrante} in Florence in 1959. He described the interior of these
spaces as exhibiting an “interior joy” and was thinking of the “spiritual spaces” of Finsterlin.
Simultaneously, he discussed his interest in the experimental work in the study of wave phenomona
(known as cymatics) in the work of Hans Jenny (1904-1972).\textsuperscript{101} The sonic figures of Jenny, he

\textsuperscript{99} Ibid., second page. “Tutto ciò è alla base del mio lavoro, che consiste nell’analisi delle premesse
fino alle considerazioni che ne derivano alfine di individuare delle ipotesi da verificare e delle
metodologie di lavoro.” [Translation mine throughout]

\textsuperscript{100} Ibid. “La costruzione di una curva, sia pure simmetrica, costa.”

\textsuperscript{101} Hans Jenny, \textit{Kymatik. Wellen und Schwingungen mit ihrer Struktur und Dynamik. Cymatics. The structure
explained are the perfecting of Chladni figures and are obtained by utilizing piezoelectric transducers, which are vibrating engines that transform electric impulses into mechanical oscillations and vice versa.\textsuperscript{102} He saw in this the possibility to realize an infinite array of simple and composite configurations which have an unexpectedly strong formal characteristic that is observable in natural forms.\textsuperscript{103}

Figure 28 Various examples of Chladni figures.

Giorgini discussed Hans Jenny and the Chladni figures and then explained that he began his studies of the Casa di Baratti (Baratti house) with these figures in mind. Before examining this project, it will be interesting to look for a moment at the reactions to the work of Ernst Chladni first published in 1817. Elaborations and reactions to his work were numerous.

\textsuperscript{102} Ernst Chladni, \textit{Neue Beyträge zur Akustik}, (Leipzig: Breitkopf und Härtel, 1917, 1787).

In his essay of 1833 “On the Figures Obtained by Strewing Sand on Vibrating Surfaces, Commonly Called Acoustic Figures,” Charles Wheatstone’s discussed Ernst Chladni’s (1756-1827) work and then expanded upon the different variations and then to classify and analyze the various figures. These figures were obtained by drawing the patterns that fine sand produced in response to various acoustic vibrations on a square plate. In Wheatstone’s words:

I shall proceed to class and analyse the phenomena; and I shall endeavour to show, that all the figures of vibrating surfaces are the resultants of very simple modes of vibrating, oscillating isochronously, and superposed upon each other; the resultant figure varying with the component modes of vibration, the number of superpositions, and the angles at which they are superposed.\(^\text{104}\)

The following tables analyze the musical note (the source of the vibration) and its corresponding number of vibrations. The table on the left emulates the square plate and is a matrix that can be used to understand the effect of the vibration in both the horizontal and vertical aspects of the plate. The table on the right then correlates the respective angles of the lines produced in relation to the vibration and musical note.

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\(^{104}\) Wheatstone, 596.
Figure 29 Charles Wheatstone, “On the Figures Obtained by Strewing Sand on Vibrating Surfaces, Commonly Called Acoustic Figures,” *Philosophical Transactions of the Royal Society of London*, Vol. 123 (London: 1833): 594-5. This table identifies the “relative sounds, (expressed by both their musical names and by the number of vibrations,) of all the modes of vibration of a square plate, experimentally ascertained by Chlandi. The horizontal series of numbers denotes the lines parallel to one of the sides, and the vertical series those parallel to the other.

Wheatstone described these figures resulting from the superposition of two modes of vibration:

The points where the quiescent lines of each figure intersect each other, remain quiescent points in the resultant figure; 2ndly, The quiescent lines of one figure are obliterated when superposed by the vibrating parts of the other; 3rdly, New quiescent points, which may be called points of compensation, are formed wherever the vibrations in opposite directions neutralize each other; and lastly, At all other points the motion is as the sum of the concurring, or the difference of opposing vibrations.\(^{105}\)

\(^{105}\) Ibid., 597.
Figure 30 Charles Wheatstone, “On the Figures Obtained by Strewing Sand on Vibrating Surfaces, Commonly Called Acoustic Figures,” Philosophical Transactions of the Royal Society of London, Vol. 123 (London: 1833): 615, 617. To the left is Wheatstone’s analysis of Chladni’s studies. On the right is one of the three original plates drawn by Chladni that were included in Wheatstone’s essay.

The twelve plates that accompany the essay document the various sources of vibrations that affect the plate and move through diverse introduction of vibrations in relation to the horizontal and vertical orientation of the plate with resultant patterns that display various levels of symmetry. In all cases, the drawings are quite diagrammatic, using only lines to indicate the underlying forces, although in the last image, Fig. 4.c., areas of positive and negative forces are indicated. While Wheatstone alluded to the use of sand to visualize the lines of force, he did not address this in the essay. The ambiguity of the areas in the last image will be revealed in by the closer observation of the effect of the individual particles to the vibrations.

Fifty two years later, Charles Thompson again discussed Ernst Chladni’s work in experimental acoustics in his paper of March 14, 1885. This work entailed the patterns that emerged from
particles on a flat plate resonating with different kinds of vibrations and established a direct visual analogy for sound. Thompson cites Chladni’s *Neue Beyträge zur Akustic* of 1817:

> when fine dust accumulates on the centres of vibration, it is in heaps more or less round or long, &c., according to the form assumed by the vibrating part.\(^{106}\)

Thompson also critiqued Wheatstone’s reductive approach in reducing the observation of the sand patterns:

> When Wheatstone reproduced Chladni’s figures on square plates, he did not notice the remarkable figures produced by mixing a fine powder with the sand.\(^{107}\)

Experimenting with different materials for the plates and the various kinds of dusting powders, Tomlinson found ways to fix certain of the patterns, in this case:

> After a layer of iron filings had been sifted on the plate, a layer of sand was added, when the finer particles of iron did not escape to the vibrating centres, they being apparently imprisoned by the sand.\(^{108}\)

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\(^{107}\) Tomlinson, 248.

\(^{108}\) Ibid., 249.
To return to Giorgini’s work, he referred to the influence of Han Jenny’s recent interpretation of Chladni figures. He sought to create, in a free way, inspired by Chladni figures. He began the design of the Casa di Baratti in 1961, but had already begun a series of freely configured curved forms that he realized in concrete and wire mesh beginning in 1957. He discovered in this the formal and structural power of the continuous concrete shell. He pursued this work, seeing a relationship between natural and sonic structures and what he called “psychological space” that he believed was representative of the way of being of youthful and free people. He also believed that while his studies were very handmade and artisinal, this kind of research would be echoed in new construction methods by absolutely new techniques and instruments that were already being prepared in the scientific disciplines. He stated:

> These instruments are akin to those utilized by nature, as my own hypotheses bear an analogic resemblance to the sonic figures (or structures) and to natural configurations (or structures).

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109 Ibid., 250.
111 Ibid., “Tali strumenti sembrano affini a quelli utilizzati dalla natura, in quanto le mie ipotesi si assimilano alle analogie relative alle figure (o strutture) soniche ed all configurazioni (o strutture) naturali.”
However, in the work that is shown in this exhibit catalogue, his projects do not seem rigorously connected to the symmetrical and highly organized images of Chladni figures, for example in his concrete and wire mesh sculptures of 1957 on the left or the photograph of his summer house at Baratti of 1962.

Figure 32 Vittorio Giorgini, *Strutture soniche: Ipotesi per un habitat più naturale* (Ferrara: Centro attività visive, Palazzo dei Diamanti, 1968), unpaginated. Left: Cement models, Baratti, 1957. Right: Summer residence in Baratti, 1962.

Elsewhere in this catalogue, drawings and plaster and bronze sculptures investigate similar motifs of continuous curvature and topological surfaces.

Figure 33 Vittorio Giorgini, *Strutture soniche: Ipotesi per un habitat più naturale* (Ferrara: Centro attività visive, Palazzo dei Diamanti, 1968), unpaginated. Untitled, no dimensions.

These themes are also investigated through his fantastical drawings of architecture and city scapes.
One can see in his drawings and sculptures a free use of curved surfaces without any seeming underlying order or symmetry. In addition to topological surfaces, Giorgini also used a series of reticulated hexagonal grids and stretched space frames. For the moment, these two systems were intuitively brought together in an impressionistic manner that he will later reevaluate and clarify his position vis-à-vis the Chladni figures and other scientific models. In the 1960s, Giorgini believed that organic structures were constituted of impulses residing at the cellular level and these were characterized by vibrations. He compared this kind of model to a computer, in which memory is registered by coalescing into a form that corresponds to different impulses (here one may imagine that Giorgini is referring to the electrical current which produces an “off” and “on” state central to computation). The computer would be able then to read this memory and reproduce a particular set of “vibrations.” Giorgini then made a leap to imagine that this vibrations would be spatio-temporal forces and that a material (possibly, he asked, a kind of ion powder?) that would coagulate along the surfaces of the force and materialize instantaneously and be able to reproduce the vibratory or sonic model. He believed that physics and chemistry would be able to supply these instruments. This would be a transformation of what had been in the past fifty years, the focus on Euclidean geometry in architecture which would then become one that was spatial and temporal: topological. This kind of space would not only take inspiration from nature, but in turn would speak to the “interior
dimension” of man, (he called the “space of the spirit”) and are also located in the organic structure of man and this kind of space would in kind, provide nutrition for the organic structure of man, feeding his biological functioning, in a new geometric space of a superior order.\footnote{Ibid., 4, unpaginated}

Guided first by interior characteristics of a space for an individual, Giorgini extended this as a proportional idea to the inevitable growth of the artificial environment. It would be a good idea, in his estimation, to conduct comparative studies of different populations and their habitats in order to understand the impact of habitation at a larger scale. In fact he stated, “man will only be saved as long as his habitats are grouped in small nuclei and that they succeed in being in harmony and benefitting the natural environment.”\footnote{Ibid., 5, unpaginated.} He also said:

Mankind should be liberated from the cages that are called their habitation. This means to make available ample spaces for different collective functions and to allow for a varied and individual “habitat,” that is also variable in the sense of it being mobile.\footnote{Ibid.}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{Figure35.png}
\caption{Vittorio Giorgini, \textit{Strutture soniche: Ipotesi per un habitat più naturale} (Ferrara: Centro attività visive, Palazzo dei Diamanti, 1968), unpaginated. Untitled, no dimensions.}
\end{figure}
Giorgini’s work in his *Strutture soniche: Ipotesi per un habitat più naturale* (Sonic structures: Hypotheses for a more natural habitat) made bold claims as how to use close observations of natural systems and structures in the design of new environments. At this point, the work is fairly expressionistic in its formal interpretation of these systems. However, in a folded insert that accompanies the catalogue, Giorgini used various images of microscopic and other natural forms to propose a very specific approach to the use of nature in a radical rereading of the very materials and structural shapes of architectural form.
In looking at the diatoms, bones structures, and sonic Chladni figures, Giorgini merged the examples of natural structures with examples of sonic structures in what he believed would lie the key to a completely new approach to the construction of habitat:

From the lessons of nature, architectural sculptors can create an organic and biological habitat. Science gives examples and proof and the demiurge scientists realize a chemical-physical prefabrication that is already made possible with existing knowledge. This will create a healthier and balanced human race.115

This radical proposition to use chemical reactions to develop architectural form along the invisible lines of force is a fascinating aspect of Giorgini’s work. In his book Spatiology: The Morphology of the

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115 Vittorio Giorgini, Strutture soniche: Ipotesi per un habitat più naturale (Ferrara: Centro attività visive, Palazzo dei Diamanti, 1968), insert detail. “dall’insegnamento della natura/gli architetti scultori/per un abitare più organico e biologico/” and on the right side “Esempi di alle verifiche ed ai mezzi che la scienza prepara/e gli scienziati/demiurghi/attueranno la prefabbricazione/chimico-fisica con i mezzi che le branche della chimica e della fisica già hanno preparato/ di un’umanità più sana ed equilibrata.” [Translation mine] (The text on the white sheet is illegible even in the original document).
Natural Sciences in Architecture and Design of 1995, Giorgini connected these earlier designs and focus on material with an updated focus on scientific discoveries and an extensive study of the evolution of geometric form to create thin-shell complex structures. In a section of this book Giorgini focused on thin-shell structures and connected this to having been influenced by Hans Jenny’s visit to Florence in 1950. Jenny had used piezoelectric valves and was able to, as Giorgini related:

obtain, using electric impulses and various materials such as dust, liquids or gases, shapes with an incredible similitude to natural structures. My reaction was immediate. If we could program these forms and then be able to fix them, we would have techniques similar to those in nature. At the time, we were just beginning to form the idea of genetic programs, and computers were in their infancy. The hypothesis almost formulated itself. Let us prepare a catalogue of the rapport between form and vibration. Let us make a model and use the computer to read the various parameters, both of site and the vibration of relative position necessary to obtain those forms, under given conditions and of a material capable of condensing over the virtual tensional surface created by the vibration.\footnote{Vittorio Giorgini, Spatiology: The Morphology of the Natural Sciences in Architecture and Design/Spaziologia: La morphologia delle scienze naturali nella progettazioni (Milano: L’Arca Edizioni, 1995), 158.}

From this point, Giorgini began making drawings and building models with double-curved surfaces with asymmetrical characteristics. He used these methods in the Casa Saldarini in Baratti that has already been discussed. He developed “double-curved beams” which were “both asymmetrical and compounded” and he stated that at that time, he “did not understand their topological potential and geometric aspects,” nor their static aspects.\footnote{Ibid., 161.}

Rather than thinking of the shell from the point of view of its breaking point, his collaboration with engineers helped him to understand the shell in terms of its elasticity. He lamented that the house after some time “passed into the Olympus of curiosities and kitsch, equivocally labeled informal,
organic or sculptural.” Unfortunately, the Baratti house was the only chance that Giorgini had to
build and he continued his studies to develop a more coherent structural system that was related to
his interest in scientific theory. He focused in particular in the following studies on the relationship
between the “straight and curved line plane and curved surfaces.” The drawings that follow are
very clear in relating the Chlandi figures to his ideas for structural systems.

Figure 38 Vittorio Giorgini, Spatiology: The Morphology of the Natural Sciences in Architecture and Design (Milano: L’Arca Edizioni, 1995), 170. Right: Images of various cymatic tracings based on Hans Jenny’s findings based on Chladni figures.

Figure 39 One can imagine Giorgini had looked at Chladni figures like that on the right and brought
a similar figure together in an array such as the collage by the author on the left based on the single
figure. According to Giorgini, he imagined these figures in four-dimensional space in that the
vibrations could be made three-dimensional by forming surfaces along the lines of force. The image
on the left is created by the author.

118 Ibid., 162.

Chapter 1: Crescita e forma: The Tissue of Structure
In *Spatiology*, Giorgini painstakingly documented the translation from Euclidean geometry to what he proposed as topological architecture. Looking at the following sequence of pages from the book, one can see a combination of underlying dynamic forces with material forming about these lines of forces as he had described decades earlier as a chemical-physical form-making in shell structures. In these images though, there is more of an emphasis on the transformation from the primitive figure of the torus that could be broken into its constituent surfaces, unraveled and then recombined into complex surfaces. These operations are the methods by which primitives may be transformed in three-dimensional computer modeling programs that were already in use in the early to mid-1990s. In the third diagram, Giorgini activates a cross-section of a closed shell by rotating it around a center point to create a closed figure. The lower diagrams of the mobius strip and the Klein bottle document his interest in complex topological figures. The proposal for a shell structure on the right is simultaneously a mobius strip and a self-intersecting (but open) Klein bottle, far more complex than the closed torus.


In the following images Giorgini investigated the morphological variations of a simple gridded surface. On the left he drew a gridded plane being folded into a complex geometry. He then imagined each square being broken into a gridded surface, inspired by the symmetrical patterning of
the Chladni figures. He included these diagrams in a section of the book entitled: “System.” This is important in that Giorgini did not want to imagine each geometric form in isolation, but had imagined a larger implication of self-similar and yet changing elements that could be brought together into a larger organic system.


In his discussion of the zones of interaction defined by the overlapping circles, Giorgini connected these diagrams to the isostatic diagrams of the cantilever and the beam of the well-known Lanificio Gatti project built in Rome by Pier Luigi Nervi in 1951-53.

Figure 42 Pier Luigi Nervi, the Lanificio Gatti project in Rome of 1951-53.

Not content to remain beholden to the symmetrical organization of these gridded surfaces, he discussed the zones of interaction defined by the overlapping circles. He was more interested in the asymmetrical organization of form and referred the reader to the work of D’Arcy Thompson:
For the mathematical laws of transformation, from the symmetrical grid to the asymmetrical grid, we refer you to the work of D’Arcy Thompson. We can underline that the various figures of geometry are also the expression of the rapport in relation to the parts in the structures of systems.\textsuperscript{19}

Figure 43 Vittorio Giorgini, Spatiology: The Morphology of the Natural Sciences in Architecture and Design (Milano: L’Arca Edizioni, 1995), 62. The diagrams on the bottom are inspired by D’Arcy Wentworth Thompson’s diagrams in his “Theory of Transformation,” on the right.

Figure 44 Vittorio Giorgini, Spatiology: The Morphology of the Natural Sciences in Architecture and Design (Milano: L’Arca Edizioni, 1995), 165, 166, 170-71.

Giorgini used Thompson’s “Theories of Transformations” as a basis for differential change within an otherwise regular grid of self-similar elements. Rather than a flat array, he extended this to work

\textsuperscript{19} Ibid., 60.
with complex deformations within his reticulated space frame structures to produce an intricate filigree that would bear incredible similarities with the natural structures which he had reprinted in his *Ipotesi per un habitat più naturale*.

Figure 45 Vittorio Giorgini, *Spatiology: The Morphology of the Natural Sciences in Architecture and Design* (Milano: L’Arca Edizioni, 1995), 64-5.

**Pier Luigi Nervi**

The structural analysis of the well-known oeuvre of engineer Pier Luigi Nervi (1891-1979) looked to scientific and natural phenomena as an inspiration for form. One may view the accomplishments of Pier Luigi Nervi as related to the intersection of architectural form and the technological possibilities due in part to advancements in new materials and techniques. The new forms were also based on methods of analysis and representation of the dynamic of forces at work in form in overcoming the pull of gravitational forces. Nervi’s collaboration with engineer Aldo Arcangeli for the Gatti Wool Factory in Rome of 1953, was novel in that the pattern of the ribs in the modular ceiling slab followed the isostatic lines of the dominant bending moments, revealing, as Nervi stated, that in following the laws of statics an aesthetic value is inherent:
a design which makes possible strict adherence to the laws of statics, and therefore makes the most efficient use of the materials…The aesthetically satisfying result…is a clear reminder of the mysterious affinity to be found between physical laws and our own senses.\textsuperscript{120}


In his early work, Nervi saw the potential of advances in material science to bear an important impact on the analysis of architectural form. He reprinted the diagram of a photoelastic stress analysis and was captivated by both its beauty and how the pattern that is generated showing “the harmonious and continuous way in which external forces are dispersed into the body.”\textsuperscript{121} He used this idea (as had Vittorio Giorgini and we will see in the work of Luigi Moretti) to derive an elegant and economical form, as if inspired by nature.

\begin{flushleft}
\textsuperscript{121} Pier Luigi Nervi, \textit{Structures} (F. W. Dodge Corp., 1956), 92.
\end{flushleft}
Chapter 1: Crescita e forma: The Tissue of Structure


Published reports such as this example from the research paper, “Photoelastic determination of stresses around a circular inclusion in Rubber,” of 1938 were available and were of an inspiration to engineers and architects. The isostatic forces indicate areas of similar force and are represented by

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a single contour line. Other studies such as the one reproduced by Nervi in the following image represented the various areas of force on the surface as alternating bands of black and white.

Figure 48 Pier Luigi Nervi, “Photoelastic Stress Analysis: Visible stress patterns (From Photoelasticity by Max M. Frocht; copyright 1941). The patterns show the harmonious and continuous way in which external forces are dispersed into the body, and the concentration of stress in certain regions.” In Pier Luigi Nervi, Structures (F. W. Dodge Corp., 1956), 92.

The diagram below shows the opposite effect by focusing on a point object (the black half capsule shape at the top and bottom center) and how this force is concentrated at the point of impact and then distributed throughout the material. He used this as a way to think about how he might apply this (in a time well before a computer could be used to calculate complex structures) to study the different loads on a model of his hangar structure for Ortobello.

Figure 49 Pier Luigi Nervi, “Photoelastic Stress Analysis: Visible stress patterns (From Photoelasticity by Max M. Frocht; copyright 1941). This diagram below was generated in collaboration with the

In the following image, a scale model was constructed of the hangar in celluloid that was developed in collaboration with Prof. Guido Oberti at the Stress Analysis Laboratory of the Milan School of Engineering. In this model following the photoelastic stress analysis above, the team attached weights to all of the joints of the reticulated structure that formed the structural skeleton of the hangar. These weights were to, at the “given scale” of the model, emulate both the dead and live load at each joint. At the end of these weights, strain gauges were applied at both the upper and lower faces of the structural ribs to calculate both the sheer and bending moment loads, in effect at the inside and the outside of the structure.

Figure 50 Luigi Nervi. “Experimental Stress Analysis: 1935 hangar. (Analysis directed by Prof. Guido Oberti in the Stress Analysis Laboratory of the Milan School of Engineering). The model under examination is made of celluloid and represents the hangar.” In Pier Luigi Nervi, *Structures* (F. W. Dodge Corp., 1956), 90, top.

Nervi discussed various forms of architectural projects, but of an immense scale such as bridges, coverings for vast interior spaces such as for stadia or for aircraft hangars. In the analysis of these structures it was crucial to look to the lessons that may be drawn from natural form, as he stated,
“all must have forms that are well defined and fixed beforehand by nature, no matter what the aesthetic tendency of their designer may be.”\textsuperscript{123}

This is an interesting concept, as Nervi does not point only to the influence of nature on form, but also of a constant development of architectural form according to the internal forces. He coined the idea that this is what is the point of “having reached natural form.” Not only was there an understanding and accommodation for static forces, but that this new, scientific approach to form generation would in time “produce a truly stylistic character of their own.” By being attentive to the “static necessities” of architectural form, and by the “the perfect adherence to the most natural and spontaneous static laws, besides being necessary because of technical and economical reasons, is a fundamental element in the aesthetic satisfaction of the building.”\textsuperscript{124} Nervi was not alone in this reasoning and in the use of isostatic force diagrams for the generation of form. This was taken to another level, and a different formal language by Luigi Moretti in what he developed as a theory of parametric architecture.

\textsuperscript{123} Ibid., 98.
\textsuperscript{124} Ibid.
In the exhibit brochure for the exhibit *Moretti, Storia, Arte, Scienza* at the Accademia Nazionale di San Luca in Rome in 2010, the images selected on the right from a section of the exhibit entitled “Scienza: parametri della visione” (Science: Parameters of vision), covering the arc of Luigi Moretti’s (1907-1973) career. From the top to bottom key moments in the evolution of Moretti’s development of his concept of Parametric Architecture are highlighted, from the “Structure comme forme,” article in the *United States Paris Lines Review* of 1954 (discussed at length in Chapter 3) and the installation of IRMOU and parametric architecture at the XII Triennial of Milan, showing the diagram of the optimized sight lines of the stadium and the curved stadium shown in a plaster model. The next images and model photograph are all from 1960, prepared for the exhibit at the Triennale. The central image shows the curves for the calculation of sight lines in a soccer stadium,
and the diagram below shows the curves of the equal access to good sightlines (curve di equiappetibilità visiva) for a tennis stadium, and at the bottom the parametric study for a soccer stadium based upon the sightline diagrams in a plan view of a plaster model that is 71x82x25 cm.

Figure 53 Installation view of the organization and design of the Exhibition of the IRMOU and parametric architecture, XII Triennale, Milan, 1960. The project is a 1960 parametric study for a soccer stadium, 71x82x25 cm model.


In the previous image which shows the diagrams and plaster models for the soccer stadium one can see the connection in this work and the rational scientific methods of analysis. In the catalogue for the 1960 exhibit at the XII Triennial of Milan, Moretti and others involved in the IRMOU (Istituto Nazionale di Ricerca Matematica e Operative per L’Urbanistica) stated that the method of working was primarily an empirical process, applying modern scientific methods to the design of architectural and urban form, going as far to assert that new built form would be at the intersection of new methods of analysis and form generation aided by new materials and relative technologies and that the characteristic of this new form would have a “specific and logical, conceptual, and logical rhythm.”

The spatial analysis according to Moretti would be accomplished by ascribing quantitative data to complex phenomena. Moretti on pages 8-9 of the Triennal catalogue shows a partially torn double page spread from his essay in the United States Paris Line Review of 1954 in which he enumerates the

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term “parameters” borrowed from quantitative mathematical analysis central to scientific research and development.\footnote{I discuss this essay and other aspects of Moretti’s discussion about parametric architecture, space, structure, and form in detail in the second part of Chapter 3.}

While much of the work of IRMOU was concentrated upon the analysis of urban phenomenon, Moretti’s emphasis on architectural form is notable. His selection of sports facilities was the perfect foil for developing a parametric set of relationships between individual elements. In the case of all of the stadia, this linked the individual seat of a spectator and the analysis of viewing angle to the sport observed.

In the following diagrams Moretti studied the relationship of the site lines of individual point of view from a spectator’s seat to the different areas of interest on the field, such as the center of the field or closer to the goal on either end. By completing this study (with the assistance of computers) the team was able to generate a optimum viewing positions in the symmetrical playing field. These

\footnote{I discuss this essay and other aspects of Moretti’s discussion about parametric architecture, space, structure, and form in detail in the second part of Chapter 3.}
points were then connected using the equivalent of an isostatic line to produce a series of “contour lines” which reflect the optimum viewing areas as a shorter interval between lines and the larger spread of lines indicating less desirable positions.

Figure 55 Luigi Moretti. Left: Diagram of the soccer field and relationship to the particular seats. Right: Zones of optimum (and less than optimum) viewing areas in the stadium. As the “contour lines” have a greater distance between them, the viewing angle diminishes. *Mostra di Architetta Parametrica e di Ricerca Matematica e di Ricerca Matematica e Operativa nell’Urbanistica*. By I.R.M.O.U.: Istituto Nazionale di Ricerca Matematica e Operativa per l’Urbanistica. (Milano, Palazzo dell’Arte, Sept.–Oct., 1960), 13, 15.

The calculations that follow accompanied the diagrams in the catalogue for the XII Triennial *Mostra di Architetta Parametrica e di Ricerca Matematica e di Ricerca Matematica e Operativa nell’Urbanistica*.

Figure 56 Luigi Moretti, Calculations for the soccer stadium, identifying direct viewing angles from a particular seat in the stadium in regard to the most important areas for play. *Mostra di Architetta*
Figure 57 Luigi Moretti. Calculations for the soccer stadium, identifying direct viewing angles from a particular seat in the stadium in regard to the most important areas for play. *Mostra di Architetta Parametrica e di Ricerca Matematica e di Ricerca Matematica e Operativa nell’Urbanistica.* By I.R.M.O.U.: Istituto Nazionale di Ricerca Matematica e Operativa per l’Urbanistica. (Milano, Palazzo dell’Arte, Sept.-Oct., 1960), 17.

In the following sets of images, Moretti showed the applicability of this method of analysis to another sporting venues, first an Aquatics Center and then a Tennis Stadium. In the calculations for an Aquatics Stadium, the team identified direct viewing angles from a particular seat in the stadium in regard to the different kinds of swimming events. While a the stadium might be full at some point to watch racing events in which the swimmers used the length of the pool, it is notable that in a diving event, point B which represents the diving board is given priority for the overall form.
In the second set of images, the same method was used for the design of a Tennis Stadium for which the calculations identify direct viewing angles from a particular seat in the stadium for both the net and the back of the court. The “isostatic” or contour type drawing on the right shows the zones of optimum (and less than optimum) viewing areas as had been discussed in the soccer stadium.

Figure 58 Luigi Moretti. Left: Calculations for an Aquatics Stadium, identifying direct viewing angles from a particular seat in the stadium in regard to the different kinds of swimming events, at point B is the diving board which has a greater pull than the sides of the pool for races. Right: Zones of optimum (and less than optimum) viewing areas in the stadium for diving events. Mostra di Architetta Parametrica e di Ricerca Matematica e di Ricerca Matematica e Operativa nell’Urbanistica. By I.R.M.O.U.: Istituto Nazionale di Ricerca Matematica e Operativa per l’Urbanistica. (Milano, Palazzo dell’Arte, Sept.-Oct., 1960), 19, 21.
Figure 59 Luigi Moretti. Left: Calculations for an Tennis Stadium, identifying direct viewing angles from a particular seats in the stadium for both the net and the back of the court. Right: Zones of optimum (and less than optimum) viewing areas. *Mostra di Architettura Parametrica e di Ricerca Matematica e di Ricerca Matematica e Operativa nell’Urbanistica*. By I.R.M.O.U.: Istituto Nazionale di Ricerca Matematica e Operativa per l’Urbanistica. (Milano, Palazzo dell’Arte, Sept.-Oct., 1960), 23, 25.

Figure 60 Luigi Moretti. “Soccer stadium,” in *Luigi Moretti*. Federico Bucci and Marco Mulazzani, ed. (New York: Princeton Architectural Press, 2002), 114.
Finally, what is notable is that these diagrams, with additional information regarding height differentials are used directly to produce the shell-like forms of both the soccer stadium and the aquatics center.

**Sergio Musmeci**

Engineer Sergio Musmeci (Rome, 1926-1981) is another Italian engineer whose link between the close study of statics and forces, like Pier Luigi Nervi, or Moretti’s work on parametric architecture, studied the lines of force and used these calculations to produce a number of important “organic” works. Best known for his Bridge over the Basento River in the southern Italian town of Potenzia in the Basilicata region of 1969, this project, a continuous surface, is exemplary as an example of an alternate organic approach by which a rigorous study of the forces and rules that govern natural form are used to produce a work which looks and performs organically.
Figure 62 Sergio Musmeci’s design for the Bridge over the Basento, 1967-69. In Manfredi Nicoletti, Sergio Musmeci: Organicità di forme e forze nello spazio. 1999), 62-63. He designed this with the assistance of Aldo Liviadiotti. The left image shows the bridge in the construction phase. The top right image studies the minimum surface of the basic shape through a soap film model. The model on the lower right is a rubber model in which the membrane is pulled to emulate the points of contact of the bridge with the environment.

Figure 63 Margherita Guccione, ed. Sergio Musmeci: Il ponte e la città, Sergio Musmeci a Potenza (Roma: Gangemi editore, 2003), 30-31. The left image is the tables of calculations and structural diagrams and on the right a scale model in polymer plastic. 1:100 scale.

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127 Margherita Guccione, ed. Sergio Musmeci: Il ponte e la città, Sergio Musmeci a Potenza (Roma: Gangemi editore, 2003), 30-31. Conference at the Università degli studi della Basilicata, Engineering School, May 10, 2003. The book was edited and supported by the MAXXI (Musco nazionale delle arti del XXI secolo, Roma which holds Musmeci’s archive) and DARC (Ministero per I beni e le attività culturali—Direzione generale per l’architettura e l’arte contemporanea).
Figure 64 Sergio Musmeci’s design for the Bridge over the Basento, 1967-69. In Manfredi Nicoletti, *Sergio Musmeci: Organicità di forme e forze nello spazio*. 1999), 66-67.

Figure 65 Margherita Guccione, ed. *Sergio Musmeci: Il ponte e la città*, *Sergio Musmeci a Potenza* (Roma: Gangemi editore, 2003), 32-33. Model at 1:10 scale in “microcalcestruzzo” or “micro reinforced concrete”

A number of Musmeci’s projects from the 1950s are interesting as one can see he is already searching for the possibility to create organic structural form through the use of a single concrete membrane. Projects such as a folded roof structure for the Cinema Araldo in Rome of 1955, or the curved singular surface of the project for the Central Markets for Rome of 1960 show the relationship to other studies by Nervi or Moretti.

Figure 67 Sergio Musmeci’s design on the left the Palazzetto dello Sport in Rome, 1953, and right the Church of the Villaggio del Sole in Vicenza, 1960. Below on the right is the double spiral of

The projects that most clearly relate Musmeci’s studies of architectural form derived from a close study of natural forms and the laws that govern them, are his Palazzetto dello Sport for Rome of 1953 and his built Church of the Villaggio del Sole in Vicenza of 1960. Both projects use the overlaid system of equiangular spirals, what is termed the *Spira Mirabilis* or the logarithmic spiral to generate the form. The *spira mirabilis* is known as the underlying structure for the whorling pattern of pine cones and the distribution of seeds in the head of the sunflower (*girasole*) and is seen in other natural structures. The spiral is constructed by connecting equally spaced lines which radiate from a center point. Musmeci, in his book *La Statica e le Strutture* (Statics and Structures) graphically describes the curve and provides the calculations that determine the radius, arc length, curvature, and tangential angle of the logarithmic spiral.
Musmeci then applied this underlying geometric structure to his design for the competition entry to the competition for the Palazzetto dello Sport of Florence in 1965, in which he generated a double spiral of steel cables that would radiate from two vertical towers also made of a reticulated structure. This tensile hanging roof bears much similarity to the work of Frei Otto in a similar time period.
Figure 69 Sergio Musmeci’s design for the Palazzetto dello Sport in Florence, 1965. In Manfredi Nicoletti, *Sergio Musmeci: Organicità di forme e forze nello spazio*. 1999), 81-82.

Figure 70 Manfredi Nicoletti’s design of 1968 for a *Grattacielo Elicoidale* (helicoidal skyscraper). In Manfredi Nicoletti, *Sergio Musmeci: Organicità di forme e forze nello spazio*. 1999), 88-89.
Manfredi Nicoletti worked with Sergio Musmeci in the design for a helicoidal skyscraper based on similar principles evident in the *spira mirabilis*. In this project for a *Grattacielo Elicoidale* (helicoidal skyscraper) of 1968, three radiating spiral towers grow from the nodes of a triangular center. Musmeci worked with Nicoletti to develop each of the spirals studying its aerodynamic principles, searching to extend the internal geometries to the environment in which the project was sited.Overall, Musmeci’s work brings together the relationship between form and an attentive and close reading of natural structures.

**Future work**

There are also other architects and engineers who worked in the period from the late 1950s through the early 1970s whose work also has attributes of an “alternate organic,” such as Leonardo and Laura Mosso, Luigi Pellegrin, and Maurizio Sacripanti whose work will be studied in a future project. This portion of the chapter on “Other Alternative Organicists” stands as a sketch to this future work. The group of Nizzoli Associati, Renzo Piano, and the bridge at the Strait of Messina of 1969 by Sergio Musmeci are introduced in Chapter Seven and will be studied more extensively in a future work.

Chapter Two will interrogate the use of the term “organic” or “organicism” in relation to architecture, through a series of case studies of “organic” architecture in the twentieth century. The crystalline, symmetrical structure seen in the influential drawings of Ernst Haeckel held no small fascination for D’Arcy Thompson and found they found their way into architecture and the visual

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arts in the early part of the century. Haeckel drew the radiolaria skeleton and emphasized the symmetrical structure, which was refuted by Thompson, whose contribution was profound in the recognition of all manner of natural form as being guided by both internal rules of growth and pressures from the environment. One could say that natural form is the mediator between these forces or is in fact mediated. The symmetrical skeleton or the radiolarian or of inorganic crystalline forms were often held as an inviolate notion of beauty and perfection in nature. The questions about the laws behind the range and beauty of natural form was a continual influence for the arts and architecture. This kind of understanding is seen in the drawings of Hermann Weyl, Bruno Taut, Luigi Moretti, the Independent Group and Pier Luigi Nervi, and many others. Their work may be contrasted with a more biomorphic approach to form for example in the work of Hugo Haring, Hermann Finsterlin, Frederick Kiesler and others. The key difference is that a mathematical analysis of organic form is expressed through mathematics and understandable through scientific investigation. The complexity of the question regarding organic form may be seen as the dynamic forces made manifest in form.
Chapter 2: Organic Architecture and Natural Principles

Architects have taken various approaches to define what constitutes an organic form in modern architecture. Biomorphic, body-like shapes have been used to speak to the freedom of expression and harmonious proportions that are shared with natural form. This literal and superficial reference to the biomorphic led Bruno Zevi to speak of this kind of architecture as a “biological fallacy,” borrowing Geoffrey Scott’s term from the early twentieth century.\(^\text{129}\) Another approach is seen in Frank Lloyd Wright’s work in the emphasis on the geometric laws that organize form, which allow the form to shimmer, be broken and reorganized by the underlying, often principally planimetric iterative geometric games. Another possibility, and the one that is of the most interest here, is an architecture that, as Philip Steadman summarizes, exhibits “qualities of wholeness, of integrity, of a unity in structure such that the parts all contribute to the effect or purpose of the whole.” The second part of his definition emphasizes that “no part may be removed without some damage to the whole.”\(^\text{130}\) The idea of wholeness is a classical idea of perfection.

Contrasting that notion of a perfect whole, organicism is not a perfect whole broken down into parts but is a dynamic and complex organization of the parts coming together to form the whole. The organizational complexity is able to respond to particularities of site, growing organically as needed. Architecture cannot just not appear organic; it must perform organically.

To appreciate both the dynamism and complexity of the “organic,” it will help to look at the influence that illustrated scientific texts had on artists and architects in the 1950s and 1960s through

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a selected series of case studies. Zoologist Ernst Haeckel’s (1834-1919) drawings of the radiolarian skeleton combined the interest in living organisms, with a study of the almost inorganic aspect of the siliceous shells. Beautiful, symmetrical microscopic structures found expression in Art Nouveau design and architecture, and in the work of Bruno Taut and the Gläserne Kette (the Crystal Chain Group), which elides organic and inorganic models of growth (of crystals and cells). These expressions indicate the changing status of what constituted a living organism in science at the time.


Haeckel’s drawings bring up critical issues regarding the difficulty in distinguishing organic and inorganic models of growth and form; likewise, the artists and architects of the Gläserne Kette used both inorganic models of crystals and biomorphic shapes to elaborate an organic approach to a visionary architecture. It is also important to look towards Haeckel’s drawings of radiolarian as inspiration to or forerunner to D’Arcy Thompson’s 1917 work *On Growth and Form*. Thompson (1860-1948) grappled with the distinction of the inorganic and organic. The radiolarian was
representative of an organism that is both organic in the protoplasm of the cellular material and inorganic in the crystalline matter of its skeleton. Semino reports that he studied the work of Thompson, but it is not evident that he was aware of key precedents of the mutual influence of art and science that framed some of the discussion of the postwar period.

The exhibit *Growth and Form* at the ICA in London of 1951, organized by art critic Herbert Read and artist Richard Hamilton just prior to the founding of the Independent Group, was dedicated to the work of D’Arcy Thompson. Separately, Herbert Read introduced sculptor Naum Gabo to the newly revised edition of *On Growth and Form* of 1942. This work resonated with Gabo, since Thompson discussed natural examples of what Gabo was already manifesting in his work; material could be a clear demonstration of the dynamic forces governing the patterns of nature and form.

In a different context, shortly after the *Growth and Form* exhibition, Italian architect Luigi Moretti, in his search for a system for parametric design, used illustrations from *On Growth and Form* to illustrate his 1954 essay “Structure Comme Forme,” which was published in the *United States Line Paris Review*. The investigation of art and science accelerated exponentially after WWII and exerted a diffuse influence in architecture culture that surpassed national boundaries, in part through architectural publications. Reyner Banham, already in a heated discussion (in print) with Ernesto Nathan Rogers, editor of *Casabella-continuità*, in his series of essays “Stocktaking 1960” for *Architectural Review*, examines the importance of “technology” in relation to certain inclinations towards “tradition” (especially in Italian architecture) in the Italian magazines in the mid- to late-1950s. The merging of art and science with economic development and exponential growth in industry made an impact on architecture but especially architectural culture, as a receptive field where various experiments also grew and flourished.
In the symposium and published proceedings, *Aspects of Form*, associated with the *Growth and Form* exhibition, the essay by Konrad Z. Lorenz, “The Role of Gestalt Perception in Animal and Human Behaviour,” is interesting because in it he speaks to the importance of the *gestalt* (summarized as “the visual perception of single completed configurations, where the whole appears to dominate the parts”).  

Many other exhibits and symposia discussed organic form during the same period. The exhibit *Growth and Form* and the symposium *Aspects of Form* are the leading edge of a number of similar exhibitions/symposia that would be organized in the next twenty years, exhibiting both the early interest in the immediate postwar period, and then a renewal of interest in the late 1960s on the work of D’Arcy Thompson, Ernst Haeckel, and other morphological and mathematical studies on the interrelationship between natural laws underlying form and structure and art, architecture, and other human expressions.  

The currency of the term *gestalt* and the importance of perception will

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132 Other examples are Gyorgy Kepes’s books and exhibit at the CAV at MIT in 1960; Luigi Moretti’s exhibit on Parametric Architecture for the XII Milan Triennial of 1960; the 1968 exhibit organized at the Museum of Natural History, in Washington and published by the Smithsonian Institution by Philip C. Ritterbush *The Art of Organic Form* (chapters titles, “To Set Form above Nature,” “Esthetics and Analogies to Life,” “A Tissue of Imagining,” “Living Symmetry,” The Progress of Biological Forms,” all in very scientific investigations and crossing over to speak about the influence in the practice of artists such as Klee and Kandinsky. The exhibit was dedicated to painting and drawing does not indicate its indebtedness to the *Aspects of Form* conference. It is as if a claim is made to the term *Art of Organic Form*: “This book is the report of a rather hasty exploratory reconnaissance, a brief adventure of ideas. It is an historical sketch of a fruitful and protean concept, which I have called the idea of organic form, the notion that organized beings display principles of emergent order of greater complexity than nonliving entities, whereby organic form is seen to be a property of the whole organism, in distinction to the forms of its parts or subordinate elements.” [Emphasis mine]. Rather than reference other studies he begins the first line of the first chapter of what will be a summary history of biological form with, “Johann Wolfgang von Goethe (1749-1832)…” [This should be compared with the exhibit *Arte Programmatu* that was at the Smithsonian several years earlier]. Another project that Rittenbush is involved with as Chairman of the Organization (formerly Director of Academic Programs, the Smithsonian Institution) is the book G.S. Rousseau, ed. *Organic Form: The Life of an Idea* (London: Routledge, and Boston: Kegan Paul, 1972). The essays assembled by G.S. Rousseau (Associate Prof. of English, UCLA) “were orginally delivered in December 1970 at the Literature and Science section of the annual Modern Language Association meeting in New York City. (p.2). The essays are G.N. Giordano Orsini, (Comp. Lit. U.
be highlighted in the work of Enrico Guidoni who examined a gestalt reading of city fabric using scientifically inspired diagrams as a guide, rounding out the focus in this chapter regarding the influence of scientific texts in art and architecture and further interrogating the term *organic*.

**What is meant by the “organic metaphor”?**

To begin, it will be helpful to probe deeper into the meaning of the term “organic.” The term *metaphor* is chosen as opposed to *analogy*, as metaphor is more abstract, implying a comparison of function versus having a direct comparison of appearance between two things. Metaphor will be used as it relates more to the idea of an isomorphic appearance of an idea in various manifestations. According to the Zanichelli Italian dictionary, the term derives from the Latin *orgānicu(m)* and from the Greek *organikós*, agg. of *órganon* or ‘strumento’ or ‘instrument’ then *organo* [1308]. It refers to something that is composed or of a bringing together of organs (as in an organic body or organic structure), or elements or parts that are coordinated into one whole. It is used to describe something in which the elements are brought together in a harmonious whole, as if in a façade composed of various harmoniously coordinated elements. An “organ” is defined as any part of a human, animal, or vegetable body that is formed of multiple cells to produce a tissue and that has a particular function. This is very informative if one begins to substitute the term architecture for the “human, animal, or vegetable body.” These consonances, such that architecture is composed of smaller cells, or elements that are combined into a larger whole, is the main theme of this dissertation. But it is in

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the various manifestations and interpretations of this term, and the ambiguity that this metaphor carries in relation to a concrete and theoretically inanimate (or inorganic) entity that is architecture (both built, and speculative) that is the real object of study.\(^\text{134}\) As a metaphor, architecture thus functions “as if” it is an organic entity and its study can be expanded greatly by perceiving its parts in dynamic/organic relations to each other and to the whole “organ” of section, building, siting, urban plan, or region.

Raymond Williams in his *Keywords: A vocabulary of culture and society* dedicates three pages to this complex term as used in the English language. His first paragraph is concise as to the mixed meaning of the term:

Organic has a specific meaning in modern English, to refer to the processes or products of life, in human beings, animals or plants. It has also an important applied or metaphorical meaning, to indicate certain kinds of relationship and thence certain kinds of society. In this latter sense it is an especially difficult word, and its history is in any case exceptionally complicated.\(^\text{135}\)

And as one can see, the term is “an especially difficult word,” and rather than use this term in regard to its specific meaning as outlined by Williams, the more ambiguous use of the term, its “applied metaphorical meaning,” will be examined so as to understand the implied comparison of an organic body to the seemingly inanimate and static nature of architecture. It is in fact the use of this metaphor that seems to breathe life, as it were, into architecture. The metaphor is a resistance to the

\(^{134}\)“Metaphor.” Etymology: Middle French or Latin; Middle French *metaphore*, from Latin *metaphora*, from Greek, from *metapherin* to transfer, change, from *meta- + pherin* to bear—a figure of speech in which a word or phrase denoting one kind of object or action is used in place of another to suggest a likeness or analogy between them (as in *the ship plows the seas* or in *a volley of oaths*); an implied comparison (as in *a marble brow*) in contrast to the explicit comparison of the simile (as in *a brow white as marble*). “metaphor.” Webster’s Third New International Dictionary, Unabridged. Merriam-Webster, 2002. http://unabridged.merriam-webster.com (12 Nov. 2012).

inflexible and predetermined aspect of static architecture that does not take into account change and temporality, human use and variability, or the vagaries of the environment in which a work of architecture is situated. What will be important to the use of the term organic here is that it also is not situated only in each individual work of architecture (or building), but extends into an understanding of how individual buildings are accreted into larger organizations, into streets and blocks, neighborhoods and cities, and how the development of the human built environment is by necessity in a larger relationship with the natural environment and larger territories. This line of thought will be examined directly in case studies in Italian architecture and urbanism in the time period of the late 1950s through the early 1970s.

**Crystals: Bruno Taut and the Gläserne Kette**

Between 1913 and 1915, the art historian Adolf Behne described Bruno Taut’s working method as being “without preconceptions,” a “form with organic aspects,” and as “expressionist,” meaning something elementary, produced from the inside (internal) towards the outside (external), contrary to what is ‘impressionist’, that proceeded from the outside. Behne stated that:

> The expressionist goes deeply into the essence of his work, before having a clearly defined approach, or a well defined formal idea. The form will show itself in its essential aspect, he will create entirely from the inside of things…Every form is something unique and unrepeatable.\(^{136}\)

For Taut the focus was on the cross-influence of art and nature, without any preconceptions regarding form. He looked for something that was elemental to form itself. It was from this practical and emotional way of working that an appropriate form would emerge; the form would and have an

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Extending his thoughts to others, in 1919, Taut contacted Adolf Behne and 12 other architects and artists to form a group that would communicate, through an exchange of letters, a new idea of an architecture of fantasy…to become visionary architects. Old concepts, Taut wrote, were like manure, and “we are a seed in the new humus.” Behne declined the invitation, but those who accepted the invitation, Walter Gropius, Hans Scharoun, Max Taut, Hermann Finsterlin, Wenzel Hablik and the Luckardt brothers, agreed to meet, as if a secret society, the Gläserne Kette, to disseminate their vision of architecture of the future. Despite Taut’s call to revolution, the works of the groups were not as politically motivated as Taut would have liked. Rather, the group looked towards a remote past that would give clues as to the origin of form and of material, towards a past that would evoke a lost innocence, of a primordial world, one that would erase the horrors of the recent war.

Figure 72 Hermann Finsterlin, Architectural project, 1920. This drawing by Hermann Finsterlin explores and explicit reference to biological form. The spiral form, emerging from the earth prompts one to think of its continued growth and transformation. In the Deutsches Architektur-Museum, Frankfurt. From Marco De Michelis, Espressionismo e nuova oggettività: la nuova architettura europea degli anni venti (Milano: Electa, 1995), 73.

A seminal proposal to emerge from Taut et al. was that an architecture made of glass would have the potential to liberate mankind. The material was a reference to the object of study, or rather, the

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preferred symbol of this renewal which was the *crystal.* The crystal represents an inalienable, primordial inorganic structure that does not speak only to its origins in the pure earth, but of the perfection of the structure of the cosmos. Taut outlined a new approach:

New architecture: fluctuating, unusable. Models: stars and an absolute fantasy. Purely joyous things. To remain enchanted by their *pure essence.*

![Figure 73 Wenzel Hablik, From the series, ‘Exhibition buildings’](image)


The group was inspired by the inorganic model of the crystal but also by other organic metaphors as well. The organic provided a conceptual model that was clearly different than that of the inorganic crystal that emphasized pure and irreducible form. An important source of organic studies for the *Gläserne Kette* was the work of Ernst Haeckel whose work spanned the end of the nineteenth and

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into the beginning of the twentieth century. Haeckel's work, *Art Forms in Nature* showed, though exquisite drawings, a series of unicellular animals and plants. Haeckel's assertion was that the form of all matter in the world, organic or inorganic, depends for its formation upon a universal set of natural laws. To Haeckel, the formal investigations reveal the constitutive laws that governed form, whether inorganic or organic. As a result, though some expected that the members of the *Gläserne Kette* would draw solely on crystalline imagery for inspiration for their work, there are also a series of biomorphic, polyp-like forms produced by Hans Scharoun and Hermann Finsterlin in addition to the work inspired by crystals by Bruno Taut, Wassili Luckhardt, and Wenzel Hablik. Yet at the core, the crystal was an organic analogy and a means to attain an *Ur Form* and would become the kernel of the new architecture. As Hablik wrote, “The contemplation of the roots is especially important for us. Our works must grow organically out of the simple primitive cell,” seemingly as a way that architecture would grow and retain its connection to a primordial condition of nature. To our eyes, it would seem that the expression of the organic and inorganic models of nature would be representative of vastly different orders of natural form. However, at the time, the distinction between one and the other were not so clearly drawn.

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143 It is beyond the scope of this chapter to treat the visionary work of the *Gläserne Kette* and the social and utopic theories of Bruno Taut in a full manner, so while brief, a discussion of the work of the *Gläserne Kette* is used to to sketch out a kind of history of organic architecture in the twentieth-century. As such, the discussion here is limited to a search for the overlap and distinctions of the terms *organic* and *inorganic* as used in relation to architectural form. In order to do so, it is important to look for a moment to some of the influences that infiltrated from the sciences into art and culture at the time. Taking the drawings of German zoologist Ernst Haeckel as a model for organic form brings with it a loaded condition, as he negotiated between the simultaneous presence in the radiolaria of living cells and the internal, crystal-like skeleton.
Cells: Ernst Haeckel’s microscopic visions of grandeur

Ernst Haeckel (1834-1919) did not distinguish between the organic and inorganic models of growth. Despite this oversight, Haeckel’s work is regarded as groundbreaking and contributed significantly to scientific knowledge. Haeckel is credited with the discovery of thousands of new species of radiolarians.\textsuperscript{144} Radiolarians are microscopic single-celled organisms, free-swimming protozoa that are found in all of the earth’s oceans. For a single-celled organism, they possess an extremely complex body and frequently have a spherical or helmet-like skeleton, through which pseudopodia or filaments extend to capture microorganisms.\textsuperscript{145} What is critical to understand is that an intellectual (and perhaps spiritual) filter came between Haeckel’s direct observation under the microscope and his drawing of the beautiful plates. This filter seems to have urged him to regularize the variations seen in actual species. He would gloss over the aberrations and often emphasize the symmetrical configurations of the glorious specimens in the drawing plates. But he also studied irregularities in the structures as well, something that is noted less about his work.

\textsuperscript{144} Ernst Haeckel published \textit{Die Radiolarien} was first published in 1862. His \textit{Generelle Morphologie der Organismen} (General Morphology of Organisms) was published in 1866. Haeckel emphasized that the same physical laws govern both organic and inorganic nature. In his drawings, he tended to minimize differences and emphasize ideal symmetries, something that D’Arcy Thompson will repudiate.

Another issue is that Haeckel did not draw the radiolarians with its enclosing protoplasmic cell, but drew only the skeleton or parts of the radiolarians, exhibiting an almost crystalline purity that is normally covered by the cell body. These cell bodies, in fact, were often compromised in preserving the specimens.146

We do not see in many of Haeckel’s drawings the individual cellular elements brought together as they exist in situ in the natural world. Yet his work was illuminating to the Gläserne Kette who rarely show an individual crystal or biomorphic form. Haeckel’s drawings do show agglomerations, clusters of regularly faced or smooth shapes in which there is an implied notion of growth, of cluster, and of community seen in a number of plates that show coral and other animals in colonies. The relationship of the individual within the collective is paramount. The works of the Gläserne Kette parallel this idea of growth and development that was a consonance of the individual parts in the creation of a larger organism.

146 Olaf Breidbach, “Brief Instructions to Viewing Haeckel’s Pictures,” in Ernst Haeckel, Art Forms in Nature: The Prints of Ernst Haeckel. With contributions by Olaf Breidbach and Irenäus Eibl-Eibesfeldt and a Preface by Richard Hartmann. (Munich, Berlin, London, New York: Prestel Verlag, 2004), 11. First published in 1904. While Haeckel often drew only parts of the radiolarians that would bring the symmetrical qualities to the fore, something that is echoed in the arrangement of the different individual biological forms in the space of the larger drawing plate. But many of these plates do not emphasize a simple symmetrical relationship between parts, but show a complex set of relationships between the individual specimens as they are brought into interaction (at least in the drawing plate), separated, yet interrelated in complex symmetrical relationships. The drawing substitutes for the natural environment of the organism depicted in an abstract sense. The relationship between organism and environment is not delineated, but the relationship between variations in a certain species, angle of view and stage of growth is triggered in the act of drawing and juxtaposition of different elements of diverse scales.
Haeckel filtered the natural forms through the stylistic flourishes of the day, the beauty of *Art Nouveau* forms and of ornament. The patterns of the ornament led to an “autonomous existence” – fragmenting and isolating particular features of natural forms to conform to current aesthetic taste.

Olaf Breidbach states that in Haeckel’s work,

> Nature appears to be stratified in symmetries. These symmetries are manifest. In beholding animate nature, Haeckel, accordingly, seems to lay open its essence. Seeing—that is à la mode de l’art nouveau—becomes an act of acquiring knowledge. Haeckel’s perception remains determined by a style, which guarantees a certain continuity. Because this modish way of seeing, with its narrow categories, finds confirmation even in the formal organizational peculiarities of such distant deep-sea organisms, it concludes that it is universally valid. It no longer reflects its preconditions, it simply illustrates them: nature appears à la mode.\(^{147}\)

Haeckel’s work influenced the work of architects and artists for decades. Likewise, another scientist, D’Arcy Wentworth Thompson (1860-1948) became a profound source of inspiration for

\(^{147}\) Breidbach, “The Most Charming Creatures, Haeckel’s 1862 Monograph on Radiolarians,” 15.
generations of artists and architects. Thompson’s view and influence is vastly different than Haeckel’s. Thompson glimpsed a different world, one in which pattern and ornament, as well as crystalline and symbolic perfection, give over to the dynamic, changing forces in matter and organisms.


Thompson’s ground-breaking work *On Growth and Form* of 1917 interrogated the static and quasi-mystical conception in Haeckel’s symmetry and implied perfection of organic form and arrived at dynamic systems subject to geometric and mathematical laws that guide the growth of organisms, in form and through time. Thompson was critical of Haeckel’s creative symmetries that often do not in fact exist in the microscopic radiolarian. Regarding the siliceous shells of the oceanic Radiolaria

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148 In relation to digital work, Greg Lynn *Animate Form,* 1999; R. Martin, “Organicism’s Other,” and other in Beesley and Bonnemaison *On Growth and Form,* among many others.
drawn by Haeckel, Thompson questioned the absolute symmetry of organic form as there are dynamic forces to be considered in the development of form.\textsuperscript{149}

The symmetry of crystallization, which Haeckel tried hard to discover and to reveal in these [radiolarian] and other organisms, resolves itself into remote analogies from which no conclusions can be drawn. Many a beautiful protozoan form has lent itself to easy physico-mathematical explanation; others, no less simple and no more beautiful, prove harder to explain. That Nature keeps some of her secrets longer than others—that she tells the secret of the rainbow and hides that of the northern lights—is a lesson taught me when I was a boy.\textsuperscript{150}

Instead of a perfectly symmetrical radiolarian skeleton, Thompson counters with a drawing that shows a slightly bulging irregularly formed skeleton. Thompson discovers that geometry underlies the form of these skeletons: not a perfect geometry, but mediated by the material itself and the interaction with the environment.


\textsuperscript{150} Thompson, \textit{On Growth and Form}, 732. (abridged version, p. 171)
Figure 77 D’Arcy Wentworth Thompson, drawings of *Reticulum plasmatique*, after Carney; the Aulonia hexagona, after Haeckel; and Haeckel’s *Actinomma arcadophorum*. Thompson notes that by looking carefully at both Carney’s drawing that both pentagons and heptagons are found and that Haeckel notes that there are a few square or pentagonal faces to be found in the *Aulonia hexagona*. From D’Arcy Wentworth Thompson, *On Growth and Form—The Complete Revised Edition* (New York: Dover Publications, Inc., 1992), 708-9.

The influence of his work would be felt throughout the twentieth century, including the exhibition *Growth and Form* at the Institute of Contemporary Art in London in 1951, Luigi Moretti’s article “Structure Comme Forme” in the *United States Line Paris Review*, referred to in articles in Gyorgy Kepes’s *Structure in Art and Science*, in addition to explicit references in *Zodiac* 22 and the publication of the University of Pennsylvania Architecture School *Via 3* (which are further discussed in Chapter 5). His work is still of interest today.151

**On Growth and Form**152

D’Arcy Wentworth Thompson’s *On Growth and Form* was initially published in 1917, a book of 793 pages written, as Thompson notes in his Prefatory Note to the revised and expanded edition of

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151 Thompson’s work was studied throughout the 20c and is still influential in contemporary architectural culture. See the edited volume by Philip Beesely and Sarah Bonnemaison.

1,116 pages in 1942. Regarding this expanded edition, Thompson said: “in wartime, and its revision has employed me during another war. It gave me solace and occupation, when service was debarred me by my years.”\textsuperscript{153} The 1942 edition drew the attention of artists and architects in the postwar period. But the abridged and edited version of 1961, at 346 pages, is the edition that most likely found its way onto the desks of American and English architects in the 1960s. The abridged and edited version is translated into Italian as the 356 page \textit{Crescita e Forma, la geometria della natura} in 1969.\textsuperscript{154}

Stephen Jay Gould, in his Foreword “This Was a Man,” described some of the positive and negative aspects of Thompson and the vast range of his inquiries in this major book. Thompson was offered professorships in three different disciplines, classics, mathematics, and zoology, and while he maintained his position of professor of zoology, he asserted in his Epilogue that the primary purpose of the book was “to show that a certain mathematical aspect of morphology...[is] helpful, nay essential, to [the] proper study and comprehension of Growth and Form.”\textsuperscript{155} Gould extrapolating on Thompson’s point stated:

> the application of mathematics to organic form may sound like a highly modern enterprise, but D’Arcy Thompson’s examples contain blessedly little of the apparatus usually employed in such efforts: theoretical modelling with differential equations or empirical treatment with sophisticated statistics….Thompson knew these fields, but he approached \textit{Growth and Form} as a classical scholar, in particular as a Pythagorean geometer boosted with a knowledge of


\textsuperscript{154} D’Arcy W. Thompson \textit{Crescita e Forma, la geometria della natura} (Torino: Editore Boringhieri, s.p.a., 1969).

Newtonian mechanics. This book dwells in the Mirdal angle, the Fibonacci series, the logarithmic spiral and the golden ratio.\textsuperscript{156}

It is this aspect of Thompson as a classic “geometer” drafting diagrams and drawings (some prepared for the book and others “after” a previous discovery) amply throughout the text that attracted the attention of artists and architects alike. While the text is accessible yet erudite, it was the highly evocative images and diagrams that exert a powerful influence on mid-century art and architecture.\textsuperscript{157}

It is not unusual to see the influence of Thompson’s text in the formation of various projects. In other cases, the images make the text accessible beyond English speaking circles. The \textit{Growth and Form} exhibition at the Institute of Contemporary Art in London and discussed in the companion symposium \textit{Aspects of Form} of 1951 and in a publication by Luigi Moretti in 1954 exemplify the force of the images to clarify text and inspire thoughtful reflection among artists and architects. In an essay in \textit{Ulm} 12/13, an essay references the Fibonacci series in the spiral configuration in a pinecone as discussed by Thompson and provides an inspiration for architects. This same point was discussed by Maria Bottero in her Introduction to \textit{Zodiac} 22. Bottero also speaks about the influence of other key scientific and morphological texts that influenced architects especially at the intersection between art and science and as a viable technique in design at both small scale and at the urban scale as a kind of new organicity.

**Growth and Form, ICA, London, 1951**

The exhibit \textit{Growth and Form} is a prime example of the far-reaching influence of D’Arcy Thompson’s book \textit{On Growth and Form}. Organized by art critic Herbert Read at the suggestion of artist Richard

\textsuperscript{156} Stephen Jay Gould, “This Was a Man,” x.

\textsuperscript{157} This has been pointed out by both Gould and John Tyler Bonner in the abridged version of 1992 reprint of the original 1961 abridged text.
Hamilton, Hamilton had been working with very ambiguous organic forms in a series of photograms in the late 1940s and was fascinated by the structural order of organic and biological life. Artist Eduardo Paolozzi, wrote to Nigel Henderson from Paris telling him of D’Arcy Thompson’s book which had been republished in 1942.\(^{158}\) Paolozzi thought that Henderson would be interested in the underlying mathematical order that Thompson attributed to the organization and structure of all matter and was particularly evident in natural structures such as skeletons, eggs, and crystals. Henderson tentatively made a suggestion to Henderson that they could organize an exhibit around this theme. Hamilton drafted a proposal by 1949 that linked mathematical complexity behind natural form and psychological complexity in the human into an exhibition theme.

Early section headings for the parts of the exhibit are telling as to the depth and seriousness with which Hamilton assembled the materials for the exhibit: Crystal Structure, Organization in Colloidal Systems, Chromosomes and Cell Division, Skeletal Structure, Vertebrates, Plankton etc. The materials in the show were not labeled in such distinct categories, but were arranged in a freer, more artistic manner that tracked on themes or processes in growth and form. The exhibit catalogue

Chapter 2: Organic architecture and natural laws

however retained these headings. Hamilton brought together a juxtaposition of all sorts of media, drawings, models, film, film stills, photomicrographs, electron-micrographs, photographs, and so forth.

The exhibit opened on July 3, 1951, and was officially opened by Le Corbusier, who had kind words for the exhibit:

The authors of this exhibition are people who have observed, who are sensitive and who are poets...The exhibition has moved me very deeply, for I found in it unity of thought which gave me great pleasure.  

Nigel Henderson had withdrawn from the project in the middle of 1950, but his role is still clear. He documented the exhibit for the Architectural Review, which appeared in the October 1951 issue.

Hamilton’s hand is also seen in the unconventional choice of images from non-art disciplines, and “arranged within a dramatic and darkened stage-set of enlarged models of cell structures.”


160 Walsh, Nigel Henderson, 28.
The cover design of the catalogue echoes the tension that is seen in the exhibition design: a juxtaposition between a cartesian grid and that of the more fluid geometries of natural specimens or of Hamilton’s gestural, informal etchings. The cover is organized by a grid demarcated by fine black lines of 3 rectangles (the top row is slightly shorter than the others) across by 5 down, providing a background matrix against which, and within which images and text are placed. The boxes contain, as it were, the images of a radiolarian skeleton from Thompson’s text, a gestural drawing, a scattering of overlapping black drop-like forms, a tetrahedral drawing of a three-dimensional reticular structure, and a black ground through which the title of the exhibition Growth and Form is shown as the negative cut-out of the paper below.

Figure 78 Cover of the exhibition catalogue for Growth and Form at the Institute of Contemporary Art, London, July 1951.

In the few photographs that remain of the exhibit, one can see the layering of image, screens, and display case breaking the cartesian geometry of the normative gallery space as a design concept. The choice ruptures the one-to-one scalar relationships as the X-ray which reveals the coordinated bones of the hand at the huge scale of the back wall of the gallery is framed through the bone-like reticular screen as you enter the gallery space. The dimensional focus of the exhibit, which is in dialogue with
the enormous photographic prints, is a gridded display case of extremely thin, white elements that relate to the catalogue cover. The structure is not closed at the top or bottom by horizontal connecting members: rather each of the final cubic volumes is open with the structure sitting on the floor on 20 points and complemented by the 20 reaching toward the ceiling. This cubic structure is composed of 4 squares across, by 3 squares deep, by 4 squares high. Because the top and bottom layers are open, there is a horizontal emphasis of the display at eye level. Solid white or black panels on some of which images are printed enclose some of the cubes. The structure also serves as a display for plaster models of spicules, the microscopic elements that are part of the constituent skeleton of the microscopic calcareous sponges or of the *Prismatium tripodium* that Thompson illustrates, citing Haeckel’s work. Most of these models are displayed within the volume of one cube, but notably one of the spicules is suspended in space in the center of 3 vertically stacked cubes, lending an extraordinarily dynamic aspect to what would have been a normative and static display.

The exhibit was associated with the Independent Group which met at the Institute of Contemporary Art in London from 1952-55. The symposium “Aspects of Form” was organized in connection with the exhibition. Isabelle Moffat has provided an interesting point of view regarding this exhibit being emblematic of a postwar climate of “an overall aspiration ‘to be scientific’…of the faith in an objective truth, in a verifiable fact that guides Hamilton in his penchant for photographic reproduction, especially microscopic photography and diagrammatic depictions.” As is echoed in

other places in her dissertation, Moffat also described the interest in the this exhibit as a conflation of the “postwar progressivist, scientistic spirit, and the overwhelming domination of the popular imagination by the mirage of a social utopia…. ” Her analysis highlights that the exhibit *Growth and Form* placed a primacy on the visual image and a faith in “creating environments to control the spectator’s perceptions.”162 The expanded implication of Thompson’s *Growth and Form* was explored in the *Aspects of Form* symposium.

**Aspects of Form, a Symposium on Form in Nature and Art, 1951**

The “increasing significance” of *form* or *pattern* in diverse scientific fields “has suggested the possibility of a certain parallelism, if not identity, in the structures of natural phenomena and of authentic works of art,” Herbert Read states in his Preface to the publication of the proceedings of the *Aspects of Form* symposium. Art has a formal structure of a “rhythmical, even of a precisely geometrical kind,” he continues, and suggests that these “structures or proportions” such as the Golden section have been recognized in natural forms. Rather than imitate nature it is perception itself, and the ability to recognize pattern, that is of contemporary interest. This “pattern-selecting” and “pattern-making” function is essentially Gestalt formation, Read summarizes.163 This is then recognized in diverse structures both physical and intellectual such as the nervous system, gestalt psychology, biochemistry, and artistic form.

In the 1961 reprint of the original 1951 book *Aspects of Form*, editor Lancelot Law Whyte noted the “significant evidence of the increased interest in wide circles in physical, organic, mental, and aesthetic forms and their relationships,” which he believes that the symposium had helped foster.

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He reprinted the original essays without modification. In his original Introduction, Whyte also posed the central question:

Form is very important and yet tantalisingly subtle. Exact science seems to know much, and yet it has so far only got to grips with the simplest forms such as crystals and bubbles. Complex forms still baffle it. All the powers of science do not let us see into the growing point of a plant, or the dominant centres of an embryo, or the grey matter of the brain, and understand exactly what is going on there when new forms develop. Our eyes look out on a complex world, but the brain unconsciously selects what interests us and makes it seem simple. Yet we do not know how the brain does this, and science has not yet discovered its own method of making complex forms appear simple.

The eleven essays approach form in very different ways as specialists from different fields explore the issue of form. Form may be thought of a spatial form, visible or not visible, internal or external, as well temporally framed, in that it is a transformation; form can and does change over time. Whyte goes on:

Common to the ideas of form, configuration, pattern, and structure, is the notion of an ordered complexity, a multiplicity which is governed by some unifying principle. Our themes is thus the realisation of unity of spatial form in the complex processes of physics, biology, psychology, and art. But “form” includes development and transformation. Indeed we can regard “matter” as that which persists, and “form” as that which changes, for no form is eternal. And form, like change itself, is in many fields still obscure.

Whyte summarized in the Introduction what he expanded later in the book in a “Chronological Survey on Form,” grounding the discussion of form as a primary concern of intellectual thought. He points to what has been a dialectical opposition between form as a unity of parts and atomism. He

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164 Should a similar study be conducted at the present moment new areas of scientific development such as evolutionary aspects of organic form and mathematical methods of analyzing organic form would be important to include in the discussion.


166 Whyte, “Introduction,” 2.
looks to combine these in something outside of the “mechanism-vitalism quarrel.” He saw this antithesis as now being overcome, “that is if science is to advance it must discover how the ordering of parts gives form to the whole, in organisms for example.”

The symposium was convened to bring scientists, psychologists, and artist historians, though not the artists themselves, together to study the issue of form, but he cautioned:

There are dangers in the collaboration of scientist and artist, for superficial analogies between science and art are harmful to both. Yet the scientist’s study of spatial forms and the artist’s creation of them are both human activities, and we can find a common root if we look deep enough. The scientist’s curiosity about natural forms ultimately leads him to consider how the mind selects and modifies forms in the processes of perception, and so to an examination of the sources of the aesthetic sense. And the artist who pauses to try to understand his own activities cannot remain content to regard them as “purely aesthetic”….The divergence of the two attitudes can only be validly overcome in one way: by a broadened understanding of the importance of form in all realms, not only in the external world but also in the unconscious root of all human activities. Indeed we may discover that there is nothing wholly formless in nature, that if there were it could never be known to man, and that every particular form has its own special significance within the universal order of which man is part.

The symposium included the far-ranging studies by a crystallographer, contributions by specialists in plant physiology, human anatomy and embryology, zoology, comparative psychology, astronomers, and art historians, all with the question of form in mind. Form creation is studied in the physical

\[167\] Ibid., 2-3. “Ever since Democritus sought understanding in atoms, and Plato and Aristotle in forms, there has been a vigorous competition between two sets of ideas: atomism—material analysis—quantitative precision, and form—unity—symmetry. These may really be complementary rather than antagonistic, but it is a remarkable fact that throughout this debate, that is during eighty human generations, no one has suggested how to combine them into one simple and comprehensive way of thinking: hence much of the disorder in thought. The influence of every great thinker and scientist has fallen on one side or the other: Democritus being followed by Newton, Rutherford, and all the atomists, and Aristotle by Aquinas, Goethe, and the morphologists in biology and other sciences.”

\[168\] Ibid., 3-4.
principles that govern inorganic growth such as in crystals and biochemical aspects of growth. How does an organism perceive these changes? How patterns are formed, recognized, and interpreted is the open-ended question posed by the symposium and reflected upon by the various contributions.

The papers may be divided into two areas of interest, that of form creation and form recognition. Konrad Z. Lorenz’s contribution “The Role of Gestalt Perception in Animal and Human Behaviour” and Rudolf Arnheim’s “Gestalt Psychology and Artistic Form” presented complementary roles of perception. Lorenz explores the scientific explanation of perception and the role of the gestalt as “the visual perception of single completed configurations, where the whole appears to dominate the parts.” Arnheim “shows how the aesthetic significance of a particular form depends not only on its actual shape and structure, but also on the formative processes of perception, the personal needs and tensions of the perceiver, and on his social and historical context.”

The interest in the Gestalt highlights not only the creation of form as a patterning of individual elements that form a whole, but the role of the observer as an active participant in making sense out of the relationships between disparate elements to understand them as a whole, a form.

C.H.Waddington investigated the preponderance of spirals in the study of nebulae and galaxies discussed by C.C.L. Gregory from the University of London Observatory, explored “The Character of Biological Form.” Waddinton posited the possibility of “completeness” in organic form defined by “no ragged edges, nothing obviously lacking or merely and irrelevantly added...it is ‘individuated’.” He continued:

The quality which we recognise as organic wholeness—individuation—is the symptom and expression of an underlying order; an internal order which endows the organ with such unity.

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as it possesses and an external order which relates it to the rest of the organism. Crystals, among inorganic forms, are also pre-eminent in the possession of an internal order. But they are distinguished from organic forms in that they are ordered according to a single or very few relations. Each unit is composed of atoms arranged in a definite and specific way according to their mutual attractions and repulsions, and the units, grouped in some simple relation of symmetry are repeated indefinitely to build up the crystal, which is, as it were, the solution of a single equation. Organic forms must be compared to solutions of a much more complicated system of simultaneous equations. The forces which hold the elementary parts in a certain orderly relation to each other are not derived from the affinities of just a few kinds of units, but arise from the interactions of very numerous active entities. Only in the simplest unicellular organisms do we commonly find some approximation of organic form to the simplicity of crystals, systems of bubbles, or other relatively pure mechanical arrangements. Most organic forms are built up from very many cells, each of which contains and is controlled by a whole host, several hundreds at least, or hereditary factors.

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Ibid., 45. Waddington and Whyte are among others who were included in Gyorgy Kepes’s “Vision+Value Series” published in the 1965-66 in connection with Kepes’s research at the Massachusetts Institute of Technology. The titles are: The Education of Vision; Structure in Art and Science; The Nature and Art of Motion; Module, Symmetry, Proportion, Rhythm; Sign, Image, Symbol; and The Man-Made Object. Kepes’s interest beginning in the 1950s on “structure in science and art,” echoes the interdisciplinary nature of the Aspects of Form symposium and for that matter the Macy seminars on cybernetics (discussed in Chapter 4). Kepes, an abstract painter was also in a parallel manner (and similar to Henderson and the other members of the Independent Group, interested in the expanding world of visual imagery made possible through scientific advances. In 1956 he published The New Landscape in Art and Science, investigating worlds of image and order made possible through new modes of expanding human vision such as high-powered telescope or electron microscope and non-optical ‘imagery’ such as that provided through sonar, infrared, etc. Characteristic of these kinds of images is a scalar shift between micro- and macro- and the impact of juxtaposition of these wildly different scales, a mode of working that was not unique to Kepes. The use of scientific imagery also emphasized what has already been discusses in the influence of D’Arcy Thompson’s work, that ideas of pattern, rhythm, and gestalt, of reading of form, structure, and pattern are very important. While important, even crucial to a discussion of the intersection of science and art in the 1950s and 1960s, I do not emphasize Kepes’s work even though many of the artists, scientists, engineers, and critics were involved in the Aspects of Form series. I do this as I try to follow the line of reasoning through the influence of D’Arcy Thompson in this chapter and to try to always keep the conversation relating to Italy. I am not aware of Kepes’s books being widely distributed in Italy. I will discuss Kepes’s work briefly in the next chapter as he had a solo exhibit in Milan in 1958 at the invitation of Olivetti, and an exhibit with the text by Gillo Dorfles in 1975 for example, so there are in fact overlaps. I would like to write more thoroughly about the “Vision+Value Series,” but this has already been investigated by Reinhold Martin, who in addition to giving an overview of the content
Waddington quoted Alfred North Whitehead as an example of the complexity of forces that are at play, even in a relationship such as pattern and rhythm, to highlight a structural process at work:

A rhythm involves a pattern, and to that extent is always self-identical. But no rhythm can be a mere pattern; for the rhythmic quality depends equally upon the differences involved in each exhibition of the pattern. The essence of rhythm is the fusion of sameness and novelty; so that the whole never loses the essential unity of the pattern, while the parts exhibit the contrast arising from the novelty of their detail. A mere recurrence kills rhythm as surely as does a mere confusion of detail. 172

Waddington then referred to D’Arcy Thompson’s well-known comparison of the truss structure visible in a magnified view of a vulture’s wing. 173 Waddington cited examples of human-made products that utilize repetition to produce a pattern, but laments the fact that the variation produced is a result of error. These examples lead back to Whitehead’s critique that “a mere confusion of detail,” or the production of sufficient variations, accumulate so that the structure begins to resemble the variation in a natural organism, with each “variation...resolved and brought into harmony with the whole.” 174 Waddington returned to state the lesson to be learned from organic form, that form is the result of material and the balance of the various internal and external forces, balanced in a “near-equilibrium” with variations produced by internal laws of growth guided by genetic and heredity factors and in response to environmental forces. Producing human-made form that exhibits complexity similar to organic form necessitates introducing rhythm, to pattern, a
fluidity which counters monotonously repetition. Waddinton attempts to summarize a set of principles about pattern and rhythm, in both “nature” and “man”:

Man, it seems, when he begins to create, is usually more single-purposed than living Nature. The inner logic of his constructions is simpler; or he is concerned more with an externally imposed logic, of representation or symbolism. There is, in a human work of sculpture, no actual multitude of internal growth-forces which are balanced so as to issue in a near-equilibrium of a rhythmic character. We should therefore not expect that works of art will often arrive at the same type of form as we commonly find in the structures of living matter.\textsuperscript{175}

He concludes this paragraph, and his essay with:

Much more can we anticipate an influence of man’s intellectualising, pattern-making habit of simplification, diluted perhaps by an intrusion of unresolved detail. Only the extremely simple, or the extremely sophisticated, are likely to stray into the realm of form which is the proper outcome of the blind but complex forces of life.\textsuperscript{176}

Waddington’s efforts to derive a set of principles regarding rhythm, pattern, and internal and external complex forces that produce form reiterates the importance that \textit{On Growth and Form} held as inspiration for artists and architects. Thompson’s opus also opened up new and deeper considerations of methods. Inspired by these concepts but also becoming more discipline-specific, Waddington made a case for the “common language of mathematics,” as D’Arcy Thompson stated in his Prefatory Note to \textit{On Growth and Form}:

\begin{quote}
It is not the biologist with an inkling of mathematics, but the skilled and learned mathematician who must ultimately deal with such problems as are sketched and adumbrated here.\textsuperscript{177}
\end{quote}

\textsuperscript{175} Ibid., 51-52.
\textsuperscript{176} Ibid., 52.
It is just this mixture of the search to define *form* and *structure* joined with mathematical analysis that guided Luigi Moretti in his theory and practice of parametric architecture.
Chapter 3: Organic Architecture in Italy: two historical paradigms

Chapter One began with a section entitled “Macrostructure as Organism in the work of Rinaldo Semino,” in order to interrupt the trope of “organicism” and make space for an alternate understanding of “organic architecture” in postwar Italy. This assertion is meant to challenge the traditional historical narrative that limits organicism in postwar Italian architecture to a set of architects and concerns that served as foils to Fascism and support for a new democratic Italy. In the immediate postwar years, Bruno Zevi’s book, Verso un’architettura organica (1945), and the ensuing discussion through the Association of Organic Architects (APAO) and the magazine Metron, were seminal in providing a “democratic” model for organic architecture; one that took its inspiration from Zevi’s experience in the U.S. during the war, and was a response to modernist architecture that had been, in Zevi’s opinion, corrupted in Italy by its adoption in the architecture of Fascism.

Not associated with organic architecture, Luigi Moretti, an architect who worked under the fascist regime, held to his conviction that modern architecture was removed from the political agenda and had its deeper value in regard to space and representation of natural principles. Moretti invented a system of Parametric Architecture in the late 1950s in which an understanding of mathematical and scientific methods was developed in order to produce a truly genuine architecture. He and Zevi had differing opinions, but in Moretti’s work one sees an integration of scientific principles that long evaded Zevi and which might have allowed him to evolve a more precise definition of organic architecture. Moretti derived principles from the observation about natural phenomena and found a common language in linguistics, mathematics, and parametric analysis, and applied this method to the generation of architectural and urban form. This will be important for the move toward a system.

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178 This connects the idea of the serial and rules as an “organic” method.

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understanding of form as a system of constituent parts. Leaving Moretti at the end of this chapter we can identify a methodology that is partly inspired by the mathematical analysis of natural form as seen in D’Arcy Thompson’s *On Growth and Form*.

**What is meant by organic architecture in Italy and the writings of Bruno Zevi?**

In order to fully appreciate this discussion, I will discuss the term *organic architecture* and the prevailing interpretation of this term in postwar Italy. Examples of organic architecture from the 1960s illustrate the shift in the meaning of the term *organic*: a semantic change that is evident in Semino’s work. In fact, a critical elision in the English translation of Bruno Zevi’s *Verso un’architettura organica* illustrates the way in which the term *organic* came to be misunderstood in architecture. The missing (or mistranslated) text is crucial in that it points to the salient characteristics of Zevi’s definition of organic architecture. Furthermore, it opens up the potential for alternate formal strategies of the organic that were not taken on by the followers of the movement founded in Rome, L’Associazione per l’Architettura Organica (or the A.P.A.O.). I will first discuss Zevi’s background and some of the events that occurred during the period of 1939-45. I will outline some of the problematics surrounding Zevi’s book and the ambiguity of the term “organic architecture” in the time that the book was written. I will also look at how, partly due to Zevi’s use of Frank Lloyd Wright and Alvar Aalto as examples of organic architecture, an “organic style” became accepted or contested, which was counter to his initial intentions for the book.
After this initial discussion, I will return to examine the missing part of the text of *Verso un’architettura organica*, which describes a way that prefabricated architecture can in fact be organic, as a building made of component pieces that can be added to and changed over the building’s lifespan, something which Zevi does discusses as having organic qualities. In this way, it is the performance, not the actual materials and layout that signal organic architecture. This is the key point and the basis for what I propose as an alternate organicism.

As mentioned, Bruno Zevi, in his book of 1945 *Verso un’architettura organica*, was key in disseminating the idea of organic architecture in the postwar period in Italy. In this text, Zevi pointed to the difficulty in using the term organic when applied to architecture and how the term has been subject to much confusion:

> The architectural use of the word organic is, as we said, of old standing and has given rise to a great deal of confusion. But we do not pretend to give it an exact meaning; there is no
word—and certainly no adjective—of which the meaning is not to some extent approximate. There are, however, two fallacies against which the meaning is not to some extent approximate.

One of these is naturalistic. Through saying that we must keep our eyes on nature there is a danger of a mistaken belief that we ought to imitate nature.\(^\text{180}\)

In this statement, Zevi distances himself from relying on literal imitations of natural form as being a valid architectural use of the word organic. He continues to describe the problems of making direct comparisons between Frank Lloyd Wright’s design (which he sees in Walter Curt Behrendt’s book, *Modern Building* of 1938) and their similarity to natural forms:

> the various shapes of the windows and their relations to each other remind one of the disposition of leaves; and the relation between the body of the house and its various details suggests the trunk of a tree—“as the bulk rises higher from the ground it becomes looser and lighter, while the detail becomes more elaborate and more tenuous.”\(^\text{181}\)

Zevi then continues to what he considers a “much more serious matter” in the misunderstanding of the term organic as used metaphorically to describe architecture. In this sense he is very much against the *analogic* use of the term in that an analogy implies a direct similarity between two very different entities.\(^\text{182}\) He attributes this misunderstanding to the use of the direct comparison between the human body and architecture and the inherent difference between analogies and metaphors:


\(^{\text{182}}\) “Analogy.” Etymology: probably from Greek *analogia* mathematical proportion, correspondence, from *analogos* proportionate + *-ia* -ia. 1 a : mathematical proportion or ratios (as in a statement of the
From the time when Vasari declared that if architecture was to convey essential spiritual values it must seem as organic as a human body or when Michelangelo said that no one would ever be able to understand architecture without a profound knowledge of human anatomy down to Geoffrey Scott and Arnold Whittick, a long series of critics, especially Germans and Englishmen, have constructed an aesthetic system out of biological metaphors. In these metaphors, they speak of a tower raising itself, of a column contracting, of one façade being full of movement and of another being calm and extended, of the curves of a volute being bold or weak, tense or lax, powerful, flowing, and so forth.\footnote{Zevi, Towards an Organic Architecture, 73-74.}

This he then, borrowing Geoffrey Scott’s term the “biological fallacy” (elaborated in his The Architecture of Humanism of 1914) extends this to discredit the visual and formal analogies that were prevalent in in describing architecture that related to the organic, or the biological. Zevi laments the “biological or anthropomorphic fallacy [which] is at the root of expressionism,” which, he states, “gave rise to the conviction that houses should represent sentiments, states of mind or the actual content of the building; it was in fact a phenomenon of decadence.”\footnote{Ibid., 75.} But Zevi is not precise in his

\begin{itemize}
  \item \textbf{form} $a \times b = c \times d$ where the values of $a$, $b$, and $c$ are given, so that $d$ may be calculated
  \item \textbf{proposition} or a statement that embodies such an analogy
  \item \textbf{2 a} : similarity of ratios or of properties
  \item \textbf{b} : inference that if two or more things agree with one another in one or more respects they will prob. agree in yet other respects
  \item \textbf{analogies} by attribution, and analogies by metaphor
  \item \textbf{3} : resemblance in some particulars between things otherwise unlike
  \item \textbf{similarity}, correspondence, parallelism
  \item \textbf{analogies} by metaphor
  \item \textbf{4 a} : analogue
  \item \textbf{b} : a figure of speech embodying an extended or elaborate comparison between two things or situations
  \item \textbf{similitude}
  \item \textbf{5} : correspondence between the members of pairs or sets of linguistic forms that is taken as a basis for the creation of another form (as reindeers, plural of reindeer, created on the basis of such pairs as bear, bears or dog, dogs; cows, plural of cow, replacing earlier kine and kye, on the basis of such pairs as bough, boughs; glided, past tense of glide, replacing earlier glode and glid, on the basis of such pairs as guide, guided; a deck of cigarettes, standing in the same synonymous relationship to a pack of cigarettes as a deck of cards does to a pack of cards)
  \item \textbf{6} [French \textit{analogie}, from Greek \textit{analogia}]: correspondence in function between organs or parts of different structure and origin -- distinguished from homology “analogy.”
\end{itemize}
use of terms. He accepts analogy as an equivalent term for metaphor, but there is a distinct difference. Accepting this imprecision for the moment, Zevi then acknowledges the recent interest in organic architecture, that it is the goal of many architects who create projects of organic architecture that would have “a feeling of movement and dynamic quality,” but he then clarifies what he means. He does not believe that organic architecture is like art nouveau architecture and design which would include walls embellished in:

neurotic linear patterns which evoke recollections of movement, nor through the composition being such as to necessitate ocular movement before it is intelligible (as we saw in the case of the Bauhaus). The reason is that the spatial arrangement corresponds fundamentally to the actual movements of the man who inhabits it; organic architecture is not abstractly utilitarian but, in the integral sense of the work, functional....The organic architect concentrates upon the structure, and he [sic] regards it not merely from a technical point of view but as the complex of all human activities and feelings of the people who use it.\textsuperscript{185}

Zevi uses the term “organic” to indicate a much larger and more complex set of psychological, sociological, and political implications of architecture; he is focused on the way architecture engenders a response or a change of action within a person. He then brings the focus back to the particulars of architectural form and how the larger order of the city is organically linked to the individual home:

\begin{quote}
Architecture is organic when the spatial arrangement of room, house and city is planned for human happiness, material, psychological and spiritual. The organic is based therefore on a social idea and not on a figurative idea. We can only call architecture organic when it aims at being human before it is humanist.\textsuperscript{186}
\end{quote}

\textsuperscript{185} Ibid., 75-76.
\textsuperscript{186} Ibid., 75-76.
But Zevi is really no clearer in establishing a blueprint, a modus operandi, or interpretive lens to actually say what is in fact “organic architecture.” It is in this duality, of both waxing poetic about the democratic and social nature of organic architecture and including a profuse number of examples which favor the showcasing of Frank Lloyd Wright’s architecture, that Zevi’s work is flawed, precisely because it conflates the principles of forming architectural spaces with the psychological principles that govern the experiences of architectural spaces. Zevi’s use of the experience of architecture as a basis for his definition of “organic” relocates the functional definition from the practice of architecture to the human experience of architecture. Seen as an ode to Wright as a physical example of what is in fact organic architecture, Zevi is reduced to making his point by illustrations. This method is doomed to be equivocal because it relies upon the person(s) experiencing architecture to support its “organic” quality. The term organic does glide from the aesthetic to the psychological or sociological or political, depending on how it is experienced. Yet it is an appropriate moment to reevaluate his book precisely because of the contemporary currency of the term organic architecture, or biomorphic architecture in connection with architecture generated using experimental digital techniques. Moreover, it is precisely because of the ambiguity of the term organic architecture that we find in Zevi’s text that “troubles” the imprecise use of the term and invites us as readers to further question what in fact organic architecture signifies.

While I agree with Zevi on his articulation of what organic architecture is not, he is difficult to follow as a guide because of his propensity, as critic, to advocate for particular architects, and particular works as embodying the metaphorical attributes of organic architecture.\footnote{This is in deep contrast with what he was to advocate for in his action as chair of the A.P.A.O. and ultimately his work in INU in which a much more nuanced view of the organic as political and urbanistically embodied idea about democracy which rather than emphasize the individual, stressed the interrelatedness of the individual in collective life and political organizations.} But essentially it is in his analogic equation of particular works of architecture as similar to the organic proposition that his...
definition loses its strength and clarity. Zevi is perhaps clearest when he speaks of the organic metaphor, which is not really to be proved through example of a finite work of architecture, but is rather a process, a way of working, an approach towards the intent of the work. It is of this point of “intent” that Zevi’s working definition abandons the consideration of the constituents of organic process to focus on the effects of his architecture. Intents may include provisions of shelter, comfort, or culture, all of which may be aspects of human nature, i.e. “organic,” but not the architectural process that meets that intent. Zevi’s focus on “a process” and “metaphor” coincides with my definition of the organic in that it is in its nature made from a bottom-up organization of parts, of an emergent organization that is determined from the interaction of the constituent elements of architecture, their disposition and reaction to the environmental milieu, and the social aspects of the negotiation of the design, the making, and the inhabitation of architecture itself.

In a crucial part of the text that was eliminated in the English translation, which I will describe shortly, Zevi stated that perhaps it is in the flexibility of the parts of a modular or prefabricated construction that the intersection of the social and political aspects of architectural form are disclosed. Although Zevi is still focused on the experience of architecture, he is also making an interesting point: a prefabricated house is not architecture with a capital “A;” rather, it is a mundane structure, built of necessity. Zevi sees the aspirations to elevate a user’s experience beyond the merely functional. The metaphorical idea that Zevi outlines focuses on “function” and that the fact of individuals being able to enlarge and reduce their houses as needed is part of the “organic” process of experiences. It is a social and political analysis of use. Zevi, perhaps unknown to himself, is speaking presciently about a way that the term organic will be used in architecture in the 1960s: as an open system that is more representative of individuals’ choice about how to live personally, and how to negotiate larger areas of inhabitation. Zevi is writing at a time when Italy was in the throes of
transitioning from a Fascist state to a new democracy. He was a missionary for the message that the architecture of American democracy was an approach that expressed freedom of choices.  

**Background to the writing of Verso un’architettura organica**

Written in London in 1944 after a period of refuge in the United States from 1940 to 1943, Verso un’architettura organica was published in 1945. With this seminal work, Zevi brought to Italy the notion of an architecture of democracy articulated by American architect Frank Lloyd Wright. However, Wright’s work had already been published in Italy by Edoardo Persico in the early 1930s, and Zevi certainly went to the United States with his admiration of Wright firmly in place.

Forced to leave his architectural studies in Rome due to the enforcement of anti-Semitic laws in Italy in 1938, Bruno Zevi had a brief sojourn at the Architectural Association in London. As deeply involved in anti-Fascist organizations in London as he had been in Italy, Zevi became dissatisfied with the low level of commitment and activity in the London group and left for Paris to discuss his options with the leaders of the group Giustizia e Libertà. It was decided that Zevi would try to obtain a student visa to study in the United States and there publish an anti-Fascist magazine that would be smuggled into Italy via France. Zevi was in contact with Lionello Venturi, and though him

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188 Frank Lloyd Wright, *An Organic Architecture: the Architecture of Democracy; The Sir George Watson Lectures of the Sulgrave Manor Board for 1939* (Cambridge: MIT Press, 1970), 3. It is a freedom of choice that Zevi sees in Frank Lloyd Wright’s democratic ideal that architecture is a natural expression of the people—left to their own devices. This idea only partially captures Wright’s idea of the connection as in his assessment that “Modern architecture is organic architecture, is a natural architecture—the architecture of nature, for Nature.” Wright also discusses the fact that form is organic, especially when viewed in light of the “natural” expression of indigenous architecture. Wright equates “indigenous” architecture to the “organic” and thus is “modern” and expression of the what he believes to be “true” and equates this kind of expression to “poetry.” (page 7)


190 Persico was editor of the magazine *Casabella* with Giuseppe Pagano from 1931 until his untimely death in 1936.
was introduced to Venturi’s son Franco and became involved with the antifascist publication

*Quaderni di Giustizia e Libertà.*

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191 Andrea Oppenheimer Dean, *Bruno Zevi on Modern Architecture* (New York: Rizzoli, 1983), 22–23. and Roberto Dulio, *Introduzione a Bruno Zevi* (Roma-Bari: Edizione Laterza & Figli, 2008), 13-14. Dean and Dulio present different accounts of Zevi’s early period in the United States: Dean claims that Zevi saw Lionello Venturi his first evening in New York, while Dulio does not detail the meeting, only that Zevi did not know Venturi personally prior to arriving in New York. Dulio states that before attending Harvard, Zevi studied at Columbia University for a “brief and unsatisfactory period,” before being accepted to the GSD, something that Dean doesn’t say. There may be discrepancies between the two accounts for a number of reasons. Andrea Oppenheimer Dean, in her “Introduction” discusses her material, that was written in the winter of 1979-80 when “I was privileged to spend long hours in conversation with Zevi over a period of five months discussing his major writings and ideas on modern architecture.” She is most concerned with Zevi’s “principle contributions to the criticism of modern architecture,” and “often the material is presented in Zevi’s own words in order to permit the reader to arrive at his or her own conclusions. This text is therefore a presentation, not a critical evaluation of his thinking.” (p. 16). This is not entirely true, as she does interpret his writings in numerous places in the book. Dean’s work depends heavily upon Zevi’s published works in books and magazines as well as upon other contemporary texts. Her own text ends on page 94, and the bulk of the book are reprints of important essays and speeches of Zevi’s. On the other hand, Roberto Dulio’s more recent book is the outcome of his doctoral dissertation *Bruno Zevi. Le radici di un progetto storico 1933-1950* at the Politecnico di Torino. It is a comprehensive small text which Dulio produced as part of his work directly in Zevi’s library/archive after his death in 2000. A copy of his dissertation is still in the Archive and had been instrumental in organizing the archive of original documents, magazines, and books, undertaken after Zevi’s death. Dulio works deftly with archival materials, deducing connections based upon Zevi’s calendar agenda, correspondence, and a close reading of the existing literature. What is perhaps lacking in this otherwise accomplished small book is a point of view that is larger than a deep scientific biography of an important figure in Italian modernism. In all though Dulio depend heavily on Zevi’s autobiography *Zevi su Bruno Zevi: Coll. “Uomini-oggi”* (Milano: Magma, 1977) and *Zevi su Zevi: architettura come profezia* (Venezia: Marsilio, 1993). So much of Zevi’s own work suffers from this: he was a significant thinker and was astute from very early on in his career in making his voice known, perhaps too much so. Whether in the United States at Harvard, or working with the United States Information Agency or his time in the U.S. Service, as a crucial player in the development of the *Manuale dell’Architetto* (discussed later in Chapter Four) or the continued access to presenting his ideas through the vehicles of *Metron*, his column in the weekly magazine *L’Espresso*, his monthly journal *L’Architettura. Cronache e storia*, his many books, *The Modern Language of Architecture*, the book series, “Cronache di Architettura” and to a book series with Testo & Immagine until his death (in which my book *Nuove bidimensionalità*, the Italian translation of *New Flatness*, was one of the last books published before Zevi’s death), one is always aware of Zevi’s point of view. In addition to his prolific publication record, Zevi was deeply involved in the founding and development of the Association for Organic Architecture in the immediate postwar years and later in the 1950s with urban issues and the national agency Istituto Nazionale Urbanistica and was founder of the national architectural association In/Arch. I focus in this chapter on a close reading of Zevi’s discussion on organic architecture rather than a broader biography. In a future and expanded version of this
Granted admission by Walter Gropius to the Harvard Graduate School of Design (GSD), Zevi published the *Quaderni* while studying in the 1940–41 academic year.\textsuperscript{192} While at Harvard, Zevi objected to Gropius’s pedagogy of architectural education in that it gave preferential treatment to group work and collaboration and diminished the role of the individual designer and contributed to a lack of support in nurturing individual creativity. As a result he critiqued the pedagogy of the GSD as a whole, and Gropius in particular, in a letter addressed to Dean Hudnut, and published as a pamphlet, *An Opinion on Architecture*, that was written by Zevi and signed by nine other students and distributed at the GSD.\textsuperscript{193} This text shows that Zevi disagreed with the tenets held by the Bauhaus and, by extension, the curriculum at Harvard under the influence of Gropius. In the simplest of terms, Zevi could not accept that modern architecture had been reduced to stylistic issues at the cost of what was for him the purpose of architecture: a free society in which social justice and equality were paramount.\textsuperscript{194}

Central to the questions for Zevi was how modern architecture and architects responding to the current situation. How would architects respond to social problems, fight Fascism, and have a vision and plan for architecture as an expression of a new society? Their critique of the school was that it was out of touch with life outside the school, Zevi calling attention to the fact that of a total of 120 weeks of training during their matriculation, “only seven weeks are devoted to housing, the main architectural problem of our time,” and that the inner organization of the school did not reflect the “social organization of contemporary society; our life in the school is not fundamentally different

\textsuperscript{194} Ibid., 23.
from that of any Beaux-Arts school.” The call is for both collective work, “united by a common principles and a common fight,” but also, and perhaps contradictorily for the recognition of individual genius “as a philosophical necessity.”

Outside and above collaborative work and group movements, there has been in the past, and there will be in the future the man of self-sufficiency in analytical and comprehensive work: the man of synthesis and creation. We call for collaboration but a Leonardo could work alone.

Just prior to these proclamations, the author(s) describe the current state of the prominent international architects of the time in Present Picture: the pioneers today. From dismissing “Le Corbusier, who has not completed work within the past five years (“during the architectural reaction in France, he preferred to renounce work rather than compromise”) to the Architects of Sweden, who “continue to maintain their high standard of work, which is closely integrated with the social conditions of their country.” Zevi moves on to dismissing Mies van der Rohe, mainly supportive of Gropius and interested in Erich Mendelsohn and Alvar Aalto. Notably Zevi is already expressing an early interest in Frank Lloyd Wright:

this obscure genius has a deep interest in social problems, but, in their solution he is overshadowed by his own personality. We regard him, as he probably will be regarded by history, as a genius able to free himself from the conventions of the outside world, but never able to free himself from himself.

Yet for Zevi, Wright was at least focusing his attention correctly:

there is a domination of his personality in his solution of social problems. In so doing, we advocated the principle of collective work as the only one which can solve the architectural problem, but, of course, we do not mean to deny the value of personality. Collaboration and

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196 Ibid., 104-105.
197 Ibid., 103.
collective work does not mean anonymity, but a meeting of personalities in mutual understanding. It means: no more individual separation in momentary preferences, but, on the contrary, liberation from those preferences through a consciousness of an arising civilization.

Central to Zevi’s understanding of Wright is the belief that the individual’s expression was at the center of democracy and design, a vision of democracy that is naturally organic.\(^{198}\) Ironically, the term “organic architecture” went through a change at this split, when there was a preference for “organic” processes, in no small measure inspired by the work of Team 10 and seen in the interest in Japanese metabolism, which was published regularly in Italian architectural magazines.

Despite Zevi’s fight with Gropius, he graduated Harvard in 1942.\(^{199}\) In the years after his graduation, Zevi worked as an architect in the planning office of the U.S. Army, and despite a pressing desire to return to Italy, Italy had not as yet been liberated by the Allies, so Zevi could not safely return. Zevi transferred to work in London in connection with his appointment with the United States Army. In London, Zevi, consulting books at the library of the Royal Institute of British Architects (RIBA), began work on Verso un’architettura organica. In doing so, he consciously invoked Le Corbusier’s Vers une architecture, adding the adjective that would describe his contribution and rewriting of recent architectural history, the word, “organico.”\(^{200}\)

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\(^{198}\) This will remain a constant issue for Zevi’s conception of an organic work: the reconciliation of the individual with the group: something that will emerge by the end of the 1950s as a problem. By the 1960s, in grappling with an extraordinary population growth coupled with an increased industrial base in Italy, architects and urbanists moved decidedly away from both unplanned development and the idea of a central genius in preference to collaborative work.


\(^{200}\) Dean, Bruno Zevi, 24-28; Dulio Bruno Zevi, 18-22.
To underscore his effort to redefine this term, Zevi referred to the words and work of Frank Lloyd Wright, emblematic to Zevi of the merging of form and politics for a democratic society, notwithstanding the apparent contradictions between collaborative work as a foundation of democratic society potentially being at odds with the personality of the individual genius.\textsuperscript{201}

\textit{Space, Time and Architecture} as a starting point and the case of Frank Lloyd Wright

\textit{An Organic Architecture, the Architecture of Democracy} is the transcription of a series of lectures delivered by Frank Lloyd Wright over four evenings in London at the invitation of the Sulgrave Manor Board in May 1939.\textsuperscript{202} It is not clear if Zevi followed the lectures directly or consulted the publication during his research there in 1944, but one can see the definite influence of Wright’s term “organic” providing both inspiration and problems of clarity to Zevi. Wright’s conception of what is “organic” architecture is nebulous indeed. Zevi is uncritical of Wright and inherits the problems, something that created both praise and criticism of his book. Wright’s impressionistic use of the term “organic” architecture became a constant source of questioning in the meetings of the “Associazione per Architettura Organica,” or the A.P.A.O. after the book’s publication in 1945.\textsuperscript{203}

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\textsuperscript{202} Frank Lloyd Wright, \textit{An Organic Architecture: the Architecture of Democracy; The Sir George Watson Lectures of the Sulgrave Manor Board for 1939} (Cambridge: MIT Press, 1970), 18. Wright states in his Foreward: “Speaking strictly these spontaneous talks were not intended to be ‘lectures’ on Architecture. Had I been commissioned to give them by the Royal Institute of British Architects instead of the Sulgrave Manor Board they might have been properly, so limited.” (vii) This is perhaps the nature of these talks, which the editors, delighted at the record number in the audience, capture in the revival meeting conjured up: “No one need seek to tot up ‘converts,’ for even in the face of the evangelistic character of the meetings, which survives well enough in the printed text, the temper of English modernism is too tough for sudden conversions.” (vi).
\textsuperscript{203} In \textit{Metron} 23/24 (1948): 37-51. In the general introduction on pages 37-38, some of the outline of the first national congress of the APAO (Dec. 6-8, 1947) is outlined. (Associazione per l’Architettura Organica). The plural nature of this organization is noted in its title “Il congresso delle APAO italiane,” which was the first meeting of the different regional groups of the APAO and “one could say, after the end of the Rationalist movement, for 20 or more years modern architects were without a common meeting ground, without a national organization,” (37, translation mine throughout this
In these lectures Wright referred to and sought to define “organic architecture,” its theory, application, and how it would lead to freedom, something that does not always seem to be of a democratic nature, though it is in his title. He used the Sulgraves talks to advocate for his new vision of a dispersed urbanism, dependent on the “motor car” that he believed was the new future of community, and community life, a concept very much questioned by audience members. Wright mostly brushed off the audience’s probing questions regarding the inconsistencies and lacunae of his thesis.

Wright declared that freedom is a critical feature of organic architecture and sought to define his broad-ranging notion of freedom:

The law of change is immutable law; the only law we have not taken into account. It is the only law we have not learned to consider and respect when we proceed to make FORM. We have tried to stem and hold in check the tides of life. Now, why go on with it? Why not see that if pattern is to be made at all it must be free pattern, the one most suited to growth, the

note). Representatives were present from all parts of Italy, the APAO from Rome (Quaroni), Sicily (represented by architects Caracciolo and Calandra), Campania (Cosenza), Tuscany (Gamberini), Genoa (Devoto), Bologna (Vaccaro), and Turin (Astengo), (8 groups in all), plus Giuseppe Samonà and students from the architecture school in Venice, Scarpa, the painter De Luigi. Of particular interest was the participation of the MSA, the Movimento Studi Architettura of Milan, represented by the architects Mucchi, Gentili and Peressutti. “With union between the eight APAO groups and the MSA of Milan, all of the front line of modern architects is organized to reinforce its battle,” that is, the enormous task of the reconstruction of Italy after the war. Quaroni began the proceedings of the first day, Piccinato the second, the third day, to which was open to the public) was dedicated to the internal organization of the 8 APAO groups and the MSA. In the second day, Samonà held a session “Actualities of our cultural responsibilities,” with Roberto Pane (University of Naples), G.C. Argan, Ragghianti, and G. Nicco Fasola (University of Florence). The paperwork from the Ministry of Public Works was presented by prof. Colonnetti, president of the CNR (Consiglio Nazionale delle Ricerche), and engineer Valle, head of urbanism at the Ministry of Works. The next portion printed is the address by Bruno Zevi, “L’Architettura organica di fronte ai suoi critici.” (39-51). See the interpretation by Maristella Casciato, “Gli esordi della rivista ‘Metron’: eventi e protagonisti,” Rassegna di Architettura e Urbanistica 117 (September-December 2005): 48. Here she describes the meeting by grouping the participants under their prevailing tendencies: the organic architects Zevi, Calcaprina, Fiorentino, Radiconcini; those conducting the rationalist battle, Libera Quaroni, Samonà and Vaccaro (also active in Rome), and the MSA represented by Pagano, the Turin faction. [Translation mine] Robert Dulio, Bruno Zevi, 24, 30-37 and Dean cover this general genealogy.
one most likely to encourage and concede growth to life? That means, I think, the end of the word “institution” as we have it set up.\textsuperscript{204}

This way of speaking seems to have been critical, and even hypnotic, for Zevi. His critique of the International style centered on its reduction of the social and political aspects of modern architecture to merely formal concerns.

Zevi had the same critique of Sigfried Giedion who, in his \textit{Space, Time and Architecture} of 1941 (a book that he consulted in the preparation of his manuscript for \textit{Verso un’architettura organica}), articulated a history of modern architecture which, for Zevi, minimized the social implications of modernism and advocated a stylistic interpretation of the modern movement.\textsuperscript{205} Giedion wrote about the works of Le Corbusier, especially the Villa Savoye, and Walter Gropius’s design for the Bauhaus as being examples of the pinnacle of modern architecture. There is little room in Giedion’s history for the “organic,” which he deemed to be too personal an expression to have a consistent impact on modern architecture. He wrote that the “notion of the organic is anchored so deeply in the irrational


\textsuperscript{205} Sigfried Giedion who, in his \textit{Space, Time and Architecture} of 1941. Sigfried Giedion, \textit{Space, Time and Architecture: the growth of a new tradition} (Cambridge: Harvard University Press, 1941) and (London: H. Milford, Oxford University Press, 1941). Explain the context of how important Giedion’s book was at the time, following up on Hitchcock (who also relegated Wright to the role of historic precedent for the modern movement and not adhering to the 3 keys to the the architecture of the International Style, both in the MoMA exhibit, and later 1932 book. This is something that he then rewrites in 1952, in the essay “20 years after…” in which he speaks of Aalto and especially of Wright, a revisionist history. Giedion’s book was extraordinarily popular and well read in Italy, on the desk of every architect and architectural student (including Semino).
unconscious that it is extremely difficult to define it at all precisely,” and believed that Antonio Gaudí was the “originator of the organic development of contemporary architecture.”

In his assessment of what defines the organic in Gaudí’s work, Giedion pointed to an intuitive use of material and an “adventurous sculptural imagination.” He ascribed a new intuitive and fluid sculptural sensibility in architectural form with the “greatest freedom of expression” as the salient characteristic of the organic in architecture. Giedion’s categorization of the organic as personal expression was not shared by Frank Lloyd Wright, who believed in a deeper social meaning in organic architecture. To Wright, the organic principle was another way to describe the “indigenous,” the true the unique and unscripted creation of an individual. Coupled with an idea about the demos, the individual that is part of the greater democratic society, Wright advocates for an architecture that expresses this natural or indigenous truth. Zevi’s difficulty in defining organic architecture is inherited from Wright’s vague focus on the indigenous and its expression.

Giedion’s characterization of Frank Lloyd Wright as an architect who produced organic, or intuitive architecture is consistent with Giedion’s definition of “organic.” Giedion sees that Wright’s projects

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206 Giedion, 876.
207 Ibid.
208 Manfredo Tafuri, in History of Italian Architecture 1944-1985 (Cambridge: MIT Press, 1989), 20-22. Originally published in Italy under the title Storia dell’architettura italiana, 1944-1985 (Torino: Giulio Einaudi, 1982). It is worth noting here that not even Tafuri was immune from trying to point to architectural projects that would exhibit organic properties, or rather poetics: “It is no coincidence that in this volume Zevi does not acknowledge neorealism to be the incarnation of ‘organic’ poetics, but identifies as examples of the forming tendenza only Samonà’s projects for the Ospedale Traumatologico of Rome, Claudio Dall’Olio’s restaurant in Sabaudia, and the building that he and S. Radiconcini designed for the Via Pisanelli in Rome. Neither Scarpa—who had not yet been ‘discovered’—nor Carlo Mollino were considered. Yet Mollino himself, with his sled-lift station, his hotel on the Lago Nero in the Val di Susa begun in 1946, and with his product designs, was proceeding toward an integration of skeletal structures and aerodynamic organisms. Thus he furnished, as he had already done in his center for the Società Ippica of Turin of 1935-39, an original and ironic version of organicism. In reality, a true organic tendency did not take root in Italy, in spite of Zevi’s passionate preaching.” (Tafuri, History of Italian Architecture, 21).

Chapter 3: Organic Architecture in Italy: two historical paradigms
related that which he had never successfully put into words."²⁰⁹ Louis Sullivan, Frank Lloyd Wright's mentor, in Giedion's assessment, comes close to a satisfactory verbal definition of the “organic” in his 1900 book, *Kindergarten Chats*, when he defined the organic as the “ten-fingered grasp of reality.”²¹⁰ In this sense, the organic is living, conveys a sense of life and is in the process of becoming “that development in which thinking and feeling approach coincidence.”²¹¹ Giedion sums up his understanding of Sullivan and the organic in the following paragraphs:

²⁰⁹ [Emphasis mine]. That in fact “organic” was already a commonly used term. It is just that Zevi introduced the term to Italy, as noted by Roberto Dulio, *Bruno Zevi*, 33-37 for the background influences on *Verso* and in particular page 39-40. “Anche l’uso dell’aggettivo ‘organico’ nella terminologia corrente dell’architettura viene introdotto in Italia da Zevi. Nell’Profezia all’architettura [of Edoardo Persico, *Casabella* 98 (Feb. 1936): 2-3.] Persico non lo utilizza e scorrendo gli articoli o gli accenni su Wright pubblicati in Italia prima del 1945, il termine ‘organico’ è pressoché assente. Come è assente tout court dal linguaggio del dibattito italiano sull’architettura. Zevi introduce nella patria dell’architettura ‘mediterranea’ la declinazione ‘organica’. Non solo utilizza il termine nel titolo del suo libro, ma ne fa un evidente mezzo per ribaltare il senso della citazione lecorbusieriana.”

Translation: “Even in the use of the adjective ‘organic’ in the prevailing architectural terminology was introduced in Italy by Zevi. In [his article “Profezia dell’architettura,” in *Casabella* n.98 of 1936] Persico doesn’t use the term and scanning through articles and citations of Wright’s work published before 1945, the nearly completely absent simply missing in the language of the architectural debate of the time in Italy. Zevi introduced to the Italian ‘mediterranean’ architecture the decination, ‘organic’. He didn’t just use the term in the title of his book, but also evidently used it to overturn the sense of his citation of Le Corbusier’s title *[Vers une architecture]*.


²¹¹ Sigfried Giedion, “On the limits of the Organic in Architecture,” in *Space, Time and Architecture: The Growth of a new Tradition* (Cambridge: Harvard University Press, 1991), 415. The illustration accompanying this text is the Residence at Taliesin and is discussed as “Wright’s organic treatment.” Again, on page 417, “Behind this cautiousness in the use of new materials and this hesitation about opening up the house with glass walls, as was done in the Chicago office buildings of the eighties and the European houses of the twenties, seems to lie a special conception of the needs of human nature. Wright bound the human dwelling to the earth as intimately as possible, introducing the earth into the house in the form of rough walls, and attached to it as if, in the words of Louis Sullivan, by ‘the ten-fingered grasp of reality’….The European development based on constructive means and the new visual approach had first to clear the atmosphere by pure functionalism. This was necessary,
Architecture, when built, must create a unity from a number of different parts. One of the many ways to achieve the spatial relationships that transform an assembly of parts into a unity is through the use of a system of proportions or of a simple module—that is, by employing certain measurements that recur in all three dimensions.

The foundation of architecture is bound up with its relations to proportions and to geometrical forms. But architecture is not only a geometrical structure. It is not solely dependent on eternal laws. It exists to serve man, who is as perishable as a plant. Thus architecture also bears certain human and plant-like traits.\(^{212}\)

So while Gideon recognized the “urge toward the organic,” in the work of Wright and Aalto, he was also cautious about this kind of work having a universal importance for architecture and society. In his assessment, this kind of work, whether historically in the work of Antonio Gaudi or in the recent work of Wright and Aalto, was intuitive and not able to be understood as a method with which to address the complexity of the modern world. On the other hand, Zevi feared that Giedion’s unavoidable, and healthful, but the moment the means of expression had been found, the clearing up accomplished, then again the urge to the organic could be felt. On another level and by other ways than Wright’s it is moving toward the organic. In the northern countries the work of the Finnish architect Alvar Aalto indicates this—and not only there.” [Emphasis mine].

\(^{212}\) Sigfried Giedion, “On the limits of the Organic in Architecture,” in Space, Time and Architecture: The Growth of a new Tradition (Cambridge: Harvard University Press, 1941, 1991), 875-876. Giedion’s text was translated into Italian in 1954. Sigfried Giedion, Spazio, tempo ed architettura: lo sviluppo di una nuova tradizione, Enrica and Mario Labó, ed. (Milano: Hoepli, 1954). Giedion looked for a new tradition, linking space and time, and nature and human habitation with the changes seen as a result of industrialization, such as serialized production and the effect on building. What kind of organism is architecture when it is seen in this light as a product of multiple factors such as social, economic, technical, and ethnographic conditions? Can architecture be studied in an isolated manner as a finite organism? Marcelo Catalin argues that Giedion viewed architecture as determined by external conditions, but when it is realized constitutes an autonomous organism that retains its autonomy even after the initial conditions that were responsible for its formation disappear. In addition, in an autonomous modern work, the relation between the elements of the composition are decisive in determining its character, while modern science sees objects through a lens of their interactions with other objects in an environment. It is the way that Catalini sees the mutual influence of art and science in modern architecture. Marcelo Catalini, “Sigfried Giedion, Spazio, tempo ed architettura: lo sviluppo di una nuova scienza.” http://www.academia.edu/2549230/Spazio_tempo_ed_architettura
promotion of the International Style would lead to a sterile and mechanistic approach to modern architecture that “would be followed by a chaotic revolt against it.”

In contrast to Giedion, Zevi wanted his own book to be more than just a discussion of the various formal and spatial characteristics of organic architecture; in fact, he wanted his book to provide a model for how to facilitate a “post-war reconstruction of Europe along democratic architectural principles.” Andrea Oppenheimer Dean compares Zevi’s outlook to that of anti-Fascist writer Carlo Levi, who in his book *Christ Stopped at Eboli* wrote about the need to rebuild a concept of the state based on the individual. She quotes Levi:

> The individual is not a separate unit, but a link, a meeting place of relationships of every kind. This concept of relationship, without which the individual has no life, is at the same time the basis of the State. The individual and the State coincide in theory and they must be made to coincide in practice as well, if they are to survive...The State can only be a group of autonomies, an organic federation...the autonomy of the factory, the school, and the city, of every form of social life.

It is this sense of the organic that is of interest to the larger discussion. Rather than top-down organization, unity could arise from the interaction and cooperation of autonomous assemblies of individuals. Levi points out in political organization a model for the “organic” that highlights the individual as the base unit, but also stresses that a set of relations weld them into autonomous groups, “autonomies” which in turn must be related into a larger group. Louis Sullivan’s poetic image of the organic as a “ten-fingered grasp of reality” is a parallel to Levi’s political image. Each

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213 Dean, *Bruno Zevi*, 26. Dean quotes from Zevi. She alludes to these two quotations being taken from *Towards an Organic Architecture* but she does not cite page numbers.

214 Ibid., 25.

finger is an “autonomy” made up of countless individual cells in relation to each other and this autonomy is in relationship with other autonomies in order to make a hand. For Sullivan, architecture requires both hands to grasp a new relationship to reality. This grasp of reality was not always so clear in Wright but it was clear enough for Zevi that Wright’s work represented it.

**Verso un’architettura organica, 1945**

A photograph of Fallingwater graced the cover of the second edition of *Verso un’architettura organica*, an interesting choice on many levels. Fallingwater captures the spatial qualities and asymmetries that Zevi equates with organic architecture, but it is an interesting choice to privilege a single family house given Zevi’s interest and appeal for the democratic aspect of organic architecture. His book is partly a rewriting of the history of modern architecture, placing in a central position the work of Frank Lloyd Wright as a contemporary modern architect, rather than only a precursor to the Modern Movement and an understudy of Louis Sullivan. The book, when it was originally published in Italy, had no illustrations due to the lack of satin paper, but was amply illustrated in the 1950 English translation. His examples are primarily from the United States, England, and Scandinavia. In the initial three chapters of *Verso un’architettura organica*, Bruno Zevi summarizes the ascent of modern architecture in the interwar period in Part One, I, “The Origins and the ‘Isms’ of the First Modern Architecture;” laments in Part One, II, “The Revolt against Modern Architecture in Europe;” and then advocates for and looks at “The Survival of Modern Architecture in Europe and its Development” in Part One, III. As a contribution to understanding Zevi’s use of the term organic, it is curious and meaningful that in the English edition, the second part of this chapter heading, “Significance and limits of the term organic in respect to architecture,” is not translated. In

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216 The original Einaudi edition did not have the image of Fallingwater, but the next printing as he described the lack of coated paper stock.
the second part of the book, Zevi outlines “Architectural Tradition in the United States” and looks at the work and influence of Frank Lloyd Wright on contemporary architecture.217

A key “Intermediate Chapter” is entitled “Meaning and Scope of the Term Organic in Reference to Architecture.”218 In this section, Zevi strives to make a connection between modern architecture and a technologically oriented world, distancing his own interests from antiquated modes of production and more overtly organic form. Zevi quotes the text for the catalog for an exhibition of domestic furniture held in New York in 1941 (Zevi does not specify, but this show is in fact Organic Design in Home Furnishings by Eliot Noyes), using the smaller, industrially produced object as ersatz stand-in for architecture.219

A design may be called organic when there is an harmonious organization of the parts within the whole, according to structure, material, and purpose. Within this definition there can be no vain ornamentation or superfluity, but the part of beauty is none the less great—in ideal choice of material, in visual refinement, and in rational elegance of things intended for use.220

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217 These chapters are organized in the original as such: “Parte Prima: I. Le origini e gli -ismi della prima architettura moderna,” “II. La rivolta contro l’architettura moderna in Europa,” “III. La resistenza dell’architettura moderna europea e i suoi sviluppi. (Significato e limiti della voce organico rispetto alla architettura),” “Parte Seconda: I. La tradizione architettonica degli Stati Uniti,” “II. Frank Lloyd Wright,” “III. L’influenza di Frank Lloyd Wright,” “IV. L’architettura contemporanea negli Stati Uniti. (Conclusione).”


219 Zevi does not state the exhibition name, date, or author of the text that he quotes. Zevi, Towards an Organic Architecture, 70. Though Zevi does not cite the exhibit by name, it was the exhibit “Organic Design in Home Furnishings” organized by Eliot Noyes at the Museum of Modern Art. Noyes (who was mentored by Gropius) became the first curator of Industrial Design at MoMA in 1940. This exhibit was the result of a competition and a catalogue was published documenting the results. Eliot F. Noyes Organic design in home furnishings (New York: Museum of Modern Art, 1941). See also John Harwood. “The White Room: Eliot Noyes and the Logic of the Information Age Interior” Grey Room no.12 (Summer 2003).

220 The inside cover establishes the competition theme, (and the source of his quoted text, by Noyes) defining for him what was Organic Design: “A design may be called organic when there is an harmonious organization of the parts within the whole, according to structure, material, and purpose. Within this definition there can be no vain ornamentation or superfluity, but the part of beauty is none the less great—in ideal choice of material, in visual refinement, and in the rational
This statement already echoes Sullivan’s idea of the organic as a “grasp of reality,” which will for Zevi become a more robust idea about organic architecture: a kind of “natural functionalism.” Zevi is less focused on defining abstract ideas about what is organic architecture and more oriented towards looking at changes in housing types that he observed during his stay and work in the United States and England. In the following paragraphs (from his original Italian text Verso un'architettura organica and my translation), Zevi writes of his experience in the United States, and especially interested in equating American industrialization with the possibility of democracy emerging in postwar, industrially undeveloped Italy. Zevi makes his case for industrialism as the engine of a democratic, organic development from the scale of furniture to the scale of the house, and by extension from the single-family house to large-scale developments.221 Notable is Zevi’s emphasis on elegance of things intended for use.” It also included this text by Lewis Mumford from Technics and Civilization “Our capacity to go beyond the machine rests in our power to assimilate the machine. Until we have absorbed the lessons of objectivity, impersonality, neutrality, the lessons of the mechanical realm, we cannot go further in our development toward the more richly organic, the more profoundly human. The economic: the objective: and finally the integration of these principles in a new conception of the organic—these are the marks, already discernible, of our assimilation of the machine not merely as an instrument of action but as a valuable mode of life.” Additionally, Zevi was very familiar with Mumford’s work as he was published in the first issue of Metron 1 (1945), one of the first articles is by Mumford on Garden Cities in the United States.  

221 It is interesting to note that the importation into postwar Europe of the American (and British) model of single-family dwellings for returning veterans and/or the relocation of large numbers of people to work in defense-industry plants in the U.S. seems unconsciously to adopt an anti-urban stance, although this was observed and commented upon by audience questions posed to Frank Lloyd Wright during the Sulgrave lectures. These projects differ from European responses to the housing crises in which housing was seen in its totality as already an accumulation of the various minimal living units into larger patterns of inhabitation. This could either be understood as a unified block (Unité d’Habitation), a Plan Voisin, challenges to the rigidity of the relation of building to landscape in Alison and Peter Smithson’s Golden Lane housing of 1952, or even the visionary schemes of Kenzo Tange’s 1960 plan for Tokyo Bay or Yona Friedman’s 1959 Paris Spatiale and his Toward a Scientific Architecture (MIT Press, 1975). Unlike Max Taut’s project the Hans Luckhardt: Einzelhaussiedlung in Frühlicht: Herausgegeben von Bruno Taut Winter 1921/22, which considers the single-family house in larger patterns; the Packaged House by Konrad Wachsmann and Walter Gropius or similar prefabricated units were never considered to be brought together with other houses. While very much an open system within its own fabrication logic and seemingly endless in its combinatorial logic based upon an architect’s whim or client desire, it is a closed system socially and formally—extending itself out only to modify and anchor itself more comfortably on a small
the pragmatic and practical values of industry and architecture, again echoing that the aim is a
“grasp” of reality: of real problems, real materials, real designs, and real solutions. Zevi expresses this
in the Italian text and the following is my translation:

At this point it is important to clarify something: we don’t want to state that there is an
absolute category into which all organic tendencies fall. But this is not to say that it is not
clearly distinguishable and doesn’t contrast directly with the other tendency [by this he
means inorganic]. There’s nothing vague or sentimental about organic tendencies [translated
as “the Organic” herein]. It is not just an expression of “local color,” nor does it only look
toward the past, neither is it an instinctive improvisation, nor rustic or indigenous building,
not the countryside, nor the island of Capri, nor any other kind of provincialism. The
Organic marks the road toward a healthy modern architecture, a better method in which to
conceive spaces and structures in both old and new issues in building.

What is the most pressing question of the day in England or in America? The prefabricated
house, mass produced in industrialized factories. It is therefore in the actual solving of
problems that are raised because of the necessity for prefabricated houses that the antithesis
between organic and inorganic architecture is most clearly revealed. In England the
government has produced a prefabricated house for soldiers returning from the war for
public viewing. It is a parallel-piped box divided into four rooms, cold, standardized,
anonymous, ugly, that has already provoked protest from everywhere; it is an example of
classical architecture, geometric, without any possibility of expansion. But in America various
designs of prefabricated houses have perhaps opened the way for a new solution: one needs
to prefabricate the base unit, baths, kitchens, plumbing and heating systems, bedrooms,
perhaps all of the spaces, separately. These units then get assembled together according to
the various needs of the inhabitant who will live there. There needs to be the possibility to
add and subtract units or spaces, to substitute larger rooms for when the inhabitant
outgrows the smaller rooms and vice versa, meaning that the principle of flexibility must be

suburban quarter acre (or less) site. What would represent the largest formal gesture for an entire
development would be the utility grid and access street layout, which would more often than not be
“designed” for maximum efficiency (primarily for the automobile) and completely disassociated
from the design of the housing. This is a lapsus that should be interrogated and brought into the
light.
respected, and that of organic growth and reduction. [Emphasis mine] With these criteria one could also imagine a house of a mixed construction type in which all of the basic services are prefabricated, and that the living room and the studio could be constructed partly on the site.

It is evident that we are dealing with two tendencies that value life in opposite ways. The first is an absolutist tendency, totalitarian in the field of housing; the second is elastic and leaves space for life. The first imposes on all inhabitants a suffocating uniformity, a total rigidity of life; the second proposes to give to all the means, materials, and equipment in order to have a comfortable house at low cost, but leaving the individual freedom and variety.  

Consulting the English translation, Towards an Organic Architecture, a critical difference is found: Zevi’s more robust thesis on the notion of the organic had been changed in the English translation, and a diluted version of the original replaces these key paragraphs. This difference is striking, as this

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222 Zevi, Verso un’architettura organica, 69–70. Original text: “A questo punto è bene precisare una cosa: non intendiamo dare alla tendenza organica un valore di categoria assoluta nell’architettura. Ma questo non vuol dire che essa non sia chiaramente distinguibile, e che non contrasti direttamente con l’altra tendenza. Non c’è niente di vago, di sentimentalistico nella tendenza organica. Non implica il colore locale, né richiami al passato, né l’improvvisazione istintiva, né l’edilizia rustica o indigena, né la campagna, né Capri, né provincialismi di sorta. La tendenza organica segna la via sana dell’architettura moderna, il processo migliore di concepire gli spazi e le strutture nei temi vecchi e nuovi dell’edilizia.

Qual’è oggi il problema all’ordine del giorno in Inghilterra e in America? La casa prefabbricata costruita in massa negli stabilimenti industriali. Ebbene, proprio nel risolvere i problemi posti dalla necessità di case prefabbricate, l’antitesi tra architettura organica ed inorganica si rivela nettissima. In Inghilterra il governo ha sottoposto all’esame del pubblico una casa prefabbricata da costruirsi in serie per i soldati che tornano dalla guerra. E’ un parallelepipedo diviso in quattro stanze, freddo, standardizzato, anonimo, brutto, che ha già provocato proteste da ogni part; è un esempio di architettura classica, geometrica, senza possibilità di espansione. Ma in America vari tentativi di case prefabbricate hanno dato le chiavi della soluzione: bisogna prefabbricare le unità-base, i bagni, le cucine, gli impianti, le camere da letto, magari tutti gli ambienti, ma distintamente. Le unità vanno poi montate insieme secondo le varie esigenze di chi abiterà la casa, ci deve essere la possibilità di aggiungere e di sottrarre ambienti, di sostituire camere più grande a quelle divenute piccole e viceversa, cioè deve essere rispettato il principio della flessibilità, della crescita e della des crescita organica. Con questo criterio si può anche concepire una casa a costruzione mista in cui tutti i servizi siano prefabbricati, e la stanza di soggiorno e lo studio siano edificati a parte sul posto.

È evidente che si tratta di due tendenze che valutano la vita in modo opposto. La prima è la tendenza assolutista, totalitaria nel campo delle abitazioni; la seconda è elastica e lascia spazio alla vita. La prima impone a tutti l’uniformità soffocante, l’irregimentazione totale; la seconda si propone di dare a tutti i mezzi materiali e meccanici per avere una casa comoda a poco prezzo, ma lascia libertà e varietà, rispetta l’individuo.”
actually places the emphasis on Wright’s work in the chapter as an appropriate organic approach, which is not emphasized in the Italian original. Zevi’s wider interest in the idea of change in form over time is the salient feature of the organic. 223 In the English translation, these more complex thoughts on fabrication and individual choice are eliminated and constrain the remainder of Zevi’s argument, and indicates the change of direction of his work, as seen in this paragraph, which replaces the three paragraphs above with a slightly different discussion and emphasis:

In many European countries, when a peasant decides to build a house, he immediately thinks of it as a cube or as some other simple geometric form: and he builds it larger than he needs, and shuts off a couple of rooms which will only come into use when his children are older.

In his mind the growth of his house is subject to a definite programme and is limited to the framework of a geometric design. Now the labourer in America follows a different principle:

223 In the preceding paragraph there is nothing in Zevi’s writing that discusses natural materials, open spatial characteristics, and other “organic” attributes and he steers the discussion away from stylistic issues. The English translation Towards an Organic Architecture is published 5 years after the Italian and I believe that we are beginning to see, rather than a literal translation, already the emergence of a different Zevi, in response to a stabilization after the initial postwar reconstruction, but a Zevi who is resolutely a modernist (though for him this is what he calls “organic architecture,” thus in a complex calculus, distancing himself from the concerns of neorealism and neorealist architecture with the insistence that organic architecture IS modern architecture. Roberto Dulio has suggested that the English edition is an exact translation of the Italian original and wonders more about the delay in its publication as he was originally going to publish the book in England in 1944, he believes that it might be because Zevi returned to Italy in 1944. “È difficile capire perché Towards an Organic Architecture venga pubblicato esattamente corrispondente al manoscritto della traduzione del 1944, solo nel 1950, dopo l’edizione italiana. [Emphasis mine] Forse l’assenza dell’autore, che nel frattempo era rientrato in Italia, può aver pesato su questo fatto.” (pp. 30-31). I am interested in these 5 years, in which Zevi is involved with the APAO, has finished his collaboration on the Manuale dell’Architetto, publishes regularly and is involved in the editorialship of Metron. Perhaps it is that dealing with postwar necessity and democracy building gradually changes and Zevi changes his role to the one who will step up to write the first postwar History of Modern Architecture with a strong emphasis on Wright and the organic and leads to the direction of his career and publications. I will begin now to shift emphasis from Zevi and his idea of the definition of the organic and to discuss issues regarding an idea of organic growth and form that takes a different course in a rapidly industrializing Italy and changes in the building sector: both demands and technique. An important work to undertake is to note the changes between Verso un’architettura organica of 1945, and Zevi’s Saper vedere l’architettura: saggio sull’interpretazione spaziale dell’architettura (Torino: Einaudi, 1948)] (English translation, Architecture as Space. How to look at Architecture, Horizon Press, New York 1957; Da Capo Press, New York 1993)[] and Storia dell’architettura moderna. Dalle origini al 1950. (Torino: Einaudi, 1950).
he builds one room and then as time goes on, a second and a third to meet his progressively changing requirements. The European peasant’s way of looking at the matter is theoretic, inorganic and, if you will, classic. The American’s attitude is, on the other hand, more evolutinal and closer to natural growth, in a word, organic: the exterior forms are derivatives of the interior space.

The difference between organic and inorganic is not a matter of sentimental emphasis: it concerns the very problem of approach in planning. Between the peasant’s almost home-made house, built without an architect, to the last by-product of industrial building, the prefabricated house, the difference is evident. Look for example at the Churchill house, the proposed new mass-produced home for the British people: it is inflexible, classical, impersonal, cold. On the other hand in some of the prefabricated houses in Sweden and in America, where each individual room has been prefabricated, it is possible to add or subtract rooms as one pleases. Even with prefabrication, if it be used in this way, every house can be conceived organically, can look different from its neighbors and can express the actual and personal life of its occupants.224

Here the emphasis is on personal expression and less about a theoretical stance, or larger societal issues as Zevi continues, “the word organic can only be applied in its strictest physical sense to some of the products of modern architecture.” He then cites the physical attributes and profiles of door handles and chairs by Aalto and Saarinen as emblematic of organic form, as they are in tune with the form of the body. Yet, because he promotes a conflation of ergonomics with an unwitting appeal to the biomorphic, he deals a blow to his larger argument. He claims that he will articulate this further

224 Zevi, *Towards an Organic Architecture*, 71-72. I have not found notes in the Fondazione Bruno Zevi, his library and archive at his home at 150 via Nomentana in Rome regarding the details of the English translation. I have spoken to his daughter Adachiara Zevi, his son Luca Zevi, and Roberto Dulio regarding the discrepancies between the Italian and English translation but there were unaware of this. Luca Zevi reiterated that his father did oversee the English translation. So in this sense I have to deduce that the changes do reflect Zevi’s changing point of view and role in Italian architectural culture rather than an error in translation. Additionally, because Zevi mentions prefabricated houses in Sweden and in America it proves an increased awareness of Scandinavian New Empiricism and prefabricated building types, some of which are in fact used in the *Manuale dell’Architetto*. Zevi writes about the reality of organic architecture, which includes images of the dormitories at MIT by Alvar Aalto, in *Metron* 35–36 (1949).
on, promising that “Its meaning in regard to architecture must be defined...as something equally opposed to the theoretic and the geometrical, to the artificial standards, the white boxes and the cylinders which distinguish so much of the first modern architecture and to its general nudism.”

But he never fulfills his promise.

When Zevi wrote in Verso un’architettura organica that, “there needs to be the possibility to add and subtract units or spaces, to substitute larger rooms for when the inhabitant outgrows the smaller rooms and vice versa, meaning that the principle of flexibility must be respected, and that of organic growth and reduction,” this presents an especially rich understanding about what in fact the organic may be. It may be operative, dynamic, and not stylistically determined, something that bemoaning “general nudism” will not leave him open to appreciate.

It is this aspect, similar to Louis Sullivan’s description of the interrelationship of elements and also in line with the description that Zevi borrows from Walter Behrendt’s description, that “the structure like an organism grows in accord with the law of its own individual existence, with its own specific order in harmony with its own functions and with its environment, like a plant of any other living organisms,” that is Zevi’s main thesis and is a notion that gets buried in Towards an Organic Architecture or his later discussions about organic architecture.

The potential clarity of Zevi’s message about an “organism that grows in accord with the law of its own existence,” gets muddled with the other points in Behrendt’s checklist of what constitutes organic versus inorganic architecture such as it being a “formative art” versus “fine art,” or a “product of intuitive sensations and imagination” versus thought and “constructive imagination”, a search for the particular, a delight in “multiformity” versus “aspiring towards rule, system, law”

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225 Zevi, Towards an Organic Architecture, 72; Verso un’architettura organica, 71.
226 Zevi, Verso un’architettura organica, 70. [Translation and emphasis mine]
227 Zevi, Towards an Organic Architecture, 69. [Emphasis mine]
among many others. But perhaps most importantly, Behrendt advocates for “irregular forms (medieval)” versus “regular forms (classic).” Zevi does take Behrendt to task for how inexact are some of his terms, but he thinks Behrendt’s statement about Wright is important to his own definition in which Behrendt said of Wright: “His art is founded on a principle of general validity, the principle of organic structure which must be the guiding principle of the future if architecture is again to be a living art.”

Behrendt and Zevi are in agreement about the organic program; but the weakness of the program remains its definitional structure. With no clear strategy, it was all too easy to design architecture with superficial resemblances to Frank Lloyd Wright’s work, with features such as freedom from symmetry, anti-compositional nature, the use of geometry, and the overall emphasis on the physical attributes of organic architecture. But if this functional substitute for a concise definition remains, then the most important interpretation of Zevi’s text is lost. Paradoxically, what is a destructive elision in translation is that it provides the clearest definition of organic architecture used by Zevi. The missing translation of Zevi’s work includes a definition that neatly merges the formal, social, and political values of modern building in general and housing in particular without prescribing a specific form. Without it, Zevi’s text is viewed as naïve because of his use of Wright and Aalto as examples of the organic. Ironically, the removal of this definitional point of Zevi’s from his original text influences the grasp of his ideas in Italy. Even though the translation into English was the only missing part, the understanding of Zevi as naively using Wright becomes common even in Italy. The idea of the free exchange of parts in a prefabricated system, allowing for open form and for user

228 Zevi, Towards an Organic Architecture, 69-70.
participation, more accurately describes the potential of Zevi’s position to have gained wider currency and be instrumental in analyzing the changes that would be coming shortly.\textsuperscript{229}

\textbf{Zevi’s protest against Sigfried Giedion at 1949 CIAM 7 meeting in Bergamo}

Figure 80 Bruno Zevi, “A message to the Congrès International d’Architecture Moderne,” in \textit{Metron} 31-32 (1949): 5.

Zevi disagreed with Giedion’s promotion of the Bauhaus and the Villa Savoye as the highest forms of modern architecture, a view he articulated after the war in a 1948 address to the International Congress of Modern Architecture, gathered in Bergamo, Italy.\textsuperscript{230} In this address, Zevi takes on Giedion’s work directly and questions why:

\footnotesize{In a larger work I examine other Italian architects and engineers who worked in a similar organic mode in the 1960s who looked to underlying organizational principles in nature to guide their making in a proto-computational manner: Mario Galvagni, Leonardo Mosso, Sergio Musmeci, Renzo Piano, and Maurizio Sacripanti for example. I also examine how this work is formally quite different to other members of the APAO regional group in Rome, and its national reach, especially in Florence with Giovanni Michelucci, Leonardo Savioli, Leonardo Ricci, Vittorio Giorgini or others such as Marcello D’Olivo, Ignazio Gardella, Carlo Scarpa, Paolo Soleri, Paolo Portoghesi, etc.\textsuperscript{230} Bruno Zevi, “A Message to the Congrès International d’Architecture Moderne,” in \textit{Metron} 31-32 (1949): 5-30. This essay is partially reprinted in Andrea Oppenheimer Dean, \textit{Bruno Zevi on Modern Architecture} (New York: Rizzoli, 1983), 126-134. Dean discusses this address in Chapter 1, “A}
The CIAM, in the general feeling of modern architects, is bound to the architectural mentality of Le Corbusier, Walter Gropius, and generally with that period known as the rationalistic one. It is bound to the historical perspectives and interpretations of Sigfried Giedion. These three personalities are most important and determinant figures today, so much so that there is no foreseeable lessening of their influence, which perhaps would facilitate the development of a more appropriate and comprehensive culture. The other branch of modern architecture, that which is no longer rationalistic, the movement which is called organic, or of human architecture, or of the New Empiricism, doesn’t have adequate representation in the CIAM and its cultural position has been defended by architects who entered the CIAM as proponents of the rationalist school ten years ago and have since undergone an evolution. An entire generation of young architects who have contributed to the advancement of the modern movement, and all the adherents of the Wright school, have been more or less excluded. Why?

Zevi continues to describe the problem with Giedion’s book in that he centers on a “classicist or biological conception of the history of art.” Zevi’s critique hones in on the assumption at the center of Giedion’s analysis: that art can be meaningfully understood as a parallel process to biological growth and is therefore developmental. Based on this assumption, Giedion renders a history of art and architecture that implicitly or explicitly maintains that prior to the point of maturity or perfection in time (e.g. in the modern movement Villa Savoye and the Bauhaus), the work is embryonic and immature, and that after, there is a decline. Zevi’s critique of Giedion’s assumption

struggle against Fascism, a battle against Giedion,” pp. 26-33. Giedion (1888-1968) was appointed the Charles Eliot Norton Professor of poetry in 1938 at Harvard University. In 1938-39 he delivered the Norton lectures which formed the basis for his Space, Time and Architecture: The Growth of a New Tradition. Giedion was appointed professor at the GSD in 1938. He returned to head the Federal Polytechnic School in Zurich in 1947, and returned in 1951 to teach at MIT and lecturing at Harvard. For an overall relationship of the role of historians in the creation of a history of modern architecture, see Panayotis Tournikiotis, The historiography of modern architecture (Cambridge, MA: MIT Press, 1999).

231 Zevi, Metron 33-34 (1949): 9-10. As a note, this text was simultaneously published in Italian, French, and English.

232 Luca Molinari, “Introduction,” 2G (2000): 8-9. Luca Molinari in his introduction to the special issue of 2G summarizes architecture culture in the postwar period and ties the split in Milan and
Rome to the architects and their philosophical interests. In general, the modern movement was advocated for most by Sigfried Giedion’s, *Space, Time and Architecture*, and was seen as the official history, but with Italy’s complex relation with the Rationalist movement operating under the Fascist regime, caused varying problems in the acceptance of the modernist paradigm after World War II. This, as Molinari points out, can also be seen in “Architects of the Modern Movement” collection published by Belgiojoso, Peressutti and Rogers in 1948, coupled with monographic issues of *Casabella-Continuità* in the late 1950s (with Rogers as editor). Molinari is following Tafuri’s line of thought, though he is very clear and concise in elaborating the different tendencies in postwar Italy, essentially similar to Tafuri’s order in *History of Italian Architecture 1944-1980*, especially as he immediately moves to discussing studies for the INA-Casa, and then turns to the parallel experiment of architects designing and restoring historic buildings for museums, adding an interesting discussion between architecture and history, and demonstrated in Roger’s *Casabella-continuità*-through studies of museums and urbanization projects (Albini, Gardella, Caccia Dominioni, De Carlo, Gregotti, Michelucci, Ridolfi, Samonà). He brings the Introduction to a conclusion with the Banham-Rogers debate over the Torre Velasca…in the attempt to fuse historical context and modern architecture, prompting Banham to write the well-known “Neo-Liberty: The Retreat from Modern Architecture,” in *The Architectural Review* 747 (1959). See also Andrew Leach, “Modern Architecture and the Actualisation of History: Bruno Zevi and Michelangiolo Architetto,” Proceedings of the XXVth International Conference of the Society of Architectural Historians, Australia and New Zealand, Geelong, Australia, 3-6 July 2008. Leach points to the debate regarding the “anti-historicist stance maintained by the orthodox lines of architecture’s modern movement” and the reaction to the “modernist orthodoxy” of the CIAM and some writers and adherents to the modernist positions such as Wittkower, Pevsner, Giedion, and Colin Rowe. Leach positions Zevi as reacting to this position in that, as he quotes Zevi, described the postwar moment as a “period committed to the historicisation of contemporary action, that is in a promoting criticism which destroys the negative residues of the vanguard but defends its driving force.” [from Bruno Zevi, “Michelangiolo in Prosa,” in *L’Architettura. Cronache e storia* 9, 99 (January 1964): 652]. For other assessments of Zevi’s position vis-à-vis modern historiography, see Harry Francis Mallgrave, *Modern Architectural Theory: A Historical Survey, 1673-1968* (Cambridge; New York: Cambridge University Press, 2005), 346-48. He discusses Zevi’s organicism as a quality of “architectural space that focus(es) on content, specifically its social content…” (Mallgrave, *Modern Architectural Theory*, 347), citing Fiedler, Wölfflin, and Geoffrey Scott in line with perceptual and empathy theories. Mallgrave states that “In this phenomenal realm of spatial experience in fact lies the gist of Zevi’s organic conception, and indeed it is a conception that is far from suggesting—as some critics in his day assumed—a return to Wrightian forms. It is an antirationalist conception that allows natural materials and functional complexities back into modern architecture. In fact, the images of Wright’s buildings woven throughout the book are of highly tactile creations at Bear Run and for the Johnson Wax Company.” (Mallgrave, *Modern Architectural Theory*, 347) This is still not a satisfactory answer, in that, while Zevi may have illustrated *Verso* with material images and irregularly formed buildings based on functional complexities, Zevi still offers no strategy with which to plan, and such complexity is really advocating for the medieval or for late 19c eclecticism. What is missing in Zevi is a way to understand the relationship between the functional elements of architecture, an underlying order that is in fact evident in nature. Zevi does not acknowledge this. In fact, in the idea of “natural materials” are all still manipulated by the human hand, rendering geological mineral deposits or great trees into modularly based building materials, scaled to be manipulated and put in place by human hand augmented by the increasing use of
that history can be read developmentally may be compounded by his recognition that this approach inherently sanctions a contemporary movement that lays claim to being a highly advanced form of art or architecture, as well as sanctioning anyone who claims to have transcended the developmental cul-de-sac. Zevi wrote:

One may fear that the historical outlook of Giedion is similar to that of many leaders of the CIAM and particularly Le Corbusier, who seems sometimes to delude himself with the belief that he discovered and initiated modern architecture, not being content to remain merely that eminent figure of it which is enthusiastically recognized to be.\(^{233}\)

Zevi’s historiographic approach did not rely on a developmental approach; rather, he saw the dynamic of history as a motive force, a heritage that could be used or misused by each generation. The essential trait of Zevi’s organic architecture, an anti-symmetrical organization, was derived from his bitter criticism of the corruption of modern architecture by architects of the Fascist regime. By co-opting modernism crossed with an autarkic conflation of modern Italian nationhood with its “Roman-ness” and prior imperialist role across the Mediterranean, the architects of Fascist Italy used overt references to classical architecture that they merged with the imported model of modern architecture: this stripped down, classically organized modernism became representative of the Fascist regime. Zevi equated the symmetrical with the regime and urged architects to refuse to obey laws of symmetry; he believed that this was the most important manner in which architects could advocate for the free expression of a society through architecture. If the architecture refused to adhere to formal reductiveness and monumentality, it would stand as a physical sign of opposition to the fallen regime.\(^{234}\)


\(^{234}\) This is of course a much larger discussion in the history of the immediate postwar in Italy and the internal debate between the rationalists and the traditionalists. Modern architecture was to suffer...
from its association with the architects who had worked under Fascism (Giuseppe Terragni, Adalberto Libera, Luigi Moretti, etc.). These architects produced extraordinary works, but the backlash against modernism was extreme. We see in the housing rebuilding campaign of INA-Casa and in the work of Mario Ridolfi and others a return to traditional construction and form as a response to this issue. Zevi’s promotion of organic architecture fits into this discussion, but rather than looking at indigenous models of building, looked abroad to Wright as a model of formal variation that would reflect a free society. Above all, symmetry was the taboo gesture. See Rudolf Arnheim’s critique of Zevi in “Dimensions of Value,” in New Essays on the Psychology of Art (Berkeley: University of California Press, 1986), 320-6. Arnheim and Zevi share the centrality of the individual in responding to the perceptual properties of architecture: that the visual and the social are interconnected. But this is where some of their commonalities end. Arnheim critically discusses Bruno Zevi’s Il linguaggio moderno dell’architettura: guida al codice anticlassico (Torino: Einaudi, 1973) [Bruno Zevi, The Modern Language of Architecture (New York: Da Capo Press, 1994, 1978) in response to John Summerson, Il linguaggio classico dell’architettura (Torino: Einaudi, 1970) [John Summerson, The Classical language of architecture (London: Methuen, 1963) and (Cambridge: MIT Press, 1963)]. In this book, Zevi rallies a cry against the classical abstract principles of order, proportion, and symmetry, calling for a new language for modern architecture as seen in the work of Le Corbusier, Gropius, Mies van der Rohe, and tellingly, places Frank Lloyd Wright as a contemporary, not a predecessor, or pioneer of the modern movement, responding to Giedion, Hitchcock, and Pevsner among other historians of modern architecture. His rules, answer in negative form Summerson’s descriptions of the qualities of Classical architecture, actually utilizing a set of simple binaries that Zevi critiques in Behrendt’s work in Verso un’architettura organica. His “seven invariants” are an alternative system that opens up the idea of function to a new interpretation in relation to the specificity of site and building, emphasizes dissonance and difference, dynamic apprehension of a work, the effect of the interplay of building elements, an “organic” merging of architecture and engineering, a renewed idea of “use” for living spaces, and following Wright, an emphasis on a building’s integration with the site. Did Zevi anticipate or advocate for the traits that would be adopted in postmodern architecture? He was not receptive of historicizing elements, but again, his intent was not clear and easily misinterpreted, a point that requires further research. Returning to his “seven invariants,” he also vehemently opposes the use of symmetry in any modern work of architecture, leading Arnheim to critique Zevi’s “impetuous attack on symmetry” (Arnheim, New Essays, 324) categorizing Zevi as speaking as “a polemicist, not as a detached observer” (Arnheim, New Essays, 321). He discusses Zevi’s overly simplistic assessment of the use of symmetry: “When Zevi, for ideological purposes of his own, asserts that the geometrical simplicity of the classical style of architecture stands for dictatorship and coercive bureaucracy whereas the anticlassical style offers ‘free forms, congenial to life and the people,’ he overrides the primacy of simplicity in the service of a more particular inclination. On the other hand, it would also be pertinent to inquire about the needs that make a classical style resist the temptation to deviate from simplicity.” (Arnheim, New Essays, 322). Arnheim, in keeping with his agenda to elucidate the perception of art or the “dimensions or categories of human experience,” understands the conditions and criteria that go into making and then perceiving the work. Rather than the approach that he believes Zevi adopts, which is that “modern” architecture is only possible by the negation of the classical rules, he looks toward the categories used by Heinrich Wölflin (Giedion’s mentor) to distinguish Renaissance art from Baroque art as a “systematic investigation of the dimensional scales by which works of art are perceived would be most helpful. Here I can only enumerate a few more of them at random: homogeneity/heterogeneity, dominance of the whole/dominance of the parts,
For Zevi, Wright’s text on the architecture of democracy established the main line of attack on the architecture of the Fascist period: rationalist architecture. Italian rationalism, in Zevi’s view, forced symmetrical organizations and the classical orders on modern architecture and this program suited the political aim of the Fascist party to impose a new order on Italy. Zevi wanted to rescue modern architecture from this assault. His organic architecture proposed using the techniques and spatial qualities of modern architecture to free the organization from any vestige of classical architecture. 

Hence, Zevi’s approach shares some central features with rationalism for he sought to create a modern architecture incorporating both social progress and technical innovation. Yet, Zevi’s invitation remained keenly shaped by his agenda to rescue modern architecture from the previous hegemony of order. His focus is to produce an organic architecture that promotes asymmetrical relationships between the elements and articulates the differences in the elements that constitute the whole. It also still focuses upon the efficiency in production in the architectural realm rather than returning to a nostalgia for the handmade, or the vernacular.

endlessness/finiteness, consonance/dissonance, hierarchy/coordination.” These properties then, as Arnheim calls for, allow a systematic analysis that is understood in degrees…degrees of symmetry as an example, not as polemical all or nothing proposition. See also Nikolaus Pevsner, J. M. Richards, and Dennis Sharp, The anti-rationalists and the rationalists: theory and design in the modern movement (Oxford; Boston: Architectural, 2000), combined edition, originally published separately as The Anti-rationalists (London: Architectural Press, 1973) and (Toronto: University of Toronto Press, 1973) and other essays published in The Architectural Review from 1959-68, and includes newly commissioned essays including an essay by Bruno Zevi on the Italian Rationalists. The editors point out in their introduction that in the 5th edition of Space, Time and Architecture, that “Sigfried Giedion referred to his work in Space, Time and Architecture as the ‘combination of standardisation and irrationality, so that standardisation is no longer master but servant’.” It is interesting to note the splitting of Italian rationalism from its connection with the regime (so significant for Zevi) with the XV Milan Triennial of 1973 on the resurgence of Italian Rationalism, or the Tendenza, as connection that I will further explore in the future.

235 Bruno Zevi, Verso un’architettura organica, 12.

236 See Manfredo Tafuri “Il clima culturale del primo dopoguerra—L’APAO,” in Ludovico Quaroni e lo sviluppo dell’architettura moderna in Italia (Milano: Edizioni di Comunità, 1964), 71-82. Tafuri discusses the work of the APAO (of course in which Quaroni participated), and speaks about their search for an organic approach that would be in line with social reality, something that is prominent in the
proceedings of the APAO meetings. He laments a general lack of interest (on the part of the influence of the work of Benedetto Croci) towards sociology (something that will be addressed directly in Quaroni’s involvement in the UNRRA-Casas project in Matera and the coordination with the work of the sociologist Friedrich George Friedmann). Tafuri, following Zevi’s early impulse, focused on the effects and experience of architecture and less on the constitutive processes of architecture. This focus of architecture as a means to effect political and social change was central to the goal of the APAO. So it is in this light that Tafuri presses for the possibility for architects, as intellectuals to effectuate their interest and political responsibility in projects. He discusses Norberto Bobbio’s *Intelletuali e vita politica in Italia* (1954) [reprinted in *Politica e cultura* (Torino: G. Einaudi, 1974, 1955) and in the more recent edition Franco Sbarberi, ed. *Politica e cultura* (Torino: Einaudi, 2005), adding a fifth category to Nobbio’s levels of political engagement (outside, neutral, philanthropist, or intent on synthesis—to an intellectual who would be an active participant and contribute a new ideology and action. (73) The APAO in his estimation, because of initial ambiguities in their mission were not able to be the effective political vehicle that they had hoped. This is then overshadowed by the real absence of architects to hold public office. (78) There is also the role of Zevi in the APAO, and of his activities which were only partly involved in the activities of the APAO. He notes the different roles in the APAO, and but how all were intent on a new model after the overturning of rationalism. Tafuri gives the APAO a great deal of credit, believing that the APAO was a unique example, perhaps the only that was able to unite an artistic program with a precise political program, neither art or architecture could resolve conflict in the political situation, but politics itself is the *conditio sine qua non* of architecture and urbanism. However the APAO had different individuals (intellectuals) acting and rather than integrate within the existing political structure, remained outside and autonomous and an alternative to the political game. Finally he says that “behind the formula for organic architecture diverse tendencies were hiding that weren’t long to be brought into the light: for Zevi this was the identification in some way with the architecture of Wright even as he was always trying to establish a formula for a methodology that would be a larger and more open vision, for others it was a purely political situation, for the majority it was an arena of the convergence of the multiple forces that in the APAO were unified and coordinated. (79)

Their goal: “Organic architecture is not historically, and is not in our intentions an avant garde –ism . We have nothing to reveal: we must develop a culture, reorient all of architectonic thinking, giving it again a profound sense, a social function, gathering inside itself a vast consensus, and create a popular education about architecture.” (“E proseguiva affermando: ‘L’architettura organica non è storicamente, e non lo è nelle nostre intenzioni, un ismo di avanguardia. Non abbiamo nulla da rivelare: dobbiamo svolgere una cultura, riorientare tutto il pensiero architettonico, ridonargli un senso profondo, una funzione sociale, suscitare intorno ad esso un vasto consenso, creare una educazione popolare sull’architettura.’” (80) But the APAO fell apart exactly in the moment when Italian architectural culture had the greatest need. (81). (Tafuri is beginning to refer to an alternative that the APAO offered to neorealism as the true solution to postwar architecture, and the presumed applicability of this approach in government programs such as the INA-Casa projects, part of the Fanfani plan of 1949. He thoughtfully developed the political and intellectual approach to these problems in Ludovico Quaroni, from his prewar experiences, his imprisonment in India for 5 years during the war, his work in the APAO and then after in practice, competitions, and his lead in bringing together intellectuals, architects, sociologists, and artists in the La Martella development in Matera, part of the UNRRA-Casas program in 1951-54.
Zevi posits a new “Post-Rationalistic Architecture,” a category which is not found in Giedion’s book, which ends the history of modern architecture with Le Corbusier (who “is the perfection, all

Another interesting commentary of the role of the architect/intellectual in postwar Italy is also noted by American G.E. Kidder Smith in *Italy Builds/L’Italia Costruisce* (New York: Reinhold Publishing Corporation, 1954), a project partly supported by a Fulbright Research Grant. Kidder documented the changes in Italy, writing a book that connected to contemporary moment with a survey of the repository of great historical architecture in Italy. Kidder’s comments about “The Intellectual Depth of Leading Architects,” that in part because of a “understanding of an sympathy with Italy’s great artistic heritage,” are not slaves to the past but look to understand their “inheritances” and to integrate with contemporary work. This is on the level of the integration of painting and sculpture with architecture, without copying the past, providing a unique and important contribution. For Kidder Smith, the “intellectual” is a culturally and artistically profound person, not yet active in political life. This thread however is just below the surface, as his research in the early 1950s is at the height of U.S. sponsored plans, the Marshall Plan, the United Nations Relief and Rehabilitation Administration, which simultaneously were helping Italy rebuild buildings, society, and a democratic (non-communist) government. This is an area of my future research regarding the UNRRA-Casas and is supported by a Temple University Faculty Humanities Fellowship in the 2013-14 academic year.

Other thoughts by Tafuri:

“La teoria dell’architettura organica che sollevò allora polemiche che forse non avrebbero avuto luogo, almeno nei termini che vennero adottati, se compresa secondo il suo vero significato di politica culturale, era per Zevi un modo di presentare agli architetti italiani un programma d’azione insieme metodologico e ideologico che tenesse contemporaneamente conto e dello stato di crisi del movimento moderno internazionale scosso ormai da tempo nelle sue fedi costruttivistiche, e della nuova realtà nazionale, e delle esigenze interne allo stesso sviluppo della cultura italiana. Il funzionalismo italiano, infatti, l’abbiamo già più volte notato, era stato ben lontano, per cause intrinseche e estrinseche che non staremo ulteriormente a rammentare, dal prendere le mosse da quella rivoluzione delle coscienze che aveva caratterizzato il movimento moderno europeo, anche se aveva esplicato una lotta che era finita per divenire politica e morale. Bisognava quindi tener conto del significato storico e sentimentale dell’eredità razionalista, sottolineando contemporaneamente la necessità di un superamento e di un rinnovamento che conducessero gli architetti alla testa della produzione edilizia e della pianificazione urbanistica, legando l’impegno produttivo ad obiettivi civili e ideali.(78-9) [Emphasis mine]

‘La genesi dell’architettura contemporanea si trova essenzialmente nel funzionalismo—si legge di conseguenza nella dichiarazione dell’APAO—Qualunque sia oggi l’evoluzione dell’architettura funzionale nell’architettura organica, siamo convinti che nel funzionalismo è la radice dell’architettura moderna’. L’architettura organica era quindi il superamento dialettico del razionalismo nel quale immetteva componenti nuove prima ignorate: ‘L’architettura organica è un’architettura sociale, tecnica e artistica allo stesso tempo, diretta a creare l’ambiente per una nuova civiltà democratica. Architettura organica significa architettura per l’uomo, modellata secondo la scala umana, secondo le necessità spirituali, psicologiche e materiali dell’uomo associato’. L’ programma ideologico segue di conseguenza l’enunciazione culturale: ‘Crediamo nella pianificazione urbanistica e nella libertà architettonica…”

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that comes after him can only be decadence”). Zevi finds Swedish New Empiricism, which had begun in his estimation with G. Asplund’s 1930 Stockholm Exhibition Hall in Stockholm, and sees it as “a fact, a definite symptom of the reaction to rationalism, a reaction not brought about light-heartedly but the result of a profound re-examination of values made by Swedish architects.”

Zevi is pushing directly against Giedion. Rather than the major works of Le Corbusier and Gropius being seen as the culmination of the modern movement, tainted by a mechanistic and economic rationalism, he proposes changing to architecture that is more concerned with the quality of human life (again, another abstraction). He calls this new approach “organic,” and the “post-rationalist.”

Post-rationalism, with its approach that we term “organic”, is a phenomenon that has been going on for about 20 years. It means a new and distinct chapter in modern architectural history.

Zevi clarifies his point of view in speaking of his book *Verso un’Architettura Organica* which he said was a translation of Giedion’s *Space, Time and Architecture*:

with one modification: I transposed the chapter on F. L. Wright so that it followed the one on Le Corbusier. But this was a variation of no little importance. It changes the whole historical perspective and the development of modern architecture appears in a new light.

With this, Zevi positions Wright not as a historical precedent to the work of Le Corbusier or Gropius, but concurrent, and potentially a more advanced achievement of modern architecture. It is comprehensible why Giedion chose to exclude the work of Asplund, Zevi states, but “it is inconceivable however, even within the frameword of a tendentious historical interpretation, that he considers Wright merely as a predecessor of Le Corbusier and Gropius.”

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238 Ibid., 21.
239 Ibid., 21-22.
240 Ibid., 22-23.
Wright’s “spatial conception, the imagining, designing and building of interior spaces in both the fields of architecture and town-planning.”\(^{241}\) And it is the aspect of the open plan of Wright’s that Zevi repeatedly cites as a key feature of Wright’s architecture as emblematic of modern architecture, not merely an example of the prehistory of the modern movement.

However, this discussion is not one-sided. Giedion in fact speaks at great length about Wright’s work, although Zevi is indignant that:

> To speak of “Falling Water” or the Johnson Building of Wright fifty pages before the description of the Bauhaus and seventy-five pages before the Villa Savoye and the Swiss Pavilion at the University of Paris is chronologically, scientifically and historically incomprehensible.\(^{242}\)

While Giedion discussed Wright’s work and acknowledged organic architecture as a movement, he was not the most flattering critic in his description of Wright.

Wright’s whole career was an endeavor to express himself, in what he called “organic architecture,” whatever that may be. He liked to work in the shadow of this feeling. When, on January 25, 1940, he lectured in Jackson Hall, Boston, he devoted his entire discussion to this problem of his life. He tried by a sort of Socratic dialogue, a give-and-take between himself and his audience, to define and explain it. But his effort was futile. It was clear, finally, that no explanation was possible in words, that what he meant by organic architecture could only be revealed in his work.\(^{243}\)

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\(^{241}\) Ibid., 23.
\(^{242}\) Ibid., 22.
\(^{243}\) Sigfried Giedion, “The Urge Towards the Organic,” in *Space, Time and Architecture: The Growth of a New Tradition* (Cambridge: Harvard University Press, 1991), 414. This is exactly the opposite point that the editors describe in the introduction to Frank Lloyd Wright’s *An Organic Architecture. An Architecture of Democracy*: “The photographs at the tail of the book are the best that can be given (after having viewed color films at the beginning of each of the three lectures of the buildings and life at Taliesin, Arizona) to replace the visual enjoyments of the film—unless it is that, for those at least who were present at the lectures, Mr. Frank Lloyd Wright’s vivid commentary, which is printed verbatim, *does it even better than any still photographs.*” (p. vii)
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Giedion points to a number of explicit manners in which Wright was consciously following his “urge toward to the organic” and in doing so preferred natural materials, rough stone floors, unfinished timber, with no glass or reinforced concrete (in his Chicago period). He favored the flexible open plan, siting his buildings in accord with nature, in the folds of the earth.\textsuperscript{244} Wright’s cautiousness in the use of new materials (in the age of steel frame and glass used in the Chicago office buildings) signaled for Giedion a “special conception of the needs of human nature,” and the closest he would come to a parallel description of the organic shared by Wright and Zevi.\textsuperscript{245}

\textbf{Organic after Zevi}

Giedion and Wright share some common belief that the organic in architecture arises from a free, intuitive, and perhaps irrational gesture of the creative mind, and the attempt to translate an expression of an idea through material. Giedion, however, does not seem to be able to separate this intuitive process from the architectural program that results. Zevi has several agendas in his “organic architecture” within a sociological/political frame of reference as well as within an architectural process of design and building. This is in contrast with what is held to be the rational, the geometric and the ordered as in functionalist or rational architecture, as Giedion discussed in the section, “The Urge toward the Organic” in \textit{Space, Time and Architecture}:

Giedion’s assessment seems a good one, an it is something that perhaps Wright understood as well: “I find it safer to try to build it than to try to ‘say it’ because in construction sophistry falls down whereas tactful language has the disconcerting knack of outliving itself.” (p. vii). Or, “The atmosphere was charged with a strange expectancy, not merely caused by the natural curiosity of men [sic] to meet in person a seer, the greatest architect of his country…” (pages v-vi). It is the problem at hand, how can we speak in a measured and intellectual way about the work of a man and a cult of his personality in who is regularly referred to as “genius,” and a “seer”? This seems unreconciled and perhaps unreconcilable, and gives the historian a large task to find new ways to speak about the contribution in measured ways, something that Wright and Zevi have in common. [Emphasis mine]

\textsuperscript{244} Giedion, Space, Time and Architecture, 416.
Throughout history there persist two distinct trends—the one toward the rational and the geometrical, the other toward the irrational and the organic: Two different ways of dealing with or of mastering the environment. These contrasting approaches to the problem have been evident in all cultures both early and late. Since the beginning of civilization there have been cities planned according to regular schemes and cities which have grown up organically like trees.

What is proposed here through a re-reading of Zevi’s text is a new way of thinking about organic architecture in Italy in the 1950s. Ideas about an ideal whole, a classical idea about perfection or unity were not new and were not definitive or purely rational and especially not singularly inorganic. Giedion’s taxonomy employed a set of dualities such as these categories of “rational,” “irrational,” “organic,” and “inorganic.” As a result the “organic” was left to be defined as if a “negative space” around articulated values of rational positivism, progress, development, perfection, and the conceit of the “modern” as the most advanced expression of architecture that would be transcended only occasionally by a rare genius. Given this taxonomy, the organic was inherently linked to the irrational, the inarticulate, the intuitive, and the precursive gesture. Yet the “organic” can be articulated as sets of relationships and consonance between parts, relationships governed by simple rules that lead to complex combinations. Geometric logic and mathematical proportions are the abstract underlying laws, parallel to laws in nature that will guide how the smaller building elements will fit together to create new compositions, organisms, works of art, industrial objects, architecture, cities, and territories.

Before elaborating these themes in the chapters that follow, I will first outline a selection of various approaches that have been taken in defining what constitutes an organic form in the early twentieth century. All fall short of this complex definition of the organic. For example, biomorphic, body-like

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shapes have been utilized to evoke freedom of expression and harmonious proportions that are shared with natural form for example as seen in the work of Hermann Finsterlin, the crystal-like work of Wenzel Hablik, or the work of Bruno Taut as seen in the pages of Frühlicht. This overt appeal to the biomorphic led Zevi to critique the architectural use of the word organic and caution architects to be “on guard” against two fallacies: the literal imitation of natural forms (i.e., the tendrils and flowing boughs of art nouveau and romantic architecture) and the misappropriation of the proportions and anthropomorphic references to the human body in architecture seen in expressionism.

While Zevi successfully distanced himself from expressionism and biomorphic form as representative of organic architecture, he perhaps unwittingly advocated the hexagonal and crystalline forms of Frank Lloyd Wright and the sinuous forms of Alvar Aalto as formal expressions of the organic and was able to disseminate this tendency through his magazine L’Architettura, Cronache e storia and other publications. The approach was to work with the geometric and principally planimetric repetition of spaces created by repeated elements with slight variations. Critical to Zevi’s definition of the organic is the determined resistance to static and symmetrical organization seen in the work of Aalto and Wright.

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247 Frühlicht was edited by Bruno Taut. While one may critique the formal work of the Crystal Chain group, the political and social engagement of society by its members is well-documented in Iain Boyd Whyte, The Crystal Chain Letters: Architectural Fantasies by Bruno Taut and His Circle (Cambridge, MA: MIT Press, 1985). I imagine this would have been well known to Zevi, and I speculate that while he would have likely been sympathetic to the political leanings of the group, he would have been more critical of their use of form. Zevi preferred architecture that seemed capable of change through modifications and changes in a repetitive element rather than an overall naturalistic form.

The problem with Zevi’s approach is that many Italian architects interpreted his call for organic architecture, while others criticized him for his unabashed worship of Frank Lloyd Wright, by adopting forms that looked like fragmented crystals or other geometric organizational structures that seemed to “represent” the organic. These projects were comparatively simplistic formal interpretations of what the organic should look like.249

Was Zevi successful in defining organic architecture in Verso un’architettura organica? Zevi spoke at length about Wright’s work. He believed that Wright was able to unite in an organic manner the function of the building with the desires of its inhabitants, and the relationship of the building to the landscape in which it was situated. Zevi insisted that the organic was not a stylistic category but was defined by an openness of spatial arrangements. For Zevi, Wright’s idea of “functionalism” was related to that of Louis Sullivan. Zevi viewed the concept of the open plan as a modern concept, which was common to both functionalism and organic architecture. Rather than a volumetric or decorative approach, the open plan was, above all, a spatial concept. In order to illustrate this, Zevi compared the Villa Savoye to Fallingwater, in which the loose spatial arrangement of interior spaces was matched by the poetry of volumes suspended in air.250

In Zevi’s last paragraph of “Meaning and Scope of the Term Organic when he wrote:

Architecture is organic when the spatial arrangement of room, house and city is planned for human happiness, material, psychological and spiritual. The organic is based therefore on a

249 Here I refer to the work of Leonardo Savioli, Giovanni Michelucci, Ignazio Gardella, Marcello D’Olivo, Paolo Soleri, Leonardo Ricci, Carlo Scarpa, Luigi Pellegrin, Mario Galvagni, Paolo Portoghesi, etc. Many of these architects were associated with the Florentine group of organic architects influenced by Giovanni Michelucci.

social idea and not on a figurative idea. We can only call architecture organic when it aims at being human before it is humanist.\textsuperscript{251}

In an interview in the 1990s, Zevi reflects with the distance of time on certain aspects of the period. Surprisingly, he is quite critical of Team X, where I would assume he would find points of agreement, especially in respect to the social issues as the core of their work. Zevi states that in raising questions like those of the “cluster,” the grid, the social aggregation...boiling down to nothing more than hypotheses...Perhaps the interpretation that most closely reflects the truth is that Team X was an operation of recovery of an international circuit, which it had taken part in interrupting, contributing to the closing of the CIAM.\textsuperscript{252} This is a harsh critique of a misunderstanding that might seem to be a generational difference. The new generation (including the Smithsons, De Carlo, and others) began to work with a “philosophy of aggregation rather than that of the unique, exemplary work,” muses Zevi. This approach, the idea of aggregation versus the unique and exemplary work of architecture, is similar to the whole-to-parts analogy versus the parts-up-to-the-whole metaphorical approach of organicism that I have been outlining here. It is echoed in something that Alessandro Mendini will call the metaprogetto, a complex entity versus the singular work, the unicum.

Zevi’s contribution was to recognize the organic across different scales, from the details in home furnishings, the design of the home, housing, and up the scale of the city, a concept which will be seen in the late 1950s, a moment of economic and population growth that brought housing and exponential urban growth, and hence urban planning to the fore and explode as the most critical issue in the 1960s with plans for cities on an interregional scale.

Luigi Moretti and parametric architecture

In 1954, Italian architect Luigi Moretti published an article, “Structure Comme Forme/Structure as Form” in a version of the Paris Review that was produced exclusively for international travelers between the United States and France aboard United State Lines ships. The four page bi-lingual (French and English) article by Moretti reveals an interesting link to D’Arcy Thompson.

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253 See recent publication in connection with the exhibit Luigi Moretti architetto. Dal razionalismo all’informale curated by Bruno Reichlin and Maristella Casciato at the MAXXI Museo nazionale delle arti del XXI secolo, Rome, May 30-Nov. 23, 2010, Bruno Reichlin and Letizia Tedeschi, eds. Luigi Moretti, Razionalismo e trasgressività tra barocco e informale (Milano: Mondadori Electa, S.p.A., 2010). A concurrent exhibit Moretti, Storia, Arte, Scienza was concurrently held at the Accademia Nazionale di San Luca, curated by Bruno Reichlin and Letizia Tedeschi. See in particular these essays in the catalogue, Luigi Moretti, Razionalismo e trasgressività tra barocco e informale (Milano: Mondadori Electa, S.p.A., 2010): Letizia Tedeschi, “Algoritmie spaziali. Gli artisti, la rivista Spazio e Luigi Moretti, 1950-1953” (pp. 137-186); Annalisa Viati Navone, “Un nuovo linguaggio per il pensiero architettonico”. Ricerca operativa e architettura parametrica” (pp. 409-420) and Anna Cuzzer, Giovanni Cordella, Cristoforo Sergio Bertuglia, “Testimonianza. Ricordi dell’IRMOU” (pp. 421-428). Moretti’s work with the scientist Bruno de Finetti and Cuzzer, Cordella, and Bertuglia presented the “Mostra di Architettura Parametrica e di Ricerca Matematica e Operativa per l’Urbanistica,” at the XII Triennial of Milan in 1960. This important study is well studied in this article, but should be studied more completely, as a study of the direct relationship between architects and scientists, art and science, and the interesting implications for architecture and urbanism that is alluded to in the title of the exhibition. See recent talk by Britt Eversole “Architettura Parametrica and the Problems of Intellectual Virginity, circa 1960,” Design and the Machine at MIT, Nov. 21-23, 2013.

Notably, both item 3, Os Pelviend de l’Archaeopteryx et de l’Apatornis, and item 4, Poisson Diadon et Orthagoriscus, are not attributed to D’Arcy Thompson, although they are clearly reproductions from On Growth and Form. These and other images are neatly summarized by Federico Bucci:

The first is a detail of the corner window of the Casa dell’ONB in Trastevere by Moretti, the last is a detail of the cupola of San Gaudenzio in Novara, by Antonelli. Between these two extremes are models of an internal space by Guarini, two plates from the essay On Growth and Form by D’Arcy Thompson, a verse by Leopardi, and one study of physiognomy. Understood in sequence, these illustrations demonstrate visually the scientific basis of the following theoretical argument: “A nonelementary form is constituted by a group of differences interconnected by relationships that express and mandate its order and consequentiality. The complex of these relationships is the structure of a form, that can be expressed abstractly as a group of pure relationships.”

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255 Bucci, Luigi Moretti, fn.107, page 154. Bucci continues in fn. 108, “Moretti seems to be thinking of D’Arcy Thompson’s words: “The essential task of morphology, more than describing individual cases is to compare similar forms therefore rendering the deformation of complicated figures a simple phenomenon to understand, even if the figure itself remains undefined or not analyzed. This comparative process, which leads to the recognition of a form as a variation or deformation of another; independent of its comprehension as a fundamental ‘type’ is in keeping with mathematical methodology.” D’Arcy Thompson Crescita e forma (Torino: Bollati Boringhieri, 1992, 1969), 324, 333. This seems problematic.
Figure 82 D’Arcy Thompson, *On Growth and Form* (Abridged Version, 1961), 308-9. “The pelvis of *Archaopteryx* and of *Apatornis* with three transitional types interpolated between them.

Bucci is correct but less specific than Moretti in his studies. Moretti’s interest in natural systems as relationships was to be understood through logic, especially through mathematics. He is concerned with structural systems and the rules that govern architectural creation. The *United States Line Paris Review* article was published one year after his article “Struttura come forma,” in his magazine, *Spazio* and the content of the two articles is complementary. The *United States Line Paris Review* article is not published in *Spazio* until (1957) with the name “Forma come struttura,” but the content of these essays is similar. In the *Spazio* article, “Struttura come forma,” sets the tone for the French/English article, by defining the terms form and structure and speaking about the relationship between them.

Moretti dispels the Vitruvian separation of “plastic, constructional, and functional values,” (his interpretation of *firmitas*, *venustas*, and *utilitas*) and posits a merging of the “three aspects and modalities, each separate and the definition as a summation of the three aspects.” He continues to employ a logic both mathematical and linguistic in order to highlight that logical relationships among Vitruvian values is the greater realization, and that those logical relationships are best described by mathematics:

> Evidently it is not easy for critical thought to understand that the use of adjectives can define a subject but do not define its essence. The essence arises from the complex relations in which the principal and secondary uses of adjectives, the forces and the modalities that determine and govern them, exist contemporaneously.

> This *complex of relations* [emphasis mine] that constitutes the structure, understood in logical mathematical terms alone and independently from the concrete value of the use of adjectives, constitutes and defines the subject.  

He iterates his focus on these parameters in this article and of the scientific nature of his study:

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The complexity depends on the fact that architecture, even if like every art, is reality and representation together. It has conspicuous elements of reality, some of which even determine the reason of existence of the work so that the elements seem to have an autonomous life of their own....

To simplify, if one considers structure in its form (its own and that of the spaces it indicates, the function in the form that it implicates, and the purely expressive form, these three categories of form of an architectural work must coincide and be identical, each moment indistinguishable from the other...

To better explain, if a structure is revealed in a form that, in its figuration, has a complex of relations $A$ (relations of rhythm, of rapport, etc.), a certain presence of this order $A$ must be within the structure, as pure constructive value, in the most intimate rapport of its constructive mechanics. It must be present as representation—that is only as appearance.²⁵⁷

Moretti uses complex logical descriptions to describe the dynamic way that form is understood and is constituted in perception. It is its “oscillatory movement, its dialectic” in what he describes as the identification of forms palpitating in the area of structure or of form, which is his definition of form.

*Structure-based* architecture he identifies as Roman (Hadrian) architecture, Romanesque and Gothic architecture up to the work of Brunelleschi. What he considers *Form-based* architecture is the architecture of the Renaissance and the Baroque, and some work of the nineteenth century. He is positing a new reading of modern architecture: he sees it as a dynamic, represented as (structure →form) and not from (form→structure), which he claims is exhausted and relates to “almost all the masters of rationalism and organicism.”²⁵⁸ The “expressive” message in rationalist architecture is too mute, whereas in organic architecture, is too dominant. He instead believes that an “expressive drive” can be found in the “atmosphere of structures,” by which I believe he means iterative structures like Pier Luigi Nervi, or Guido Figus, in which, through repetition and change in a

²⁵⁷ Moretti, 176.
²⁵⁸ Moretti was likely thinking of architects such as Hugo Haring and other Expressionist architects.
singular element, complexity is built up, similar to the idea of *differences* which he develops in the *United States Lines Paris Review* article. What should be avoided at all costs he warns is the “plethora of forms that with the spread of iconographic culture is submerging use, we must instinctively refuse from the beginning as many gratuitous forms as possible.”

His example of Guido Figus’s design for a thin vaulted folded plate covering for a theater illustrates his point in this article. Moretti published the series of drawings as an example of a research

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259 By an extension to the idea of *difference* is also the movement from symmetrical to asymmetrical relationships that are part of the larger discussion in organic architecture as described by Zevi, but also crucial to the study of growth itself. An important text, which was well read in the 1950s is Hermann Weyl, *Symmetry* (Princeton: Princeton University Press, 1952). This was translated into Italian *La Simmetria* (Milano: Feltrinelli, 1962). F. Bucci in fn. 111 (p. 154) links this book to Moretti’s interests (a book which is also amply illustrated with images from *On Growth and Form*):

“Moretti reviews the book (*La Simmetria*) in the index ‘Ridotto’ of *Spazio* 7 as follows: ‘Hermann Weyl has published an excellent study on symmetry for Princeton University, which is in line with few other works in witnessing the new humanism growing in America and in Europe. The world of forms, objective and subjective, in which the theme of symmetry has meaning is incisively illuminated in order to describe a vision of this magic concept. These formal worlds are subjected to different mathematical formulations of symmetry, as are the objective groups of forms in art and biology where symmetry is revealed. Bilateral, or reflected, symmetry is the most common; in art it is found in Assyrian low-relief and in Romanesque transepts, and in biology it is found in a multitude of places in the human body. Translational symmetry that is expressed in vegetables and invertebrates and that considered in time generates rhythm; translational and reflected symmetry recognizable, for example in Greek palm motif decorations, and rotational symmetry visible in many vegetables as well as in Gothic rose windows and in the trinacria jellyfish. The volume is concluded with an elegant chapter on the symmetry of crystals. Space understood as a medium for physical events brings symmetry, and therefore geometric automorphism, level with physical automorphisms, where, considering the absence of absolute orientations in space, they reside in a world of pure relationships like the world described in the famous letter by Galois.’”

method of a living structure as form. He also introduced a revisionist reading of functionalist architecture, as he states:

In fact, if by function we mean the complex of determinative parameters of spaces and their concatenations, no less than of conditions and qualities of materials, the alternative must be clearly indicated.

These parameters may be limited in number and exactly understood, and spaces and materials can be deduced with scientific rigor and therefore the possibilities of oscillations of the forms are minimal.

At this point we enter into the field of technique, or better, to the extreme limit of what I call “Parametric Architecture.” These parameters may otherwise be numerous and not easily definable, and therefore the function cannot but indicate an approximate form, a latent pre-form that only the successive process of definition of the structure constitutes as a finished figure. Is this not the typical process of structure → form?

He concludes this article with stating that architecture is essentially structure. This aphorism is key to understanding his later articles.

Finally, going beyond the investigation of the formative act of architecture, it seems that everything reveals that architecture as a fact is essentially structure, intending the word “structure” in the sense that it is used in mathematical logic, that is, a complex of relations.

To finish, I would like to say that in its characteristic concreteness architecture is structure of density and of energies. By “density of energies” I implicitly mean spaces.

Luigi Moretti, 183-4. It is here that he adds the equations of differences, Isomorphism and Structures that is printed in the United States Lines Paris Review.


Moretti, “Structure as Form, in Bucci, Luigi Moretti, 176. While not directly related, Lancelot L. Whyte, in “Atomism, Structure and Form, A Report on the Natural Philosophy of Form,” in Gyorgy Kepes, ed. Structure in Art and Science (New York: George Braziller, Inc., 1965), 21-22, defines the key terms of his title, and their use is very similar to Moretti’s and reflects a similar idea of structure being linked by mathematical arrangement. They are roughly described here: Atomism, is
The important distinctions between these articles, “Struttura come forma” (1953) and “Structure comme form/Structure as form” (1954) are masked by the similarity in titling. The distinction may not comprise an opposition, but a complementary dynamic that he uses to make his point.

A work of architecture is in every aspect both reality and representation, that is every aspect must satisfy two categories of necessity equally, like every other art form. Each aspect is therefore a result of technical and functional laws, the imposition of parametric values of reality and technique, are an expressive fact …

the “reduction of complex data to finite numbers of fixed unit factors,” Form has myriad meanings. He is using it as an “vague sense of overall shape of line, surface or volume, or more precisely for the ordering of parts which determines these shapes,” and Structure, “for this is form seen inside, as a definite arrangement, static or changing, of localizable parts, such as a pattern of points. Structure must be at least partly ordered, or it is lost in complete chaos, if such a thing exists. To the mathematical logician structure is a formal system of relations of certain logical types, and the emphasis in all usages is on the relations rather than on the terms or entities which they relate. Structure is thus the antithesis of matter.” Elsewhere in this volume, Margit Staber, in describing the definition of structure in science states, quoting Wolfgang Wieser, “‘Structure’ should be understood to mean a network of relationships of elements or of elementary processes. Structures appear wherever elements combine into a meaningful whole whose arrangement follows definite laws…The wholeness in which we discover and examine structures, we call a ‘system.’ Thus there are inorganic, organic, sociological, and technical systems,” to which Staber adds, aesthetic systems. Wieser continued: “If we say that the concept of structure in the natural sciences is gaining in importance in our time, then this means that even such natrual occurrences, which we previously tended to conceive of as linear processes, can only be explained as the result of the complex interdependence of numerous elements. Particles and linear processes are the result of dissection and abstraction and are never representative of the whole. The basis of all of this is the phenomenon of organization.” Margit Staber “Concrete Painting as Structural Painting,” in Gyorgy Kepes, ed. Structure in Art and Science (New York: George Braziller, Inc., 1965), 181.

263 While it is beyond the scope of this study, it is of great interest to follow the text of both articles in order to see what has changed in Moretti’s notion of the rules governing form that may have urged him to invert the titles though the content is similar. In “Forma come struttura,” (1957) the emphasis shifts to the unseen abstract forces that are essential to the understanding of form, or rather, that form is a direct expression of those forces.

264 Moretti, “Struttura come forma,” 30. The original text reads “Un’opera di architettura è dunque in ogni suo punto realtà e rappresentazione, cioè ogni suo punto deve identicamente soddisfare due categorie di esigenze così come del resto ogni altra arte. Ogni punto è pertanto un fatto di ordine tecnico e funzionale, che sottostà cioè alle imposizioni parametriche della realtà e della tecnica, e un fatto espressivo….”
Moretti takes the lessons of D’Arcy Thompson’s scientific methodology in the consideration of the influence of dynamic forces on form and extends this to a system of parameters that he applies to architecture:

The enumeration of the parameters, scientific research, the quantitative mathematical analysis of these parameters, these form a task to be tackled \textit{a priori} by the new architecture in every case. There will thus be born that architecture I have long demanded, and to which I gave the name parametric. Its ineluctable geometrical character, the rigorous interconnection of its forms, the absolute freedom of fantasy itself—which can spring up where equations cannot fix their own roots—all this will give it a crystal splendor.

The various structures of an architecture concerning each aspect of the forms—i.e. a group of differences that are always, by their substance, visible differences—are above all structures of representations, which in current language means that architecture like all other arts, is reality and representation.\textsuperscript{265}

\textsuperscript{265} Moretti, Luigi. \textit{United States Lines Paris Review} (1954), page 4 of article, unpaginated within the review. A version of this text is “Forma come struttura,” was published in \textit{Spazio}, (June-July, 1957), translated in Bucci, \textit{Luigi Moretti}, 183-84.

“The fact is not that ‘we are tired of free will, ‘as Lawrence of Arabia wrote after his battles in the desert, but we are tired of casually wasting it, of throwing into the fearsome abyss of time: we want limitations in order to know exactly where to challenge them with the most boundless fantasy. In this way new worlds of architecture will rise up, cold and clear, like crystal structures and yet also impassioned bursting with energy, dilating spaces with extreme courage, concentrating the light and condensing the shadows wherever the fabric permits.

In the same way, we are driven by our inner movement, our restlessness, our will and also our non-will, for self expression.

Seeking to render these worlds comprehensible to even the simplest and most humble minds is, in the final reckoning, the only social, or rather, moral act of the architect.”
Chapter 3: Organic Architecture in Italy: two historical paradigms

Figure 83 Luigi Moretti Mostra di Architettura Parametrica e di Ricerca Matematica e Operative nell’Urbanistica Catalogue from the XII Milan Triennale, Palazzo dell’Arte, Sept.- Oct. 1960. Curated by the I.R.M.O.U. (Istituto Nazionale di Ricerca Matematica e Operativa per l’Urbanistica, organized by architect Luigi Moretti.

Moretti’s notion of the parametric initially defines the parameters. The translation of those parameters into a measurable quantity can be used to analyze and make logical comparisons between different elements. In short, Moretti’s “parametric” architecture in which the mathematical relationships among all of the parts of a building are interconnected is a clear, specific manifestation of an “alternate organicism” because it is an ethos founded on the principle of employing a methodological logic to identify, abstract, manipulate a set of forces, relationships and elements that are inherent in nature as a means towards a new theoretical basis for the practice of architecture.
Zevi and Moretti

How did Zevi respond to Moretti’s concept of parametric architecture? Zevi wrote:

> Everything that serves to give us distance from empiricism and the rationalization in design should be applauded. Especially in a moment like the current moment in which the characteristic of the [working methods] of the majority of Italian architects is careless...if parametric architecture is not to remain a brilliant intellectual exercise, it is indispensible that research is sustained by a high moral inspiration. For now, the idea surprises and fascinates us; tomorrow, it may convince.  

Zevi is genuinely interested in Moretti’s approach and for him, this is already high praise. The two men were not accustomed to agreeing at all. Moretti was described Zevi, as “my best enemy.”

Though both Roman, they were in decidedly different camps, and had very different ideas about space and form. Moretti has an idea borrowed from a mathematical conception of groups of permutations that was developed by Évariste Galois (1811-1832) in 1832. The editor of the United States Paris Lines Review wrote in the introduction to Moretti’s article that these concepts “have only very recently begun to attain their full development outside the field of mathematics” and are

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developed in Moretti's analysis of structure as form. Moretti emphasizes that forms reveal themselves “by way of the differences appearing between one form and another.” It is then in this setting itself off from other forms that form become clear. Moretti represents this as computational logic, by “positive signs and by the absence of signs, that is, by a zero.”

Moretti’s thesis is that abstraction from phenomena is required, and in order to clarify these abstract relations he ascribes quantifiable sign that could then enter into relations with other signs (or elements) in a parametric relationship.

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268 Editor’s introduction to “Structure as Form” in the United States Lines Paris Review (1954), page 1 of article, unpaginated within the review. Emphasis in the original.

269 There is ambiguity here as Bucci mentions in fn. 116 (p. 155), “See G.W. Leibniz, Scritti di Logica (Bologna: Zanichelli, 1968).” And fn. 117 “I quoted Ernst Cassirer’s definition of Leibniz’s algorithm in Philosophie der Symbolischen Form (1923) because the text could be considered a possible point of departure, directly or mediated by other readins, for Moretti’s reasoning on form. See E. Cassirer, Filosofia delle Forme Simboliche. Italian translation ed. E. Arnaud, La Nuova Italia I (Firenze: 1961), 81.” In the text in F. Bucci, “Painted Words,” pp. 147-48, he describes that although ascribed to Galois, Moretti’s sources regarding “parameters” for architecture are more complex. He sees this as D’Arcy Thompson’s “theory of transformations,” Gestalt psychology and work of Max Wertheimer that explored new artistic territory, Symmetry by Hermann Weyl, Rudolf Arnheim respectively bringing both a mathematical and perception of the world of forms, looking at these two American sources, “helping to develop a parallel vein of studies explored in Italy, among other places, by pioneers such as Gaetano Kanizsa. These studies, related to gestaltpsychologie, were driven by the intuitions of Goethe, by research in phenomenology, by H. Helmholtz’s psychology of optics, and also by the theories of ‘pure visibility’ developed by Gyorgy Kepes. In this way, Moretti’s vocabulary is enriched by new and more complex elements, from Helmholtz’s “qualitates occultae” to Thompson’s grouping of differences between forms, from Galois’s “perceptual chain” to his automorphisms, and finally the structure of forrrms and isomorphisms. All this allows Moretti to emphasize the importance of “structures of works of art” and the consequential “analysis and comparison of typologies” that would “illuminate with extreme vigor every critical discussion on the works of an artist or of an entire cultural world.” Both the idea of “similarity and difference,” of ‘superimposition” and of “simultaneity and sequence” are concepts in Arnheim, which included automorphisms and Galois’s theory of groups defined through mathematical abstraction in Weyl. “The reasoning in “Strutture comme forme,” is concluded with a return to Leibniz. Moretti exemplifies his own thoughts through a series of algebraic symbols that, replacing with signs the differences, the chains, the automorphisms, the form, the structure, isomorphism, and the union of structures, seem to reenact Leibniz’s idea of a universal language of logic that is founded on signs and characters combined with calculations. In this way, with Leibniz, the circles of Lullo reappear, that is to say, that algorithm of the painted word whose research has marked the theoretical path of the architect. It is a algorithm of alchemical origin that is not to be understood as a ‘convenient tool’ but as an ‘authentic organ’ of the investigation.
The qualities of reality, that is to say the form, is born from a group of differences that join and follow one another according to a certain order, a rhythm constituting the law of the form itself. The group in the mathematical sense, produced by the differences, individualises the form, that is to say the qualities. The group by itself is not a quality, but rather a complex of pure relations between non-differentiated elements and elementary signs.²⁷⁰

Throughout the article, Moretti refers to iterative form in Guarini’s cupola, the repetitive and diaphanous corner of his own Casa dell’ONB, the change in the repeated and slightly changing form of the pelvic bone, and the fragmented yet unified image of Botticelli’s face of Venus. These examples are visual analogies of the underlying mathematical formula of Évariste Galois.

Thompson’s Diodon et Orthagoriscus exemplifies the same principle. Differences are organized in chains; form is then identified as a set of differences, or automorphism (an isomorphism of a set or a group with itself). These are then set in relationships guided by their difference, and a structure emerges because of the arrangement between the forms (ensemble des relations d’arrangement), with an isomorphism (that is having similar form, shape, or structure), a relation is set up between previously indistinguishable phenomena. Thus form is made through difference.²⁷¹

²⁷⁰ Luigi Moretti, United States Lines Paris Review (1954), page 2 of article, unpaginated within the review.
Baroque and non Baroque groups

The repetition of the image is something that grew from Moretti’s interest in Baroque form. Wanting to abolish the old distinctions between the Classic and Baroque and focus only on “non Baroque groups” and “Baroque groups,” Moretti definitely favors the “Baroque group.”

The Baroque group, during the act of transfer, leaves intact a certain quantity of energy, that is, a certain number of structures belonging to the consumer, which the consumer may or may not therefore apply according to casual reactions, depending upon the conditions of the individual and his surroundings in the moment in which the act is undertaken. The Baroque groups are generally characterized by the absence of a general structure that is immediately apprehensible with a certain degree of intellective clarity. Their consumption comes about predominantly by means of successive readings of the subgroups of which it is composed.

Moretti invites the user in to perceive the work, to activate the response. Moretti is clearly partial to the ambiguity and engagement offered by works that he classifies as exemplary “Baroque groups” such as the Fontana dei Fiumi by Bernini, the facade of San Carlino by Borromini, some compositions by Tiepolo, and above all, Michelangelo’s work, the Last Judgement, the Porta Pia, and the Pietà Rondanini. These works are not understood in one glance, but over time, by the practice, “a learning technique by means of successive temporalities and therefore a technique of consumption that is typically musical. But this tension in these works is heightened by an awareness of its dialectical opposite. Cautioning his reader to see that each work holds the tension of its opposite, he states:

Every group, Baroque or non-Baroque, always contains its opposite, feels its presence and its fascination; every paradise, whether far or near or even negated, has influence over us. Only in our current world full of impetuous winds, disappearances, contradictory and punctilious lucidity, the two categories of groups are verified almost in their pure state and

contemporaneously: the structures of Mies van der Rohe, nearly without need of concrete reading; the enchanted stories and novels of Frank Lloyd Wright; Mondrian’s monosyllables; Tobey’s palpitating rivers.

The non-Baroque groups have a tendency at this point toward disintegrating and disappearing. It is difficult in the tumultuous confusion of today to stop and perceive a bare magical diction. And after all, why not consume a more full-bodied, sensual, demanding, and unpredictable world? The narrative is, in its own right, like the act of story-telling, an act of optimism, even if it is a desperate tale. The overfeeding and the struggling of the senses that derive from it instinctively help us enter into the tale. Therefore, only the Baroque groups seem to justify their existence in today’s world. At this point, they can be understood as groups without adjectives, since they belong to a class of structures that has become solitary.273

Moretti, writing this in 1963, is very much of his time, a time of postwar expansion and the question of the role and status of the consumer, consumer goods, popular culture, art, and architecture. The changing role of the artist and consumer is paramount, just as Moretti works at the boundaries of architecture and mathematics. As discussed in the next chapter, this is the same time period of Umberto Eco’s *The Open Work*, movements such as Gruppo ’63, Arte Programmata, and other

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273 Luigi Moretti, “Strutture di insiemi,” *Spazio* (April 1963). English translation, Bucci, Luigi Moretti, 191. Annalisa Viati Navoni as described Moretti’s categorization of “Baroque groups” and “non Baroque groups” succinctly: “Moretti called ‘non Baroque groups’ those artifacts which are available in terms of immediate and total comprehension, whose structure, forms, façade, composition, etc., are understandable immediately and without doubt, as it happens in the case of some early Renaissance buildings—and the porch of the ‘Spedale degli Innocenti’ by Brunelleschi might be an example—where a module is repeated again and again. In contrast, he understood Baroque groups, by which he was charmed, as artifacts only learnt by ‘subsequent temporality’ through a process leading to a ‘mediated and intellectual’ vision of the works. It happens that a Baroque work of art presents a complex conformation, not understandable from one point of view or from a privileged perspective, but only by turning it around and collecting visual information in memory. Such artifacts also establish a kind of empathetic communication where there is place for personal and emotional reading.” Annalisa Viati Navone, “The Architect Luigi Moretti. From Rationalism to Informalism,” an essay based on a lecture at the Faculty of Architecture Warsaw University of Technology, May 29, 2012. http://www.kaiu.pan.pl/images/stories/2.2012_pdf/A.V.Navone.eng.pdf (Accessed June 1, 2013)
aspects of what he would define as “Baroque groups” were, as he would say, the only approach that seem “to justify their existence in today’s world.”

**Interlude: Openness and Indeterminacy**

The poetic aspect of ambiguity is well understood by philosopher and semiologist Umberto Eco. While Eco’s work will be discussed in more detail in the next chapter, it seems in keeping with Moretti’s fulsome description of the Baroque group, where space and form seem to appear only through a dynamic process of change and iteration, a logical process that opens to an oneiric reverie. Umberto Eco in his book *The Open Work* of 1962 frames his idea of the Open Work isomorphically as he makes his point moving between information and system theory and cultural artifacts such as music, literature, or poetry. In the chapter “Openness, Information, Communication,” Eco, in a manner similar to Moretti’s use of group theory, uses scientific metaphors in Information theory to advance a more culturally based concept of an open system. In doing so, he looks at findings in information theory to speak about the amount of information conveyed in a message. “Information theory,” he relates:

proceeds by binary choices, uses base 2 logarithms, and calls the unit of information a ‘bit’, a contraction of ‘binary’ and ‘digit’. The base of a base 2 logarithm has one advantage: since \( \log_2 2 = 1 \), one bit of information is enough to tell us which of two probabilities has been realized….To conclude, we can say that *the quantity of information conveyed by a given message is equal to the binary logarithm of the number of possibilities necessary to define the message without ambiguity* [italics his].

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Eco continues to summarize the borrowing of thermodynamics concepts as they are appropriated by information theory, and outlines the general principles of entropy. The concept of entropy is a way to measure not only the order of a system, but the increase and decrease of information. As an evaluative criteria for the fields of information theory and cybernetics, entropy signifies a loss of information, a negative concept of a system that is spiraling towards chaos and disorder. Eco’s approach is radical in that he believes that loss of information or a movement towards an entropic state is not necessarily a negative condition. He gives many examples in language and literature in which ambiguous meanings are not negative, but positive. He gives an example of partial information that is capable of containing meaning (i.e. the consonants bldg conveying the word ‘building’ while its vowels uii are deficient in information) and ambiguous meanings in poetry and prose which allow for a creative, interpretive process to enter especially in the absence of information. In a very concise, yet ambiguous and open manner, the poetic lines of Petrarch convey the emotions of the memory of love in a way that is not literally outlined:

Chiare, fresche e dolci acque—dove le belle membra—pose colci che sola a me par donna (Clear, fresh and sweet waters where she who alone to me seems woman rested her lovely limbs.)

Eco’s example is strong. Prior to divulging the spare, but pregnant verses of Petrarch, he believes that emotion can emerge even in the absence of any clear meaning. He invites us to marvel at the potency of the spare, ambiguous poem to convey the more literal meaning which he then spells out:

Let’s imagine a lover who wants to express his feelings according to all the rules of probability imposed on him by his language. This is how he might speak: “When I try to remember the events that occurred a long time ago, I sometimes think I see a stream, a stream of smoothly flowing, cool, clear water. The memory of this stream affects me in a particular way, since the woman I then loved, and still love, used to sit on its banks. In fact, I am still so much in love with this woman that I have a

275 Eco, The Open Work, 51.
276 Eco, The Open Work, 54.
tendency, common among lovers, to consider her the only female individual existing in the world. I should add, if I may, that the memory of this stream, being so closely connected to the memory of the woman I love (I should probably mention that this woman is very beautiful), has the power to fill my soul with sweetness. As a result, following a procedure that is also fairly common among lovers, I like to transfer this feeling of sweetness to the stream that indirectly causes me to feel it, and attribute the emotion to it as if the sweetness were really a quality of the stream. This is what I wanted to tell you. I hope I have explained myself clearly.”

While ambiguous in meaning, Eco attributes to this text, an originality of organization, or disorganization, “its improbability in relation to a precise system of probability, which makes it so much more informative.”

**Organicity in a “New Key”**

Enrico Guidoni in “Organicità ‘In a New Key’,” in *Marcatré* 16/17/18 of 1965 discussed the importance of Susanne Langer’s book *Philosophy in a New Key: A Study of the Symbolism of Reason, Rite, and Art* of 1942. Langer was a philosopher influenced by Alfred North Whitehead, her dissertation advisor at Radcliffe College (1926), and Ernst Cassirer, whose work *The Philosophy of Symbolic Forms* mark important sources of inspiration for her work. Guidoni sets out a way of understanding various art forms, borrowing Langer’s term “In a New Key” and applying it to the notion of Organicism, claiming that her work, *Philosophy in a New Key*, had “a notable importance in the panorama of contemporary Aesthetics.” Guidoni sees the traditional use of the term “organic” as an expansive view of organized and living beings, all that which is not disorganized or inorganic.

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277 Eco, *The Open Work*, 54.
281 For a critical discussion of the role of the unconscious in structuralist research and how this is a similar question for architectural criticism, see Manfredo Tafuri, “Instruments of Criticism,” in
Guidoni uses Langer’s text as a way to move through a newer, more ample, and flexible definition of the term *organicità* in the light of different disciplines. His discussion ranges across multiple texts and multiple examples, but again, as is characteristic of Italy in the early to mid-1960s, the use of the organic metaphor to discuss and account for urban growth is crucial to the discussion.\(^\text{282}\)

He begins the text with the pan-disciplinary importance of the concept of the “organic” in Langer’s writings:

> The sense of organic life (a) profoundly permeates the philosophical work of Suzanne (sic) Langer (b); the “new key” is constituted of a symbol that permits an extension in all fields of Aesthetics, a critical instrument of particular importance and ductility, it is the general conception of significant form, symbolic of feeling, it is refracted in a compelling unitary vision, detailed in the expressive essence of the various artistic forms.\(^\text{283}\)

In this discussion, Guidoni then speaks about artistic form in Gestalt Psychology. Art is “an experimental field” that puts into practice their theories, and allows for a “global interpretation”
based essentially on the perceptual and structural quality of the works, ignoring for all practical purposes the problem of “value” of the artistic works themselves.284

Guidoni’s bibliography is telling in how the intellectual thread of the argument can be witnessed in the various authors and texts, ranging from the expected texts by Frank Lloyd Wright, the visual perceptual work of Rudolph Arnheim, texts on the problems and doctrines of theoretical biology, analytic texts on the nervous system, studies on the morphology of animal development, and an encyclopedia of biological sciences. The physiological is crossed with the psychological and perceptual. Other texts, such as Gillo Dorfles, Simbolo, comunicazione, consumo, P. De Lantil, Il pensiero artificiale, Langer’s Feeling and Form: A Theory of Art, and W. Sluckin Mente e macchine are examples of the thinking of infusing the artificial with the robustness and complexity of the human mind and other natural systems. Key perhaps to unlocking this interplay would be Langer’s own work on logical systems as a way to model such complexities.

The new agenda, the recently cut key of philosophy, consisted of a concern with all manner of symbols—words, numbers, and other abstract forms—and with the various meanings that underlie our dreams, fill our imaginations, and draw us to treasure works of civilization, ranging from the Parthenon to the string quartets of Beethoven.285

It is useful to return to look at the implication of Susanne’s Langer’s writing on the notion of logic and organization that becomes a new working definition for the organic. In his biography of Langer,

284 Guidoni, “Organicità ‘In a New Key’,” 176. The quote from the previous note continues here: “D’altro canto, i maggiori rappresentanti della Psicologia della Gestalt, partendo da una rivoluzionaria concezione antiatomistica dei fatti psicologici, si sono interessati in modo particolare dell’arte, dapprima come campo sperimentale per la messa a punto delle loro teorie, in seguito per darne anch’essi una interpretazione globale basata essenzialmente sulle qualità percettive e strutturali, e ignorando praticamente i problemi di “valore” delle opere artistiche.” This is the verso of “art using science.” What happens when science uses art (and inherently ignores the multiplicity of art “values” such as the poetics of Eco, Moretti, et al.? The artist may feel the mutilation of art by psychologists who use it for their purposes; but do artists recognize they too are likewise culpable of mutilating science when they use it as narrowly?

285 Anthony Flood.
Donald Dryden characterizes the seemingly contradictory use of logic in Langer’s definition of form, and posits that through the use of analogy, these guiding principles can be used to describe the organization of various manifestations of an idea or order that is in some ways akin to Bertalanffy’s notion of the isomorphic (see Chapter Five). He states:

In Langer’s view logic is not limited to the principles of inference but includes a study of the structures, forms, or patterns exhibited by objects, events, and processes of all kinds; the articulation of logical patterns in this wider sense can be achieved in any medium that can be manipulated to exhibit complex combinations of distinguishable elements—the tonal materials in a musical composition or the pigments in a painting as well as the words or mathematical symbols in a piece of discursive reasoning.286

Guidoni combines an interest in the patterns of urban growth and form, both in their creation, which is organic and the understanding of the pattern in gestalt. Organicity doesn’t always have to refer to known objects, or to a functionalist idea of the parts of something working together.

286 Donald Dryden, Susanne K. Langer, Duke University, 2004. PDF biography and bibliography, 193-4. http://www.huthsteiner.org/Knauth/Susanne.Knath.Langer_Bio_DLB.pdf. Accessed 4 Dec. 2011. The quotation continues, “Langer follows Sheffer in using the term form in its most general sense to mean a complex relational structure. In An Introduction to Symbolic Logic she points out that in this wider sense, “anything may be said to have form that follows a pattern of any sort, exhibits order, internal connection.” On this view it is the business of logic, which is the science of forms or patterns, to study the “types and relations among abstracted forms, or concepts.” Everything exemplifies some form, and any given form might also be exemplified by some other thing. When two things are put together in the same way, they are “analogous”—they exemplify the same relational structure or logical form. “The value of analogy is that a thing which has a certain logical form may be represented by another which has the same structure, i.e. which is analogous to it.” When two things exhibit a common logical form, one may serve as a “logical picture” of the other. One may attend only to the form, pattern, configuration, or complex relational structure that various objects, events, or situations have in common, thereby “consciously, deliberately abstracting the form from all things which have it.” Scientific concepts “are forms which are exemplified in some general and important part of reality”; but beyond the patterns that are the objects of scientific study is a “great storehouse of forms which may be interpretable physically, psychically, or for any realm of experience whatever.” Logic is concerned with “abstracted patterns as such—the orders in which any things whatever may be arranged, the modes under which anything whatever may present itself to our understanding.” In this sense, “logic applies to everything in the world.” The study of logic, therefore, includes but is not restricted to the study of the forms of discourse—of logical inference and the structure of propositions—“logic” in the common understanding of the term.”
Guidoni claims organicism is a way of being (of things), a kind of perfection of form, that he sees in the cellular patterns in Sardinian nuraghic ancient megalithic structures.\(^\text{287}\) He takes the complexity of the aggregate structures that he sees in the center image below and breaks them down into a diagram of a set of relationships, as seen in the left image. In doing so, Guidoni shares an approach that is seen in D’Arcy Thompson in which the form of tissues is made of the accretion of individual cells, whose relationships are understood mathematically and above all geometrically, as seen in Thompson’s diagram on the right.

He reads images like this as a kind of comprehensive pattern, seen in the built form (and by implication an innate sense of geometry and pattern in ancient builders, a kind of geometric intuition). He uses these analyses as a kind of proof, confirming the presence of axes, though not rigid symmetries, with an outline that is vaguely triangular with the nodes of the ‘organism’ constituted by a tower. By the gradual addition of extra spaces, the town grew in pieces, both by addition of elements and also of subdividing the form, a “cellular segmentation” occurs because of needing to move between the forms by a network of streets. The reading of the whole image is then simultaneously derived from its resolution of the diverse needs of form and circulation and is thus

\(^{287}\) Guidoni, “Organicità ‘In a New Key’,” 183.
the evolution of the form over time that becomes comprehensible in a reading, in the gestalt of the final form.288

Continuing this line of thought, he begins a discussion about contemporary urban form, at the level of the city and at the scale of territory. Moving against what he perceives as an intellectual desire of human’s to create linear and orthogonal connections between different urban elements, he posits the “natural,” the tendency is not to create right angles or straight lines, but curves, and a triangular mesh, with center points as a way to create a flexible grid that can be used to approximate urban centers and the connection between them. This is the logic of Organicity.

Another metaphor borrowed from nature regards attraction and repulsion between poles. Here utilizes a direct analogy between a magnetic pole and the attraction, or gravitational field that a city or town would exert on a territory: equation lines of force and gravitational fields. Guidoni’s argument and the relevance of his discussion to the present work may be summarized in his description of the following image.

Figure 85 Top: the attraction or repulsion between contiguous round cells generate the hexagonal network pattern (compressed cells) and triangular (separated cells which present themselves as nodes as well).289

288 Ibid., 183.
Chapter 3: Organic Architecture in Italy: two historical paradigms

Center: partial scheme of the territory of Puglia (a region in southeast Italy), in which the towns are nodes at the center of a number of connections that tend to optimize the most direct connections. The structure is represented as lying next to the coast (the dark area at the bottom of the center image).

Bottom: a diagram of the tension that is generated in a town which is generated along the sides of a road. In specific conditions, at the outside of the poles a fan-shaped series of streets are formed, inside the form tends to fuse together, in harmony with the lines of force of a magnetic field.290

This image is clear in that it is bringing together physical phenomena at vastly different scales, unified by the diagrammatic rendering of each image. They are indicators of organization, visual symbols of a logic that are useful in describing invisible phenomena (such as magnetic fields), or providing an abstract notion of the underlying geometric order of hexagonal packing evidenced in organic and inorganic space packing in diverse phenomena from the honeycomb, to paper wasp nests to crystal geometries, and the diagramming of molecular packing. The central image is where the power of the the different scales and the adaptation of the abstract model are tested and illustrate both the organizing principle, and the possibility to identify diversity even within a flexible organizing system. The fact that he uses a territorial analysis of town centers in the region of Puglia

289 Guidoni here uses the Italian term maglia. This is key as the term colloquially is known as a jersey, a shirt most often associated with and donned by a player in a sports team. But the meaning is even more crucial to the sense of the organic developed in this chapter, because it is also really the term for a knitted fabric. To lavorare ai ferri, or knitting, or lavorare all’uncinetto, crochet, both imply the production of a maglia, as in to lavorare a, or fare la maglia is to knit. A maglia can be a mesh, a link, chainmail, or an article of clothing made of knit. But it also has another meaning, its use as the individual link, loop, or chain as in maglia alta, treble crochet, or maglia bassa in the double crochet or simple stitch. The use of this term is important in the discussion of “organic” in this dissertation as being a entity made of individual parts and the parametric relationships between the parts. Concise Oxford Paravia Italian Dictionary © 2009 Pearson Paravia Bruno Mondadori S.p.A. e Oxford University Press, http://www.wordreference.com/iten/maglia, accessed 4 December 2011.

290 Guidoni, “Organicità ‘In a New Key’,” 185. “In alto: l’attrazione o la repulsione tra cellule rotonde contigue genera il pattern a maglia esagonale (cellule compresse) e triangolare (cellule distanziate o nodi). Al centro: schema parziale del territorio pugliese, in cui i centri sono nodi con un numero di collegamenti che tende all’optimum di sei. La struttura si appoggia alla linea della costa. In basso: schema delle tensioni che si generano in un centro lungo una strada. In determinate condizioni, all’esterna delle porte (poli) si forma un ventaglio di strade, all’interno la forma tenderà al fuso; ciò in armonia con le line di forza di un campo magnetico.” This is related to the work of Giuseppe Samonà who used the terms endogenous and exogenous to describe the internal and external forces that are negotiated through time in the creation of historic cities in L’Urbanistica e l’avventura della città of 1959.
is telling of the use of the organic metaphor as a powerful tool in describing organic growth of urban fabric.

“Organicity,” Guidoni claims is “the symbolic expression of living form.” His program is to recognize this in a slowly growing city, an ersatz vitalism, but he needs mathematics as a way to be able to comprehend and even plan this growth. Having just used a hexagonal, triangulated mesh to show the changes in growth at the territorial scale he discusses the mathematical basis of what he calls the “fundamental pattern.”

The mathematical formula of this pattern is much more than just a dry abstraction, referring only back to itself. A geometric translation [extracted from the concrete example] already has in itself the base elements of the successive states of differentiation. It moves towards complexity and irregularity, and we can see little by little a movement towards an organic and dynamic [growth]. This last aspect will be understood only in part by its geometric quality of its underlying pattern, it becomes enriched and articulated and therefore becomes perceptible as a distortion of the rigid and ideal geometric base. The distortion creates the illusion of movement and of life.

The currency of the term gestalt and the importance of perception Guidoni’s analysis underscores the importance of psychological aspects of perception, and how this was of active interest to architects in Italy. Guidoni proposed a gestalt reading of city fabric as an organization, or patterning of individual buildings, using historical cities as a model of growth and how to apply rules to guide city planning in a then contemporary context. He used scientifically inspired diagrams, such as

291 Guidoni, “Organicita ‘In a New Key’,” 186. “La formula matematica di questo pattern è quanto di più astrattamente arido si possa ricollegare ad esso. Una sua traduzione geometrica avrà già in sé gli elementi di base degli stadi successivi di differenziazione. Con il procedere verso la complessità e la irregolarità vediamo a poco a poco progredire gli elementi dinamico e organico. Quest’ultimo sarà avvertito principalmente come un adeguamento soltanto parziale alle qualità geometriche del pattern di base, che si arricchisce e si articola e quenti viene percepito come una distorsione della forma rigida ideale; e la distorsione crea l’illusione del movimento e della vita.”
hexagonal space packing exhibited in soap bubbles, or beehives, or the invisible magnetic forces revealed by iron filings and to propose organizational diagrams that could be used as a guide for flexible urban development.

These underlying geometric rules that Guidoni studies in city plans and natural forms, and the ways in which elements join to form complex organized structures, will be seen vividly and literally as core principles underlying the technological development of the electrostatic photocopier. Moreover, these same principles are also demonstrated in the effect that reproduction and permutation and the arrangement of serially disposed elements create. Literally, the technology made photocopies. Psychologically, the process and product made a gestalt. Symbolically, the process and the subsequent relationships to the technology, its products, and its process become what Umberto Eco will recognize as a form. It is not a closed, classical form, but rather an “open work.”
Chapter 4: Electrostatic Attraction: Reproduction, Seriality, Permutation

Machines and multiples and Reproduction

More than seventy five years after the publication of Walter Benjamin’s seminal essay *The Work of Art in the Age Mechanical Reproduction*, the question of the individual work and its replication, and by extension repetition and seriality, were introduced as key intellectual concerns. Working within a praxis established by Benjamin by tracking the development of techniques of reproduction, this chapter will outline a brief history of reproduction techniques that pick up from where Walter Benjamin leaves off in terms of print based media: lithography.\(^{292}\)

Benjamin’s essay interrogates the profound impact that the multiple of the art object had in relation to the original work of art and the effect of his well-known term, the loss of the “aura” of the work of art. He was speaking directly to the effect on the art object, but more importantly opening the way for there to be a breakdown of the barriers to access to all art forms for the larger population. While he speaks about film as the medium most capable of transcending these previously inpenetrable boundaries, the focus here will be on another aspect that was to open up vis-à-vis the lithograph, novel in its capacity of producing viable copies of polychromic artworks, to another need that rapidly was of concern in the first decade of the twentieth century: the need for duplication of business documents.

The rise of bureaucracy and globalization propelled numerous inventions throughout the twentieth century. Some of these developments will be outlined, but the focus will be on the successful production at an industrial scale of the Xerox machine in 1959 as a key moment of the mass reproduction and diffusion of text and image. The multiple is investigated in relation to the adoption of the Xerox machine in artistic practices in the mid-1960s and the changes in art and architectural practice associated with seriality and permutation.

The work of Rinaldo Semino has been introduced in the preceding chapters. He designed modulated building components, designed to be industrially manufactured and assembled on a building site. While Semino did not build projects, his designs and models in their own right are a clear examples of what is being proposed as an alternative organicism in Italian architecture. Semino as previously discussed was influenced by the D’Arcy Thompson’s *On Growth and Form*. Thompson observed that natural forms, both plant and animal, grow from a multiplication of individual cells. These cells then are brought together in increasingly complex configurations with both internal and external rules that govern growth. These rules of association underlie form. They are guided by the mathematical, proportional, exponential, and geometric principles that affect the growth of matter and of the role that underlying mathematical principles of growth have on the evolution of form composed of increasingly complex agglomerations of cellular elements. Inherent in the understanding of these rules of association is the critical concept of the unit. Thus both the unit (the constitutive element) and the underlying mathematical rules of seriality and growth seen in nature were inspirational for artists and architects in their efforts to define rules by which permutation of form could be obtained.

It is impossible to sum up this expansive and constantly changing knowledge, but it is possible to focus on a certain aspect of science which exerted a strong influence on artists and architects in the postwar period. Reproduction, whether organic or mechanical, speaks to the issue of growth: what
are the numerical parameters of seriality, what are its limits, and how does the concept of serial change and permutation speak to the infinite? What are the limits to growth? And what is the conception of the unit or what governs the definition of the individual unit?

The place of the electrostatic photocopy Xerox machine in Semino’s architectural work opens up these questions of the unit and relationships as an exploration into the use and wider meaning of this industrial copying device. The instantaneous and potentially infinite copies that the electrostatic photocopy machine produces led to its currency as a mode of expression in art practices after it was introduced in the early 1960s. The use of the ubiquitous identical copy introduced issues into art practice that were investigated by artist Mel Bochner as a protest to the commodification of the art object and also to reveal a fascination with the underlying notion that in seriality: the link with language was undeniable. The underlying intellectual concept of the serial unites multiple disciplines regardless of their materiality: from code encryption and the revelation of the DNA code in the 1940s and 50s, to iterative art practices, to serially produced prefabricated architecture.

Though the range of works examined in this chapter differ by location and discipline, it is the strategic and critical use of the Xerox machine, which could produce instantaneous (and potentially infinite) copies that allows for a discussion of the duplicate and the multiple both in theory and form.

Starting with the early work of Bochner within a specific time period (1960-68), is a first step in discussing this issue and then it is necessary to see how this conceptual idea resonated in Italy as well. In doing so, this chapter aims to tease out relationships and to explicate associations. On the Italian side of things, the work of Italian artist Enrico Castellani and other members of the Zero Group in Milan, whose activity was centered around the gallery Azimut provide a fertile example of seriality and changes that occur through permutation. Castellani’s canvases made from 1960 on
exhibit serial change bounded by the limits of the canvas, or move beyond the canvas to triptychs and other constructions. Other Italian artists such as Giovanni Colombo, Dadamaino, and Piero Manzoni also pursued seriality in their work.

Umberto Eco’s seminal text *The Open Work* (*Opera Aperta*, 1962) was pivotal in introducing the concept of open systems. The book examines cybernetics in detail and then speaks to the contingencies of combination and openness in various expressive art forms, language, and media. Eco’s text for the exhibit *Arte Programmata* also of 1962 is an important document in not only grounding the Italian work, but in increasing the discussion in Italy regarding conceptual art, seriality, and permutation in what may be seen as an interest in the crossover from language to form-making of linguistic concerns.

For example, critic Gillo Dorfles’s analysis of Dadamaino’s work reflects the ongoing discussion in Italy regarding the linguistic in art. In some of his other writings, inspired by Max Bense’s writings, he elucidates an important concept regarding a *technical aesthetic*. This is a key concept in the redefinition of the organic in Italian architecture, and provides a theoretical lens with which to discuss the aesthetic qualities of industrialized building.

**Electrostatic attraction**

The question of reproduction of an image is tied in specific ways to the method of reproduction, and in order to understand the impact of the Xerox machine, it is useful to consider previous technological innovations which entail different conceptual ideas about what is a copy, a replica, or a permutation. Prior to the fixed type of Gutenberg in the reproduction of manuscripts, scribes copied out by hand from the original to the new “copy”. While efficacious, the copy is also notoriously prone to error. Perhaps it is the inclination to error which spurred the development of
devices like the pantograph. Developed in the 16th century, a scribe utilized this device to aid in the reproduction of the glyphs, transferred directly from the original tracing of the original document to another sheet of paper.293

The techniques that emerged between the advent of Gutenberg’s press and the invention of the electrostatic photocopy machine, were, one could say, duplicates. A duplicator produces identical documents, though none is truly the original. There is always an intermediate phase, such as a woodblock or a lithographic plate, that copies the original document and allows for the duplication of the original work.

Figure 86 Thomas Jefferson’s polygraph machine. From David Owen, *Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg; Chester Carlson and the birth of the Xerox machine* (New York: Simon & Schuster, 2004), 29.

Thomas Jefferson’s “polygraph” was an elaborate mechanism which correlated multiple pens in order for a “transcriber” to trace an original document which would be interpreted through the use of various pens. The most exceptional aspect of this instrument was how it incorporated the multiple (and necessary) trips to the ink well needed for each pen in order to trace the original. It is important to remember that continuous flow writing and drawing implements, such as the ballpoint or the rapidograph, are relatively recent developments.

In contrast, electrostatic photocopy machines use photographic technology, with its potential to reproduce the original infinitely with high degrees of resolution. Photography, developed in the nineteenth century, was in fact put into commercial use early in the twentieth century: it could produce a high quality copy, but was time consuming, messy with wet chemistry and, above all, costly. What had been a striking breakthrough in the nineteenth century proved to be a difficulty in the twentieth. While a photograph is a high definition reproduction of the original, the original was necessarily mediated by the negative and developing processes. The more significant issues for business were that photographic copies were costly and time consuming to produce and did not satisfy the need, especially in the business world, for inexpensive and rapid copying.
This need inspired numerous attempts throughout the early twentieth century to find efficient ways to duplicate original documents. One of the first attempts, the Hectograph, did indeed allow for the reproduction of a specially produced original, but was limited by the number of copies that could be made from the original. The Hectograph was produced by filling a tray with a gelatin/glycerin mix which then received an original which was drawn with a special ink on paper. Once dry, the gelatin was dampened and the paper pressed against the tray. Some of the ink was transferred to the gelatin and copies could be made by pressing paper against the pad until the last of the ink was gone. The copies, as the copies made in the first electrostatic photocopier, were each made one-by-one by hand.

The gelatin was soon replaced by a waxed paper master sheet as in the Speed-O-Print duplicator of 1950, which used a waxed paper master sheet and a kind of carbon paper. A small amount of methyl alcohol was applied to each sheet of copy paper as it entered the machine, dampening the master enough to leave a bit of the waxy purple ink from the master affixed to a rotating drum. In this sense the Speed-O-Print duplicator was an improvement in that a machine replaced the hand labor and could quickly produce numerous copies, without the laborious and error-prone mode of hand placing paper within a frame. It was soon replaced by the Multigraph, multilith offset duplicator.
What is critical in this and in other duplicating techniques, just as in lithography, is that only a finite number of copies could be made from the original. In addition, each copy would be slightly different than the next in that the copy would be degraded as the ink on the master would be consumed, or in a lithograph or metal plate print, the original would lose detail as multiple copies were made.

The electrostatic photocopier is different. There is no intermediate material phase between the original and the copy. In addition, with this process, there is no direct and physical correlation between the original and the copy: it is not mediated by a negative, plate, or incised wax sheet, rather, the process breaks down the original image atomistically into singular microscopic elements that then reconstitute the image. The image is made by using a static charge that attracts or repels a particulate toner to translate the image to be copied. This is of great interest as it is another instance of highlighting the importance in work in this period that looks at the relationship between the constitutive element and the whole. In addition, there is a sympathetic connection between the overlap between science and art that has already been introduced and is crucial to the development of the electrostatic copier. To begin, it is instrumental to explain key scientific discoveries which
would permit the confluence of various processes in the development of the electrostatic photocopier.

Figure 89 Redrawn by the author after the diagram by Michael Faraday, in “Diamagnetic condition of matter,” (Sept. 1846) in Experimental Researches in Electricity. Vol. III (London: Bernard Quaritch, 1855, reprint), 461.

Invisible to the eye, electromagnetic forces were studied and visualized by natural philosopher Michael Faraday (1791-1867). Faraday observed that of a cylinder of peroxide of iron when placed near a magnet was either attracted or repulsed by the negative and positive poles of the magnet. In his essay on “Diamagnetic condition of matter,” he verbally described in great detail what he observed as the changing positions of the cylinder in relation to the magnetic repulsion or attraction. In the diagram, redrawn above, he uses the diagram to describes the unstable movement of the iron cylinder showing just the central axis as if stopped in the the various positions, which are symmetrical around the center line of the magnet. This diagram helped to visualize the invisible forces at work. Some of these diagrams illustrate Coulomb’s law which “quantifies the force between electrostatic charges and the concept of lines of force.” The visual expression of invisible forces was furthered by studies on the use of ferrous particles which would when subject to these forces, become arrayed in patterns that would directly correlate with the electromagnetic forces at play.
Figure 90 Left: Diagram of Coulomb’s law, illustrating the repulsive and attractive qualities of a magnetic. From David Owen, *Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg; Chester Carlson and the birth of the Xerox machine* (New York: Simon & Schuster, 2004), Right: from Enrico Guidoni, “Organicità ‘In a New Key’” the top drawing studies hexagonal space-packing in a regular array. The central diagram uses the same geometry but changes the length of the connecting line. Each node is a town in the southern Italian region of Puglia. The bottom image and that which is of most interest here is the diagram uses the diagrams of attractive and repulsive magnetic forces to describe an urban condition, a street connecting two public spaces.

The resulting patterns were analogous to what Enrico Guidoni in “Organicità ‘In a New Key’” demonstrated in similar diagrams that he used to show urban and territorial development. In each diagram he used the analogy of magnetic attraction and repulsion as a guide to organization. In the last diagram which is strikingly similar to the diagram for Coulomb’s law of attraction, he shows a bilaterally symmetrical organization of radiating lines along a center spline capped at each end by a node, or he calls *pole*, taking the magnetism analogy further. The diagram represents a long street ending on each end in gates with a series of streets fanning out from the gate but along the street the lines come together, “therefore,” he states, “in harmony with the lines of force in a magnetic field.”

Other experiments with ferromagnetic materials such as iron filings also made visible the invisible forces as they align themselves “along the associated latent magnetic lines of force,” revealing the magnetic field generated by an electrical current, or electrical charge. The physical way in which iron filings reveal invisible magnetic forces was an inspiration to Chester Carlson, the inventor of the electrostatic photocopy process of document reproduction. Carlson conducted extensive research into numerous scientific discoveries and patents he was intrigued by the critical historical work of German physicist Georg Christoph Lichtenberg in addition to Faraday’s work on electromagnetism.

Figure 91 Lichtenberg figure produced by dusting insulators exposed to an electric spark. From David Owen, *Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg: Chester Carlson and the birth of the Xerox machine* (New York: Simon & Schuster, 2004).

Lichtenberg had also noted this striking physical similarity of “images” produced at the Göttingen University in 1777 which reveal elaborate branch-like pattern structures made visible by dusting insulators exposed to an electric spark. The image is a physical tracing of an invisible and fleeting electrical charge. Such figures were produced by placing a needle perpendicular to a non-conducting plate of material such as resin or glass and then conducting a high voltage surge through the needle to the surface. The surface was then dusted with a sulfite powder mixed with red lead powder, and by pressing a piece of paper to the dust patterns, a visible record of the electric charge was
revealed. Much as the ferromagnetic dust filings reveal the electromagnetic forces at play, the electrical charge also produced patterns by attracting dust to the positively charged areas during the moment of the electric charge and spark and the negatively charged areas remained free from the powder.

Figure 92 Left: Chester Carlson’s experiments using a light discharge to fix the writing. Right: An illustration from his patent for the electrostatic copying process. From David Owen, Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg; Chester Carlson and the birth of the Xerox machine (New York: Simon & Schuster, 2004).

Carlson combined these two ideas in the development of his Xerox process during 1938, adding the use of a bright discharge of light to charge and discharge the plate. What he took from Lichtenberg’s experiments was that the sulfur tended to acquire a slight negative charge, while the red lead, a slight positive charge. The negatively charged sulfur would be attracted to the positively charged area of the plate, while the lead would be attracted to the negatively charged areas. His early experiments did not use ink to transfer an image, but a sophisticated use of static electricity. A charged plate was suffused with light, which removed the electric charge from the white areas, while a plastic toner

295 Super nova metodo motum ac naturam fluidi electri investigandi (Göttinger Novi Commentarii, Göttingen, 1777).
powder was applied to the remaining area. After a process of demagnetizing the paper, the toner was bonded to the paper through heat. Thus the resulting printout reproduced the original.296

Carlson called this new process xerography from a combination of Greek terms meaning “dry writing.” Carlson’s patent for “Electrophotography,” as he first called the process, was filed on April 4, 1939 and finally granted on October 6, 1942. In the first page of the patent, he illustrates in ten figures the steps in the production of the final image. In the first figure, he shows a cross-section through the plate upon which there is an object to be copied. In figures 2, 2a, and 2b, he shows various ways in which the plate will be charged through exposure to a bright light source. In figure 3, he illustrates the dispersion of the polymer particles that will be attracted to the negatively charged areas of the plate, and the following images show the process of removing the excess particles from the plate. The plates then form a sandwich in which the paper is to receive the polymer particles, the plate is discharged of its electric charge and affixed, and finally fused through heat and pressure, reproduces the final image that was being copied.

Carlson developed the process and created an early version of the machine with the Haloid corporation and was marketed as the Model A in 1945. It required a laborious process in which the copies were processed one by one by hand, with separate compartments: one exposes the original, another holds the toner, and a third bonds the toner to the paper, all housed within a decidedly retro wooden casing. It would take another nine years to make an automatic, high speed copier possible. Key to the development was the replacement of the charged flat plate with a drum system.

296 Copies in Seconds, 35.
Haloid’s first xerographic copier was the Model A—known within the company as the “On Box”—which was introduced in 1949. “Archaic in its lack of co-ordinated design, it required more than a dozen manual operations before it could produce a copy,” the company’s chief of research wrote later. Shown here are two prototypes—with cabinets made of wood—and an early production model. All three of these machines were able to make only contact exposures, by shining a bright light through the back of an original.

Figure 93 Haloid’s first xerographic copier the Model A of 1949. From David Owen, *Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg; Chester Carlson and the birth of the Xerox machine* (New York: Simon & Schuster, 2004).
A selenium (a thin photosensitive insulator) encased a photoreceptor drum whose circumference was that of the height of the paper to be copied. A “corotron” device generated an ion charge. An
optical image, or in other words, a document, was exposed to the “photodischarge of the photoreceptor proportional to the light intensity” in the original. A “latent” electrostatic image was rendered visible with “triboelectrically” charged toner or dry ink. The toner was transferred to the paper by charging the paper to the right polarity to attract the toner from the drum surface. Once on the paper, the toner is fused to the paper by softening the polymer-based toner through heat. Then the residual toner is removed from the drum by wiping it clean mechanically, then the latent charge on the copy is destroyed by exposing it to an even illumination over its entire surface. Because of the drum configuration, these steps can occur cyclically with incredible speed.

The Xerox Corporation acquired the rights to this process, changing the name from “electrophotography” to a proprietary eponym in accord with the original drywriting, with the first X capitalized. The Xerox corporation focused on large scale corporate research and development and the photocopy, became synonymous with the term xerox. The resulting corporation and the research and development process changed both business and culture. By 1955 with Xerox Copyflo selenium drum printer that printed up to 24” wide from a continuous roll of paper with the speed of up to twenty feet per minute.

The debut in 1960 of the Xerox 914 machine by Haloid Xerox revolutionized the role of document duplication in the office even as the company’s focus on promoting this product aided in the proliferation of bureaucratic practices. Advertising was key: while the image of the developers grouped around the 648-pound behemoth might improve sales, alternate, “unique and fresh approach(es)” towards the advertising of the product were to make the Xerox 914 all that more appealing.
Figure 95 Advertising campaign for the New Xerox 914. From David Owen, *Copies in seconds: how a lone inventor and an unknown company created the biggest communication breakthrough since Gutenberg: Chester Carlson and the birth of the Xerox machine* (New York: Simon & Schuster, 2004).

With the Xerox machine high speed and virtually infinite copies were made possible. And while it had a profound influence on the business world, the expanded possibilities of reproduction would be felt far beyond the walls of commerce. Universities and other cultural institutions leased the Xerox 914 and before long, one could register the impact of this technology perhaps most significantly through its appropriation and experimentation in art practices.

**The Xerox in the Art World**

Artist Mel Bochner’s 1966 *Working Drawings And Other Visible Things On Paper Not Necessarily Meant To Be Viewed As Art* set a precedent for presenting xerox photocopies within a gallery setting.

Bochner, an instructor in art history at the School of Visual Arts in New York City at the time, was asked to curate an exhibit in the school’s gallery space. Bochner chose to show the *working drawings* of artists like Donald Judd, Eva Hesse, Dan Graham, and Sol LeWitt rather than the final products. The exhibit was running on an extremely tight budget and there was no allowance for framing the work these drawings. Bochner had unlimited access to a large Xerox machine (presumably the
Xerox 914). As he copied the original drawings, which ranged in size, color, and media, he realized that the uniform copies that emerged resembled the form of a book.

Bochner ran with the idea and in addition to duplicating the artists’ preparatory drawings, he also copied the ephemera of peripheral materials that are part of making an art work: material receipts, sketches, research in the form of pages from *Scientific American* magazine are examples of the work that he copied. Bochner then, within the bare walls of the white gallery space, exhibited four identical three-ring binders set on white cube pedestals in the center of the space. In this exhibit, the use of a xerox machine as tool and the xerox copy as medium became a material foil for the larger conceptual discussions regarding seriality that Bochner was exploring. It was a fecond issue at the time; but it too had a history.

Figure 96 Mel Bochner, copies of original drawings, receipts, technical documentation that he copied for the installation. In Johanna Burton, *Mel Bochner: Language, 1966-2006* (Chicago: Art Institute of Chicago, 2007), 126.


Seriality investigated through the reproduction and repetition of an image or element is a methodological approach and was exhaustively explored in the late 1950s and through the 1960s. Rotation, scaling, and permutation are some of the techniques employed in order to remove the
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hand of the artist as author and to speak to the systemization of form creation. Bochner wrote about many of these issues. In his essay “Serial Art, Systems, Solipsism,” he defined the working processes of Carl Andre, Dan Flavin, and Sol LeWitt in terms of their relation to the past, stating that their methodology only be termed serial.

Serial or systematic thinking has generally been considered the antithesis of artistic thinking. Systems are characterized by regularity, thoroughness, and repetition in execution. They are methodical. It is their consistency and the continuity of application that characterizes them. Individual parts of a system are not in themselves important but are relevant only in how they are used in the enclosed logic of the whole series.

And is still a concern as seen in Gerhard Richter's recent work *Tapestries*, large scale tapestries based on a single scraped painting *Abstract Painting (724-4)* of 1990 which he mirrors and repeats to create a new image which is then woven on computerized jacquard loom. This is the same painting he explores in his book *Patterns: Divided, Mirrored, Repeated*, 2012. From Carol Diehl's ArtBlog http://artvent.blogspot.co.uk/ (accessed July 17, 2013). The theme of chance and repetition is seen in his recent painting in his exhibit at Marian Goodman Gallery in the Fall of 2012. The following text which speaks to the recent interest in iterative processes states: “In this exhibition the large scale digital *Strips* reveal a rigorous system whose point of departure is his *Abstract Painting 724-4, 1990*, and whose endgame is ultimately his creation of the Strip Paintings. Using his painting as template Richter achieves, with the help of digital software, a complex system of rules for a new game of chance which imposes on the painting an extreme vertical fracturing of the space. A voluminous limited edition book *Patterns* visually documents this digital breakdown of Richter's original painting. From this volume, one can follow the results of Richter's process in action, which focuses on the many sections of the painting. As his plan develops a life of its own, it generates a process of mirroring, repetition and multiplication of ever more reduced sections, until finally a display of more than 4000 patterns are formed, as if the digital process had now assumed the role of sorcerer. The final steps of this journey of chance produce a focused distillation of these patterns into an ever more linear pictorial plane of 8,190 refined striations, but one of inchoate color and rhythmic alignments. It is here at the end of this digital process that the artist can choose to impose his will on these dissonant relationships, this raw material, in order to create from all this his richly harmonious Strip Paintings. Each of the Strip Paintings is a unique work. As Richter has said, “Chance is a given, unpredictable, chaotic, the basis. And we try to control that by intervening, giving form to chance, putting it to use.” (from an interview between Gerhard Richter and Nicolas Serota, Spring 2011, published in Gerhard Richter: *Panorama: A Retrospective*, 2011, The Tate, London, p. 27).” http://www.mariangoodman.com/exhibitions/2012-09-12_gerhard-richter/ (Accessed July 13, 2013)


Bochner has described this way of working as a “progressional procedure.” In relation to the existence of the work to nature and natural organizations, a kind of “heightened artificiality,” Bochner asserts, is legible due to the “clearly visible and simply ordered structures” that serial works use. He also invites the reader to think about how these works exist within their environments. In the case of these works, that environment refers to the gallery or museum architectural setting, but in the world of architecture, the environment denotes the landscape and cityscape. And in architecture, seriality is pursued in modular building components and systems which will be examined shortly.
Bochner opens another essay, “The Serial Attitude” with a quote from American philosopher Josiah Royce, from his 1914 text *Principles of Logic*.

What order-type is universally present wherever there is any order in the world? The answer is, serial order. What is a series? Any row, array, rank, order of precedence, numerical or quantitative set of values, any straight line, any geometrical figure employing straight lines, and yes, all space and all time.299

“Serial order,” Bochner states, is a “method, not a style.” He cites various artists’ approaches and insists again that serial logics do not produce a style.300

This is not a stylistic phenomenon. Variousness of the above kind is sufficient grounds for suggesting that rather than a style we are dealing with an attitude. The serial attitude is a concern with how order of a specific type is manifest.

As a kind of primer, he sets out the basic operating assumptions in producing serially ordered works:

300 Other artists are Gego, Agnes Martin, Brigitte Riley, earlier examples of Paul Klee, and others mentioned as a genealogy by Lea Vergine in her Introduction to *Arte Programmata*. This is also related to “process” related to D’Arcy Thompson’s idea of *Growth and Form*. 

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The derivation of the terms or interior divisions of the work is by means of a numerical or otherwise systematically predetermined process (permutation, progression, rotation, reversal).

The order takes precedence over the execution.

The completed work is fundamentally parsimonious and systematically self-exhausting.\textsuperscript{301}

One wonders if the completed work is also therefore solipsistic, to borrow the term from Bochner’s title, or autonomous. In terms of art, perhaps, one may speak of the autonomous or closed nature of the system. If a system is self-exhausting, one could in theory generate all possible combinations. But to think of a system as solipsistic would be to think that the only point that one can understand is the exact present moment. It seems that in a system which begins with a singular element and builds up complexity there are important questions to be asked that will be instrumental in looking at art and more crucial in relation to architecture.\textsuperscript{302}

\textsuperscript{301} Bochner, “The Serial Attitude.” This is very interesting as an idea of a solipsim, a self-exhausting system that closes down possibilities after having originally seen all possibilities in combinations. This is also an important concept in Artificial Life computational models of growth. After a certain point, all possibilities may be exhausted and the system may slow down through a process of entropy or loss of information. Many artificial life scenarios introduce errors or random code to create a new variation (or species).

\textsuperscript{302} It is fairly common for the repetition of a standard modular unit in both art practices and in architecture. Relatively complex configurations are possible, especially in altering the joint between units. However, the desire for complexity is something that I will question more deeply in this work. Why complexity? Is this akin to the organic? In computation, the desire to build a computing machine that could begin to work at the level of complexity of the human brain drove scientific exploration in the mid-twentieth century, and is certainly a critical question in architectural practice today.
Bochner continued to explore the potential of the serial in his work, and evolved a conceptual approach to the work, highlighting the remove between “language and things.” In a similar way, Sol LeWitt, in his *Serial Project #1 (ABCD)* of 1966, exhibited the systematic formula alongside the realized artwork. In fact, as LeWitt’s practice evolved, his approach would absolutely force a reconsideration of the hand of the artist: LeWitt’s instructions allowed his works to be executed in various on-site settings, by the hands of others who followed a simple set of instructions to produce “wall drawings” of intense complexity. In his seminal text of 1967, *Paragraphs on Conceptual Art*, LeWitt clarifies what is at stake in serial art:

> To work with a plan that is pre-set is one way of avoiding subjectivity. It also obviates the necessity for designing each work in turn. The plan would design the work. Some plans would require millions of variations, and some a limited number, but both are finite. Other plans imply infinity. In each case however, the artist would select the basic form and rules that would govern the solution of the problem. After that the fewer decisions made in the course

of completing the work, the better. This eliminates the arbitrary, the capricious, and the subjective as much as possible. That is the reason for using this method.\footnote{Sol LeWitt, “Paragraphs on Conceptual Art,” in \textit{Artforum} 5, Summer, 1967: 80. Reprinted in Adachiara Zevi, ed. \textit{Sol LeWitt Critical Texts} (Roma: I Libri de AEIOU, Editrice Inonia, 1994), 79.}

While the rules or the code of producing the work is set in advance, there was never a preconception of what the final work would \textit{look like}, what its style would be. The introduction of simple rules that would produce works of great complexity spans multiple disciplines as diverse as emergence theory, architecture, and art.

**Transatlantic discussions-seriality in Italy**

There are many ways to link the previous discussion about the xerox machine as a process investigated in art making. It is also possible to see the labile nature of the process in art making directly linked to the more conceptual ideas about seriality, repetition, and pattern. It also important to focus with particular attention on the currency of this idea in Italy in particular. While this could be proven through direct evidence such as the fact that Sol LeWitt relocated from New York to Spoleto, Italy in 1980 (which is true) or that artists in Italy saw or read about Mel Bochner’s 1966 exhibit (which is uncertain), it is true that Bochner exhibited in 1967 at the Franco Toselli Gallery in Milan along with fellow Americans Sol LeWitt, John Baldessari, Joseph Kosuth to name just a few whose works were characterized in Italy as \textit{arte concettuale}, though the artist lists an exhibition \textit{Conceptual Art/Arte Povera/Land Art} at the Museo Civico d’Arte Moderna in Turin, Italy in 1970. Perhaps these kinds of “facts” are not the issue. It is about the transmission of content, concept, and work that is of interest.

In this light, Bochner was published in the first issue of Italian art journal \textit{Data} founded in 1971 by Tommaso Trini who claimed as the mission of the journal the movement past traditional art and the “neutrality” of information: a widespread sentiment at the time. This first issue also featured Mario
Merz, Daniel Buren, Giovanni Anselmo and others. The magazine was meant to be flexible and allow the artists to curate their contributions. An article in the first issue on “multiples,” was a critique of the art market and examined how the photograph could document ephemeral acts of the artist. The contradiction is that these photographs or other images were reproduced in limited series and offered for sale within specialized galleries. This was a signal change in the value of the art object and speaks to concerns that had an interest among many artists across national borders.\(^{305}\)

Another aspect of interest here is a conceptual one that is raised by the multiple: time captured through individual photographs and photographs used in series is another way to convey the sense of the serial. Exhibits, magazines, and such are possible ways the concept of the serial, interest in series works, or theoretical discussions about seriality moved across the Atlantic—in both directions.

These ideas were in the air so to speak and as artists began to have access to xerox machines new ways to reproduce all kinds of images and incorporate them into artworks multiplied dramatically. Artists involved in movements such as Arte Povera experimented with mundane, prosaic materials to challenge the role of the artist within capitalist society. The experimentation in the U.S. and Italy deepened, it was in the air.

To appreciate this transatlantic journey, and beginning with the xerox machine, it is useful to look at the example of the Italian artist Bruno Munari. Munari produced works by using the xerox machine as an image making tool in the early 1970s, slightly later than Bochner’s exhibit and articles, but this later use was tied to Munari’s earlier work. Munari, known for his involvement in the Arte Concreta movement of the 1950s is a central figure in the early 1960s in his role of organizer of Arte Programmata exhibition. In his xerox work Munari’s explicit use of the xerox machine as an

instrument of art making supported the proposition that technological reproduction had merged with the intellectual concerns of seriality in art production. It was a fusion of technique and idea that was absorbed into product design and architectural prefabrication concepts and processes that had currency in Italy during the 1960s.

Munari in a key move looked at both the capabilities and fidelity of the photocopied image as well as the possibilities that are latent in the degradation of an image produced by making copies of copies. His series entitled *Sparizione dell’immagine* (The disappearing image) or the distorted portrait *Xerox 4000* are tests for his project *Xerografia. Documentazione sull’uso creative delle macchine Rank Xerox* (*Xerography. Documentation of the creative use of the Rank Xerox Machine*) of 1972.306

![Figure 102 Bruno Munari, Xerografia originale (Original Xeroxes), 1972. Reproduced in Quaderni di design,” n. 4, (Bologna: Zanichelli, 1977).](image)

He also created a beautiful series of repetitively patterned xerox works entitled Xerografia originale (Original xerograph) which were tests for a publication Xerografie originali: un esempio di sperimentazione sistemica strumentale (Original xerographs: an example of systematic experimentation [through the use of] an instrument/tool) in 1977. The Xerografia originale images testify to Munari’s continued experiment with the xerox machine in making work. In one approach he placed dimensional materials on the glass flat bed of the copier and used the moving light scanner under the glass to record the dragging of an image across the glass, the white bands interrupting in a regular sinusoidal pattern through many of the images; other copies record the complete degradation of an image to a pattern of charged particles. In all of these images though he is drawn to the repetition of self-similar elements, bands, concentric geometry, and series. As the title suggests, Munari saw the xerox machine as a tool for art making. Through a systematic experimentation he was able to expose other levels of order in the random processes of making copies.

Looking at the work of Bruno Munari is one way to open up a larger discussion about transatlantic discussions of artists but is also a marker for the multi-leveled and yet more invisible and

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308 These images in particular are tied directly to the iron filing scientific experiments of Michael Faraday and are strikingly similar to the magnetic pieces shown later in this chapter by artist Davide Boriani.

309 These are reproduced in Gloria Bianchino, ed. Bruno Munari: Il Disegno, Il Design (Mantova: Corraini, 2008). The pages are not numbered therefore the references indicate image numbers. The first series for Rank Xerox are Images 339-342 and for Xerografia originali images 440-466 in which he also copies dimensional materials on the flat bed, or uses the xerox to record the dragging of an image or the complete degradation of an image to a pattern of charged particles, or that the image is then moved to the coherence of a pattern from the chaos of the particles as seen in images 465 and 466 (with catalogue numbers B034045S-C6/516 and B034044S-C6/515. This book is a catalogue in a series “Archivi del progetto,” and is a catalogue of an exhibit held at the Salone delle scuderie in Pilotta, Parma in 2008 and is based on the materials donated by Bruno Munari to the CSAC at the Università di Parma (Centro studi e archivio della comunicazione).
simultaneous transmission of ideas that move through exhibitions and publications, and easily move across air and sea.

**Seriality, rules, combinatorials, algorithms, and the question of structure**

Bochner’s extended oeuvre and writings are a critical point of reference for the way in which an interest in the serial in art can expand exponentially. The serial removes totality; it is a method, a set of rules that engage chance (*caso*). The serial is rule-based and like language points to an infinite number of possibilities. Serial art may exemplify motifs in structuralism that had been exemplified in Lévi-Strauss’s writings. As Umberto Eco’s will show, the importance of the singular element, borrowed from a scientific atomist theory could also be applied in art. Working in series opens up the possibility of indeterminacy, as seen in the scientific writings on information theory by Warren Weaver and frequently discussed in Europe in an art context by critics Abraham A. Moles and Max Bense. Seriality, while it is open in its outcome and as an approach invites novel combinations, is rule-based, and in that sense, as in a game, or in play, there are rules. Rules could be established in the spirit of Johan Huizinga and Roger Callois, as a liberating action, that would take one past one’s

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own personal creativity into a more socially related act.\textsuperscript{311} The use of chance in the game is governed by combinatorial logic, algorithms, permutation, iteration, all with an operative rigor.\textsuperscript{312}

Such possibilities are discussed directly by Umberto Eco in “Series and Structure,” originally published in \textit{La Struttura Assente (The Absent Structure)}.\textsuperscript{313} Eco examines Lévi-Strauss’s introduction to \textit{The Raw and the Cooked}, in which he reminds the reader that “serial thought is a contemporary cultural current that must be carefully distinguished from structuralism precisely because they have so many features in common.”\textsuperscript{314} Eco uses communication theory to analyze the transmission of information in code, and states that:

\begin{quote}
 every message calls the code into question. Every artistic message is a discourse on the language that generates it. At the extreme, each message posits its own code; each work is its
\end{quote}

\begin{flushleft}
\textsuperscript{312} See Abraham Moles, “Manifest d’art permutationnell,” \textit{Rot}, n. 8 Stuttgart. The underlying question in much of Programmed art is that it was meant to subvert the capitalist structure by actively involving the viewer in the performance of the work as well as to diminish the importance of the role of the artist in the production of art as well as to intentionally undermining the capacity of a work of Programmed art to be reduced to a consumer object. It is probably safe to say that these goals were not attained as the works were collected, exhibited etc., and thus complicit with the capitalist project. However, it is still very important to discuss the work within the context of the moment, and the optimism of the success of opposition, a point that is as important today as it was 50 years ago.
\end{flushleft}
own linguistic basis, a discourse on its own poetics, a declaration of freedom from all those ties that presumed to determine it in advance, the key to its interpretation.  

The salient feature of Eco’s analyses is that he breaks down any message, any artistic utterance into discrete units, musical notes, words, elements that may be recombined, and the very act of their combination is the “key to its interpretation.” In this act of making, both code and artifact are produced. The variations of combination of these units (to use a generic term for the moment) are then open to recombination and selection. This is the strength then as, “a series, qua constellation, is a field of possibilities that generates multiple choices.” He clarifies the distinction between series and structure further:

The main goal of serial thought is to allow codes to evolve historically and to discover new ones, rather than to trace them back to the original generative Code (the Structure). Thus, serial thought aims at the production of history and not at the rediscovery, beneath history, of the atemporal abscissae of all possible communication. In other words, the aim of structural thought is to discover, whereas that of serial thought is to produce.  

Eco moves back and forth in this chapter with examples of serial thought and continues the dialogue with Lévi-Strauss, which speaks to the depth of his work. But if, as Eco outlines, the aim of serial thought is to produce then the fair question is then how this is useful for artists or architects, rather than following every aspect of Eco’s discussion with Lévi-Strauss. He states this emphatically:

Permanent structures may well underlie all modes of communication, but the aim of a serial technique (technique rather than thought—a technique that may imply a vision of the world, without being itself a philosophy) is the construction of new structured realities and not the discovery of eternal structural principles.

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316 Ibid., 220.
317 Ibid., 221.
318 Ibid., 227. Eco sums up this discussion in this paragraph on page 232: “The main problem with the structural method (the very term ‘method’ here should indicate that the problem has a solution)
It seems that Mel Bochner in his term of the *serial attitude* is very much in agreement with Eco’s *serial thought*. To think serially, or rather to have a *serial attitude* is to use this technique to produce work and to offer new modes of interpretation, something that will be a central idea for the *Arte Programmata* movement in Italy and for which Umberto Eco wrote the main exhibition essay.

Working in series and generating new combinations is a way to question existing structures and hierarchies and generate “new forms of communication.” This opening up is crucial to Eco’s work and because of his ability to see deep connections through various media from language, to art, to music, to poetry, to social organization, his work was deeply influential in the art world and made him a primary contributor to the movements of the time.

**Arte Programmata. Arte cinetica, opere moltiplicate, opera aperta. 1962.**

1962: a year in which Umberto Eco published his book *Opera Aperta*, wrote the essay for the exhibit catalogue *Arte Programmata. Arte cinetica, opere moltiplicate, opera aperta* and a witty and prescient article “La forma del disordine,” [The form of disorder] published in the *Almanacco Letterario Bompiani: Le Applicazioni dei calcolatori elettronici alle scienze moralie e alla letteratura*, all of which propose the new “poetic possibilities of what is formless, thus trying to give a form, a new form, to what was

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is that, in order not to be confused with an antihistorical science, it must constantly avoid any identification between the Structure it seeks and any given series, taken as the privileged manifestation of the universals of communication. Once this ambiguity is removed, the serial method will appear as the other dialectic side of the structural method, the side of becoming as opposed to that of permanence. Series will no longer be a negation of structure; rather, it will be the expression of a structure that questions itself and sees itself as a historical phenomenon—and this is not so much in order to deny itself all possibility of research as in order to turn the utopia of an ultimate reality into a regulatory principle for an investigation in progress (which should always push beyond the structure, toward its very basis, toward an ulterior code of which the structure is just a message). In other words, series will be a structure that, recognizing itself as the mere temporal manifestation of an ulterior code, is constantly looking for it within itself, in a state of continuous tension and permanent methodological doubt which alone can produce meaning.” [Emphasis mine].
generally considered to be ‘disorder’ in its pure state.”

Eco’s articles pose questions about not only formlessness and disorder, but also about form and order and program, especially program as logic or as the logic of the serial.

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Se si vuol poi parlare di ‘opera aperta’, la definizione ‘di forma costituita da una costellazione di elementi in cui l’osservatore individui, secondo una selta interpretativa, i vari collegamenti possibili, e quindi le varie possibilità di configurazioni diverse—al limite, intervenendo di fatto per modificare la posizione reciproca degli elementi”, deve allargarsi fino ad includere, in questo senso, anche ogni manifestazione artistica di tipo neoconcreto o meglio di tipo neoestetico, del quale le opere di cui parliamo sono partecipi, ma che comporta un altro genere di riferimenti e di metodi di giudizio.”

The internal quotes are from as she state, the catalogue organized by Bruno Munari at the Olivetti showroom in Milan in May 1962. She also gives and example of a programmed work based on a work is continuously different as a viewer (or user) interprets the work and it is always a different interpretation. “In questo senso la Venere di Milo è opera programmata—perché svolta secondo una virtualità formale che ne moltiplica I contenuti linguistici, nel senso che ad una visualizzazione globale si aggiunge (o si contrappone) una visione ravvicinata dei particolari, ed ogni visione successiva presuppon la permanenza della precedente; nel senso che ha alcuni punti di vista prestabiliti (cioè secondo una costante); è opera cinetica perché varia col variare della prospettiva visuale; è opera aperta perché si svolge in un rapporto dialettico con l’osservatore, tanto che, al limite, si potrebbe dire che, non esistendo l’osservatore, l’opera non esiste.” [Emphasis in original].

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What is programmed? What is Programmed Art? It is a term that had already been used by Eco in his essay “La forma del disordine,” in the *Almanacco Letterario Bompiani* of 1962, an annual review published by Bompiani publishers in Milan, for which Eco worked as a senior non-fiction editor. He also wrote for *Il Verri*, a journal founded in 1956 by Luciano Anceschi, father the artist Giovanni Anceschi, member of Gruppo T, who will be part of the *Arte Programmata* exhibit. This issue is groundbreaking in that it focused on the early use of the computer, or “electronic calculator” in various artistic forms, hence and idea of “the programmatic wisdom of the precise sciences” brought to bear upon the process of creating art. Entitled “Le applicazioni dei calcolatori elettronici alle scienze morali e alla letteratura,” (“Applications for the electronic calculator in the sciences of morals and in literature,”) the essay brought a new viewpoint to art making.

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moral sciences and in literature”), it is telling that this publication, intended for the educated general reader, has its finger on the pulse of the enormous impact of scientific and technological advances on society and culture. In this article of the computer’s impact and the programmatic wisdom of the precise sciences, Eco invites contemplation of the “serial thought” that he cites in his essay on “Series and Structure.”

In addition to Eco’s essay, many different cultural areas are covered on this issue such as
“computation and literature,” ideas for the possibility for a digitized library, automatization of phonetic research, excerpts from literature (Franz Kafka, Alain Robbe-Grillet, Raymond Queneau, Karel Čapek), a survey of literature from Brazil, Hungary, Spain, Germany, Russia, American, etc. and Italian literature and poetry. It also covers various exhibits and happenings in various parts of the world in art and architecture, in addition to theater, music, television and cinema. It was an annual almanac and ended by covering those of note in cultured society who had passed away during the year.322


Figure 105 Umberto Eco, “La forma del disordine,” in Almanacco Letterario Bompiani 1962. Le applicazioni dei calcolatori elettronici alle scienze morali e alla letteratura (Milano: Bompiani, Dec. 1961), 178-
179. Top: Gianni Colombo, in successive moments, 4 circles cross through a square according to a simple set of rules. Lower left: Soto, “an aspect of the combinations formed by an irregular three-dimensional mark across a lined surface. Right middle: Enzo Mari, *Opera* 305. Bottom right: In 10 different moments 9 vertically oriented articles are reduced from 9 to 0 while nine horizontally oriented rectangles grow from 0 to 9 according to two different schemes. [Translation mine]

Eco’s essay, “The form of disorder,” is integrated with an image essay “Arte programmata,” with drawings and paintings by Giovanni Anceschi, Davide Boriani, Enrico Castellani, Gianni Colombo, Gabriele Devecchi, Karl Gerstner, Enzo Mari, Bruno Munari, Diter Rot, Soto, Karl Gerstner, and Grazia Varisco, many of whom will be involved in the *Arte Programmata* exhibit. In what Massimiliano Gioni describes as “half-prophetic, half-comic tone,” of the the author, he highlights that Eco gives the viewer of the abstract artworks a primer of how to “read” the work, by necessity leaving behind any clue that would be inherent in representational works that rely upon perspectival project to translate a resemblance of the three-dimensional world to the two dimensions of the painted wall or canvas:

Rest your eyes on the “cybernetic permutation” [referring to Munari’s work, *Pertubazione cibernetica* above]; let them follow along slowly, enter into the play of these rotating rods, let yourselves be taken prisoner by this graphic symbol as perfect as that esoteric one of the snake that bites its own tail. And so enter into this curved finite and limitless space. And now try to avert your eyes, to rest them on a single detail. You will no longer be able to do it, you will be drawn into the dance of the provisional and the relative, you will accumulate information that cannot be identified with a single meaning but with the totality of possible meanings, you will not receive a message, but the possibility of many coexisting messages. And you will no longer find the tranquilizing coordinates that indicate above and below, right and left. The cosmos explodes, expands, where will it end? The observer of Renaissance perspective was a good Cyclops who rested his only eye on the crack of a magical box in which he saw the world from the sole possible viewpoint. Munari’s man is forced to have a thousand eyes, on his nose, on his nape, on his shoulders, on his fingers, on his backside. And his is turned inside out, uneasy in a world that batters him with stimuli that assails him from all sides.  

Among other important concepts discussed, the description of this image as a “curved finite and limitless space” is the most interesting. This is exemplary of the seeming contradiction of finiteness and limitlessness possible in a single static image. Many of the works shown in this essay or those that will be included in the *Arte Programmatica* exhibit are kinetic works, activated by a user or by mechanical means. Eco’s text is playful, it invites the user to be an active participant, if not physically, at least intellectually, a ludic act which actualizes the virtual possibility inherent in a static work. In this playful essay, meant for a general, but educated audience, he connects the artworks shown to the larger issue of the *Almanacco*, that of studying the effect of computation on culture and society. He speaks of chance [*caso*], tying this to larger phenomenon in the universe: alluding to the creative force of chance. But the subtext is that humankind has an innate desire to control its surroundings; nature, its modes of expression and desires an inherent order that will allow the

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comfort of being able to interpret the signification of all manner of expression. The invention of the computer, the attempt to create artificial intelligence, in what he terms a “new cosmology” and those who work with information, the buildings that contain these machines are new temples, the computers contain the possibility of “new stories of creation,” and he adds:

But the technicians of the new statistical cosmology remain reticent and silent in the great sterilized monasteries erected by the Industrial Church, and almost as if they were holding the world in great contempt, they perforate on cards the binary signals of their immense cybernetic summae. They are the Bit Generation.

The “bit generation” is not only the computer programmers but is a generation of its time, a time in which art and science are mutually influenced, in which science speaks of the role of chance and disorder in all phenomena, and as Eco points out that “Art flings itself into Chance, and makes it its own.” Eco’s bold assertion is that “abstract expressionism, action painting and musical neo-dada,” are all romantic appropriations of chance. He then poses his question: Will artists be able to understand Chance in advance, to, as Eco states:

predict it, program it, not choose it once it has happened, but make it happen according to the unavoidable rules of statistical probability, where the height of randomness coincides with the height of predictability?

Again Eco draws attention to the aesthetic possibility of art work generated by harnessing chance (if one could) and raises important questions about the role of selection and interpretation, in this case in the example of a poem, published elsewhere in the Almanacco, by Nanni Balestrini, who used the computer (he is a poet and a programmer-engineer Eco informs us) to generate 3,000 “variations of the same group of verses,” only few of which would, he muses, have a “high lyrical value.” But this is not his point for he continues that the validity of this method (if there is any) consists in:

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324 Ibid., 210.
325 Ibid., 211.
precisely the fact that there are three thousand poems and they have to be read all together. The entire work lies in its variations, indeed in its variability. The electronic brain has made an attempt at an “open work”.

The importance for all of this work is that Eco welds technology and technique in the process of creation of a new work of art, an open work, as Eco outlines lies in the “coexistence of the variations.” Eco’s text sets out a logic that demystifies. He tells the reader what they are looking at and shows works that defy easy categorization, but all immediately seem mechanical and uninspired by human agency especially in contrast with the recent expressive movements in art such as the Arte Informale movement in Europe or Abstract Expressionism in the United States. The activation of the human intellect, the creation of multiple variables, the reflection on the immensely improbable order that emerges out of chaotic natural processes are the issues that are at stake in Programmed Art and in the act of interpreting a work of art. Eco does not reassure the reader. And why should he as the horrors of the Second World War were palpably present, distant by a mere seventeen years? Instead Eco is provocative: rather than an emotional and highly personal expression in a work of art, the work should invite contemplation, albeit it being a highly abstract exercise. The works are meant to make you think. Eco leaves his reader with this final thought:

326 Ibid., 211-12.
327 Arte Informale was coined by Michel Tapié in 1950. Italian artists Alberto Burri, Emilio Vedova, and Lucio Fontana are associated artists in work that highlighted the expressive gesture of the artist through the use of prosaic and unexpected materials and operations, such as Fontana’s cutting through the framed canvas, or Burri’s use of burlap and plastic sheeting often layered and burned to nod to the artist’s role in setting the stage for an act, but allowing chance to enter, challenging the role of the artist as sole generator of the work of art. Eco does not recognize these aspect of the work of the Arte Informale nor the Arte Povera which follows. While perhaps more personal expressions of the artist, the work in the use of mundane and poor materials is another direct comment and resistance to the forces of capitalism and undermines expectations regarding the market value of the work of art. But like Eco’s belief in Arte Programmata to escape the capitulation to capitalism, in time, the works, increasingly exhibited became value as art objects in and of themselves contrary to the initial intention of the artist(s).
Through the programmatic wisdom of the precise sciences one discovers the uneasy inhabitant of an expanding universe. I’m not saying it is a beautiful story. It is the story.328

This provocation is continued in Eco’s essay, “Arte Programmata” which accompanied the exhibit Arte Programmata. Arte cinetica, opere multiplicate, opera aperta (Programmed Art. Kinetic art, multiples, open work). Arte Programmata (for short) is the title of an exhibition and catalogue sponsored by the Olivetti Foundation at its showroom in Milan in March 1962.329 The exhibit was organized by artist Bruno Munari and Umberto Eco wrote the introductory text “Arte Programmata,” which

329 The 1962 exhibit was conceived and organized by Bruno Munari with the intellectual rigor of the accompanying text by Umberto Eco. The show was first in the Olivetti showroom in Milan (May 1962, Galleria Vittorio Emanuele), and then in Venice (July-August 1962, Piazza San Marco) and Rome, (October 1962, Piazza Barberini) in Italy before being shown in the Olivetti showroom in New York. In marking the 50th anniversary of the exhibit, last August 30, 2012 an exhibit Programmare l’arte. Olivetti e le neovanguardie cinetiche opened as a collateral exhibition to the Venice Biennale which hosted an exhibit Costruire la Città dell’Uomo: Adriano Olivetti e l’Urbanistica curated by Patrizia Bonifazio and Paolo Scrivano in the Italian pavilion as part of the core exhibits planned by biennal director Luca Zevi. The Programmare l’arte. Olivetti e le neovanguardie cinetiche exhibit and catalogue were curated by Marco Meneguzzo, Enrico Mortco and Alberto Saibene in collaboration with the Fondazione Adriano Olivetti and the Museo del Novecento di Milano.

The term arte programmata was originally coined by Munari and the critic Carlo Belloli and in the exhibit at the Museo del Novecento named richiamare a sé (a reference to self-referentiality of the work) a selection of works representative of, but not inclusive to the original 1962 exhibit were collected with contributions by Munari, Alviani, Bury, Landi, Mari, Gruppo N (Biasi, Chiggio, Costa) and Gruppo T (Anceschi, Boriani, Colombo, De Vecchi, Varisco) works which experiment with optical effects, kinetic structures, and with a geometrico-mathematical underpinning. Meneghio has suggested that in the recent reconsideration of the historic exhibit that he returns to the Greek origins of the word programmato: composed of pro-, before, -gramma, writing, to which he which he would like to add the subtlety of ante-scritto, preventivo, preordinato meaning a kind of pre-writing, a prefiguring, or a variability of visible functions that alternate in a way to favor a linearity similar to scientific calculation. http://www.artribune.com/2013/01/arte-programmata-il-ritorno/

Other recent exhibits on the anniversary and increased interest of this exhibit as some kind of prehistory to computation and digital art (which already existed in the 1950s and 1960s) are GNAM Galleria Nazionale d’Arte Moderna e Contemporanea, May 2012 Programmata e cinetica da Munari a Biasi a Colombo (curated by Giovanni Granzotte and Mariastella Margozzi) http://milanoartexpo.com/2012/03/09/arte-programmata-e-cinetica-da-munari-a-biasi-a-colombo-e-roma-galleria-nazionale-darte-moderna-e-contemporanea/
emphasized the expressive possibility of the computer, for the catalogue. In this essay, Eco speaks of a new kind of artist, who would work not with harmonious, Pythagorean sequences, but who

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The entire issue of the Italian literary journal II Verri 22 of 1966 was dedicated to various critical texts and works in regard to Arte Programmata. There are contributions by Gillo Dorfles (“Preambolo all’arte programmata”), Max Bense (“La teoria dei segni come fondamento della nuova estetica-Progetti di estetica generativa”), Paolo Bonaiuti (“Lineamenti d’indagine fenomenologica sperimentale in rapporto con problemi ed esperienze della progettazione visuale”), George Rickey (La morfologia del movimento: uno studio sull’arte cinetica), William C. Seitz (The Responsive Eye whose exhibit and book of the same name were published by the Museum of Modern Art in 1965), Filiberto Menna (“Situazione delle esperienze cinetiche e visuali in Italia”), and includes a section called Documents with texts by Getulio Alviani, Giovanni Anceschi, Davide Bortiani, Gianni Colombo and Gabriele De Vecchi. Other texts include Enrico Crispolti Ricerche dopo l’informale (Roma: Officina edizioni, 1968) and the more recent M. Meneguzzo, E. Morteo, A Saibene Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra. (Johan & Levi, 2012); Marco Meneguzzo, Arte programmata cinquant’anni dopo (Johan & Levi, 2012), Lucia Di Luciano and Giovanni Pizzo, Combinatorie. Arte programmata ’60 (Palombi Editori, 2007), Jacopo Galimberti, “The N Group and the ‘Operaisti’: Art and Class Struggle in the Italian Economic Boom,” in Grey Room 49 (Fall 2012): 80-101. Other exhibits at the time which connected the computer, programming, and automatic processes and questioned these in relation to the physical and political positioning of the audience and viewer included but not limited exhibits and associated publications which speak to the international interest in these themes such as: William C. Seitz, The Responsive Eye (New York: Museum of Modern Art, 1968), Jasia Reichardt Cybernetic Serendipity, the computer and the arts (New York: Praeger, 1969), Kynaston McShine, Information (New York: Museum of Modern Art, 1970) in addition to the continued publishing project of the Vision + Value Series through George Braziller, New York by Gyorgy Kepes. See also the discussion of the exhibit Arte Programmata through the
understands the fecundity of change and disorder (caso e del disordine); such an artist would utilize, but not bow towards scientific methods, by looking towards statistics and putting a more casual spin on the processes of creation. He would look for the poetic in the geometric and discover the “possibility of the formal in the informal (scoprendo le possibilità formali dell’informe), that is, how to give a form, a new form, to that which was always considered a pure state of disorder. It was Eco’s call to reuse the logic of seriality, to break it open and play with new rules.


Repeating some of his observations from “The Form of Disorder” essay, Eco begins by positioning the work by the artists presented in the Arte Programmata exhibition, (those who were “fans of the mathematizing tendency”) as linked by a common aim with the abstract expressionists (“those who made a lot of noise about tearing sculptural forms apart”) “were pursuing the same basic aim: to give contemporary human beings wider scope for perception and enjoyment.” But the approach is opposite: what he terms the “mystics” were:

upholding completed, contained, and measured form they invented within an industrial society that was accepted without reservation; while the anarchistic proponents of fractured, violated form were really protesting against an established order they could not accept. But does such a dichotomy hold? Or did not the former—exchanging abstract painting for the very concrete form of a kitchen fork or a whisk—succeed in reintegrating the art of their time within a social context, democratically introducing people at large to the appreciation of new relationships between form and function? And did not the latter, withdrawing into the fortress of their disdain and celebrating a highly individualistic type of protest, become in the final analysis the very type of artists so passionately desired by the society against which they were apparently protesting: tormented, revolutionary artists, but in their own homes and with no relationship with their fellow men?  

Eco proposes a different kind of artist, who often works (relatively) anonymously in groups and then outlines various methods by which such a work would be attained, such as by the use of mathematical programs and their iterations. These works, as alluded to in the title of the exhibition, were fixed and kinetic works which explored three-dimensional motion. The works are “open,” in different ways. Some of the works are kinetic and invite a continually changing perspective, others

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work with “constellations of multiples” not only open, but in movement. Are chance and mathematical rules mutually exclusive, he asks? One can see natural phenomena that are a result of chance as there is also an underlying mathematical order. To approximate chance, perhaps one could understand a form:

whose behavior is predictable on the basis of statistical rules, and which, as a matter of fact, measure with a sufficient degree of mathematical certainty the way random events occur. Therefore, among chance occurrences one may *a posteriori* distinguish a kind of program...Would it not be possible, to describe, with the linear purity of a mathematical program, “fields of events” in which random processes could occur? Thus we would have a unique dialectic between chance and program, between mathematics and hazard, between planned concepts and free acceptance of what will happen, but will happen according to precise, prearranged formative patterns, which do not negate spontaneity, but give it boundaries and potential directions.  

This is what is the underlying technique of Programmed Art, and the rules for its interpretation. A future critic, he muses, will look back and will be able to understand that the twentieth century person:

derived pleasure from the sight, not of one form but of so many, all co-present and simultaneous, since this fact did not in any way signify the degradation of taste, but its adaptation to an entire dynamic of perception, fostered by new technological and social conditions.

If a work is always in the state of being made, or as Eco puts it, in a state of indefinite completion, how might one judge it? It wouldn’t be in the status of the immutable law that governs its making, but truly in the appreciation of the continuous adventure of mutation. This is similar to the a dynamic perception that he ascribes to the time and also to the new technological conditions and

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333 Ibid., 99.
334 Ibid., 100.
how this would change society. The twentieth century had made mankind accustomed to new ways of simultaneously processing information, and this was constantly evolving more rapidly than ever before. How could we see the world in the same way when the astronauts Titov and Glenn in orbit for several hours saw innumerable sunset and sunrises? Eco rightfully queries. If our historically stable cycle of sunrise and sunset are fundamentally altered, a change, perhaps depending on chance would be an expression of the time. Eco ends the essay by boldly asserting that it has:

always been art that has first altered our ways of thinking, seeing, and feeling, even before (sometimes a hundred years before) we understood what a necessity it was.335

1962 is the same year in which the term paradigm shift was coined by Thomas Kuhn in his The Structure of Scientific Revolutions, no longer seen as a gradual evolution of scientific progress Kuhn posited the idea of the paradigm shift, a confluence of aspects that radically change science in a very brief time, similar in a sense to Eco’s idea of Chance. The changes in technology and the role of computation after the Second World War occurred in a startlingly brief period of time. Does the idea of Programmed Art signal such a change, a radical rewriting of the assumed norms of art production and consumption? Could this work be seen as avant garde? A salient characteristic of the work of the avant garde...of “radical” culture, was that instead of producing an autocontemplative work of art, there was an intention to construct a “project,” (not dissimilar to the serial attitude), an intervention in the world in the desire to make a change on society and culture. Critics looking at the importance of the Arte Programmata exhibit point to the problem in the “split” between the operations within the work of art and its effect in the world. One such interpretation proposes a

335 Umberto Eco, “Arte Programmata,” 101. The translation includes a note regarding the timeline of the itinerant exhibition. “The exhibition was then shown from July to August at the Olivetti showrooms in Venice, and in October in Rome, then also including works by Getulio Alviani and the Paris-based Groupe de Recherche d’Art Visuel (GRAV); from June to July 1963—from this point on without the works by GRAV—it was shown at Olivetti in Düsseldorf. Finally, and organized by the Smithsonian, the exhibition went on tour through the USA from July 1964 to July 1966.”
“continuity” between the avant garde of the 1920s and of the 1960s, based upon the mutual interest in utopia and crisis which unifies every art form and intervention, “more or less ‘projectural’, and which implicates the radical revision not only in art but also, and above all, in “value.”

336 Ernesto L. Francalanci, “Note su alcuni materiali teorici dalle avanguardie storiche agli anni ’60,” in Arte Programmatica e Cinetica 1953/1963: L’Ultima Avantguardia, ed. Lea Vergine (Milano: Gabriele Mazzotta, 1983), 19-20. “Non è fuori luogo osservare, a questo proposito, che è proprio su una questione di ‘valori’ diversi che Argan, giusto recensendo il libro di Lea Vergine Attraverso l’arte, pone l’accento per individuare I caratteri salienti dell’avanguardia, come di quel fenomeno specifico di una cultura ‘radicale’ che, invece che produrre un’arte che si autocontempli, costruisce un ‘progetto’ di intervento nella realtà per cambiarla; è proprio su questa dicotomia, su questa ‘frattura’ tra operazione dentro l’arte o dentro il mondo, che si cala il senso di una ricerca critica tesa ad individuare, come propone Lea Vergine, anche in questo attuale specifico contesto di mostra, la continuità tra anni ’20 e gli anni ’60, di quella utopia e di quella crisi, che unificò ogni forma d’arte d’intervento, più o meno ‘progettuale,’ e che implicò, proprio per ciò, la revisione radicale non solo del concetto di arte, ma anche e soprattutto do quello di ‘valore.’”
Arte Programmata is not meant to be only a kind of “poetry of the new technological universe,” seen through the vision of a stable consumer culture, a società del benessere, echoing the positivism of the economic boom, but instead was meant to be a real and true project, but the gradual disappearance of any magic aura of art and therefore the gradual abolition of the differences between art and non-art and between individual and collective research.\textsuperscript{337} In this last comment is a

\textsuperscript{337} Francalanci, “Note su alcuni materiali,” p. 20. He is quoting artist Manfredo Massironi, “Ricerche visuali,” (1973) in \textit{Situazioni dell’arte contemporanea}, (Roma: Librarte, 1976), 50-63. “Questa ricerca di un ‘valore’ complessivo sarà particolarmente evidente nell’arte programmata e cinetica; non dunque una ‘poesia del nuovo universo tecnologico’ visto attraverso l’ottimismo della nuova mitologia urbana e della incalzante ‘società del benessere,’ come è stata interpretata da molta critica, ma un vero e proprio ‘progetto,’ come già notava Massironi, di sparizione progressiva di ogni alone magico, ‘auratico,’ dell’arte e quindi di graduale abolizione delle differenze tra arte e non-arte e tra ricerca individuale e collettiva.” See also Giulio Carlo Argan, “Le ragioni del gruppo,” in M. Meneguzzo, E. Mortego, A Saibene \textit{Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra.} (Johan & Levi, 2012), 153-155. Originally published in \textit{Il Messaggero}, 21 Sept. 1963. Argan brings up an important point regarding working in groups and the gestalt: “Indipendentemente dagli assunti teorici e funzionali, i gruppi di ricerca gestaltica prendono risalto nei confronti dell’impersonalismo tecnologico da un lato e, dall’altro, del personalismo solipsistico spacciato per individualismo. La ricerca gestaltica non è riducibile alla ricerca tecnologica parallela perché il suo scopo è di verificare: primo, se e in qual modo un comportamento percettivo rigoroso possa tradursi in procedimento operativo rigoroso valga soltanto sotto l’aspetto tecnologico o anche come tipo di comportamento morale; terzo, se un comportamento morale rigoroso consegua il proprio fine nella produzione tecnicamente perfetta e socialmente utile o non esiga per attuarsi, un campo più vasto, con motivazioni e finalità ideologiche. Le correnti gestaltiche danno, ai primi due punti, una risposta affermativa; quanto alla terza, si ammette senza difficoltà che una tecnologia rigorosa non adempie a tutte le esigenze e non esaurisce le possibilità della vita morale e che, anzi, non può esservi una tecnologia rigorosa senza una finalità largamente sociale e, quindi, senza motivazione ideologiche. Una tecnologia rigorosa è quella che produce, insieme, l’oggetto e il valore; ma la coscienza del valore è già una critica del valore, cioè la condizione del suo superamento storico. Non può esservi valore e coscienza del valore senza finalità e giudizio estetico. La corrente gestaltica non identifica (e meno che mai confonde) tecnologia ed estetica, estetica ed etica: ma afferma che solo una tecnologia giudata da una coscienza del valore, o da una metodologia estetica, può situarsi nel campo etico, e che solo una tecnologia situata nel campo etico, può considerarsi una tecnologia rigorosa. Alla ricerca estetica si assegna così una funzione e una portata ‘settoriali’ ma, nel loro limite di verifica dei procedimenti e dei valori, determinante. Vi è una terza risposta, circa la funzione dell’individuo nel gruppo. La coscienza di gruppo esclude la ricerca e la scoperta individuali, per l’ovvia ragione che non ci si mette in tanti a fare quella che si può o si vuole fare da soli. Ma qui non si tratta di sapere se

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key to how discuss the artists that were part of the Arte Programmata exhibition and the preponderance of groups, rather than a focus on the individual artist.

Figure 109 Gruppo N, *Rilievo ottico-dinamico*. “On a square white surface, a series of black metal segments are arranged equally across the surface, but each is at a different angle of inclination. The external part of the section is moveable, but with the external square remaining fixed the one can obtain incredible variation.” [Translation mine]. The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra.* (Johan & Levi, 2012), unpaginated.

l’interesse dell’avventura e della scoperta individuali nel campo estetico e in tutti gli altri siano destinati o no a scomparire dalla faccia del mondo: chi vivrà vedrà. È invece estremamente importante, in un momento in cui i tempi del deprecato processo di massificazione si accelerano paurosamente, sapere se siano possibili esperienze e attività estetiche non individuali. La corrente gestaltica risponde e dimostra che si, sono possibili, ma come esperienze di gruppo e non di massa. La massa, nella sua inerzia ubbidiente, non conosce l’esigenza estetica e non può dare arte. Si spostano così i termini del pericoloso dilemma di massa e individuo; al termine ‘individuo’ si sostituisce il termine ‘gruppo’. Non arbitramente: il pericolo della situazione attuale consiste nel fatto che molto spesso invece della socialità si predica e difende la non-socialità, la solitudine della persona. Ma il singolo è disperatamente solo nel deserto, disperatamente solo nella folla. È l’individuo già spogliato di ogni interesse e attitudine sociale, disarmato, preparato a essere inghiottito dalla massa: ecco perché le correnti artistiche che vanno in cerca di indizi e di sintomi, e si limitano a constatare con indifferenza o magari, a denunciare con ira la situazione, ci appaiono, sul piano morale e politico, pericolosamente rassegnate e già, di fatto alienate. Chi voglia difendere la liber attività dell’individuo dall’inerzia torpida e letale della massa deve riflettere, anzitutto, che la qualità fondamentale della persona umana è la capacità, la volontà, di mettersi in relazione, di associarsi ad altri per un fine comune, di coordinare la propria azione all’altrui, di fare gruppo, infine, e costruire così una società che trovi nel proprio dinamismo interno l’impulso a superarsi e progredire. Non si dimentichi che la massa, o chi la dirige e la sfrutta, è sempre indulgente e perfino generosa con il solitario, quand’anche ribelle; ma tme il gruppo organico e impegnato, detesta la comunità organizzata per un fine creativo, odia mortalmente la società in movimento. Per distruggerla dalla radice è sempre capace di generare dalle tenebre delle proprie viscere un tipo mostruoso di ‘singolo’ o di ‘unico’: il dittatore Hitler.” (pp. 154-5)
Figure 110 Enzo Mari, *Opera n. 649* “Behind a translucent square screen a series of intermittently flashing colored lights are projected through a rectangular structure, a play of constantly changing colors. The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra.* (Johan & Levi, 2012), unpaginated.

Figure 111 Gianni Colombo, *Strutturazione fluida* “A long transparent plastic ribbon moves continuously in an enclosed space between two plates of glass forming a series of images that are always different.” The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene

Figure 112 Davide Boriani, *Superficie magnetica.* “A large disc, divided into irregular compartments contains iron filings. Electric controlled magnets beneath the circular disc attract the metallic dust and creates continuously changing forms.” The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra. (Johan & Levi, 2012)*, unpaginated.

Gabriele De Vecchi, *u.r.m.n.t.* 1961. “Behind a regularly perforated screen, a rubber sheet is pulled and pushed in various directions by an electric motor, making it appear that there is a networked form that is always diverse.” The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra. (Johan & Levi, 2012)*, unpaginated.
Figure 113 Gruppo N, *Interferenze geometrica.* “Elementary geometric figures (vertical and horizontal lines, chevrons) are etched on sliding panels (assuming they are plexiglas) that permit variations in the final image.” The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra.* (Johan & Levi, 2012), unpaginated.

Figure 114 Grazia Varisco, *9 x 9 x X.* “In a square space with a fixed blue light, 5 horizontal and vertical blades rotate on one of the long sides at varied speeds, always generating different conditions between light and shadow. The images are then filtered through ribbed glass.” The original catalogue is reproduced in M. Meneguzzo, E. Morteo, A Saibene *Programmare l’arte. Olivetti e le neoavanguardie cinetiche. Catalogo della mostra.* (Johan & Levi, 2012), unpaginated.

The artists whose works are considered within the overall range of Arte Programmata in a sense were simultaneously working within a country that was rapidly moving through a protoindustrial, immediate postwar condition (Italy was largely agricultural in 1950) and at breakneck speed was developing a robust industrial and consumer culture, quickly catching up by the late 1960s to countries like Britain or the U.S., which had over a century long cycle to arrive at a similar postindustrial state. It is just this absolutely strange, fast forwarded vision of the movement from the euphoria of industrial and technological possibility which I believe that we hear echoes in so many
of the works of Arte Programmata, coupled with what will soon be a fall to a postindustrial entropic state in terms of stagnation of growth and disillu- sionment with the technocratic. This is coupled with the incalculable political complexity of the recent liberation from Fascism and the evolution of the left in Italy. What may have made sense from a Marxist point of view in terms of a developing economy is quickly surpassed, leaving most artists and intellectuals in the position of coming to terms with this new postindustrial cultural landscape. But in the early 1960s the promise of technology was liberating and its aleatory expression still held currency. The formal aspects and techniques in Programmed Art were used to investigate not only the visual arts, but also industrial design, and by extension industrialized and programmed building.

**Design techniques and Programmed Art**

The works grouped together in the Arte Programmata exhibit shared an assumption about art as a perceptual phenomenon of potential variations mediated by the programming of *simple* elements. A work of “programmed art” would not have a predetermined singular reading, but would be more open for interpretation. In some cases, the “programming” is perceptible in the overall aspect and multiple readings of the work, in other cases of kinetic art, where a work is manipulated by the viewer or by motors, its reading is in a temporal sequence. In an essay, entitled “Geometria come difesa e seduzione,” (Geometry as a defense and seduction) Lea Vergine, in a section entitled *The Painting without Qualities*, echoes Robert Musil’s work *The Man without Qualities* as she describes the

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semantics of painting, exchanging singular definitions for an expanded constellation of meanings which she posits as more characteristic of modern man. Programmed art, Vergine wrote was “a diary of signs, that traces the biography of points, lines, and planes, that looks closely at what is most essential about the essential, the secret of appearance, that pull the veil to show the truth. Circles, squares, triangles, white, black, empty and solid figures that eliminate representation from painting.”

For Vergine, as programmed painting moves away from claiming its stance as painting it reveals its defining characteristic: painting without order (disposizione), or sensibility, painting without qualities. Programmed art is really tangible only in the way that it hovers between presence and absence. This idea was seen as a radical political response that could justify both being participant and outside of the capitalist project.

**The larger implications of Arte Programmata**

The Arte Programmata exhibit of 1962 was in some sense an outcome of the work of an earlier movement and also part of a larger series of international exhibitions that grappled with the intersection between technology, computation, and art, intimately linked with the importance of critical writings. To begin by looking at a precedent, there is a connection with the Movimento Arte Concreta (MAC) founded in Milan in 1948 by Bruno Munari and Gillo Dorfles, co-founders with Atanasio Soldati and Gianni Monnet, known in English as the Concrete Art Movement. The concept of a “concrete” work of art was originally introduced in the 1930s by Theo van Doesberg and Wassily Kandinsky, and in the sense developed by the MAC was a common acceptance of

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Chapter 4: Electrostatic Attraction: Reproduction, Seriality, Permutation
abstract and primarily geometric works. The members of the group were linked though located in various cities such as Milan, Turin, Genoa, and Florence. Later they were affiliated to the Roman group Forma 1, the young painters Carla Accardi, Piero Dorazio, and Achille Perilli. The groups disband in 1958, but the continuation in is discernible in Munari’s curating Arte Programmata and the growing list of shows which exhibited kinetic art beginning with the 1952 MAC exhibit in Milan which showed works in motion, organic art, transformable works, and space modulators.

The exhibit Arte Programmata brought together by the curator (and exhibitor) Bruno Munari the work of individual artist and groups already active in Italy and already being included in exhibitions abroad. In the original exhibition Arte Programmata of May 1962 in Milan (before the exhibit traveled), the works of two groups the Gruppo T and the Gruppo N were shown in addition to a

341 See Theo van Doesburg, “Manifesto of Concrete Art,” 1930 to refer to non-figurative and abstract art. The movement also included Wassily Kandinsky and Max Bill. Stating that abstraction should be free of symbolic associations, that colors and lines and the marks of painting were concrete and could be interpreted on their own merit. “It was published in the first and only issue of Art Concret (April 1930) with a manifesto, The Basis of Concrete Art. The manifesto stated: “The painting should be constructed entirely from purely plastic elements, that is to say planes and colours. A pictorial element has no other significance than itself and consequently the painting possesses no other significance than itself.” As stated in the Grove Art Online “Natural forms, lyricism and sentiment were strictly forbidden. Taking a narrow sense of the word ‘abstract’ as implying a starting-point in the visible world, it distinguishes Concrete art form Abstract art as emanating directly from the mind rather than from an abstraction of forms in nature.” (www.moma.org/collection) Max Bill continued this by organizing an international exhibition on concrete art in 1944. The movement was then continues in Italy and France in the 1940s and 1950s. In Milan, this was seen in the MAC, which was founded in 1948 with Atanasio Soldati, Gillo Dorfles, Bruno Munari, and Gianni Monnet and was related to other movements in Group Espace (1951) and Motus/GRAV (1960) in Paris, the Asociación Arte Concreto Invención (1945) and Movimento Madi (1946) in Buenos Aires, the Grupo Frente in Brazil, among others and with connections at the Hochschule für Gestaltung, Ulm, and then associated with the Gruppo Zero (1957) Düsseldorf, Gruppo T (1959) Milan, Gruppo N (1959) Padua, Anonima Group (1960) Cleveland, Gruppo Uno (1960) Rome, Group Dvizjenije (1962) Moscow, Gruppo Tempo 3 (1963), Synthese (1964) Prague. A key aspect it that the work is not abstracted from nature…but emanates from the mind!

few individuals artists. Gruppo T (referring to the T in *tempo* (time) a new spatio-temporal variable) was founded in Milan by Davide Boriani and Gabriele De Vecchi and also included the artists Giovanni Anceschi, Gianni Colombo, and Grazia Varisco); the Gruppo N was formed in 1959 in Padua, and included Alberto Biasi, Ennio Chiggio, Giovanni Antonio Costa, Edoardo N. Landi and Manfredo Massironi and were known primarily for the advancement of Op Art in Italy. The exhibit also included works by Enzo Mari, who went on later to found the Nuova Tendenza movement which united the work of the Italians to a larger international movement such as the Nouvelle Tendance, the nova tendencija series of exhibitions in Zagreb and related to *bit international* magazine and the theoretical work of Abraham A. Moles and Max Bense. These connections have recently been well-documented in the catalogue *A Little-Known Story about a Movement, a Magazine, and the Computer’s Arrival in Art: New Tendencies and Bit International, 1961-1973*. As the exhibit moved venues, the roster of artists changed as did the accompanying catalogues.

Margit Staber, working alongside Max Bill had already been writing about Concrete Art and the relationship to the Gestalt. Staber’s article, “Concrete Painting as Structural Painting,” was published by Gyorgy Kepes in his “Vision + Value” series in 1965, a series in which many overlaps are seen with artists, critics, and scientists who were working in Europe and in the U.S. In this essay, Staber, continues the interest in Concrete Art into the 1960s and while she keeps this title, she also uses many concepts and terms that have a resonance with Arte Programmata. In this essay she discussed the work of Italian artist Piero Dorazio and cited Max Bense who wrote that “an aesthetic conception could come into existence under the aspect of form and under the aspect of structure,” and “the symbol as a differentiated structure, as element, can be the basis of an integrating aesthetic process; that is how wholeness and form come into existence.” Staber then links these scientific

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processes to a process based approach common to art and the natural sciences, in which “elements and their relation to one another, the inner order, and organization of natural and artificial systems come under investigation,” as they do in art.344

On the European end, Staber wrote in the catalogue for *Konkrete Kunst* at the Biennal of Venice of 1960 (in which Max Bill participated) with enthusiasm about many of the artists who would eventually be part of the *Arte Programmata* exhibition. Staber, saw much of the work as a fertile “contamination” between new technologies and human science, in the end superceding the split between art and science without falling into rhetoric about the utopia of historical avantgarde. For her, their works, fused the absolute freedom of the artist with a controlled study of forms.345 In the spirit of experimentation, she discusses terms used by Wolfgang Metzger of the Berlin School of Gestalt theory (which also included Max Wertheimer, Wolfgang Köhler and Kurt Koffka) to describe the structure of dynamic structures such as “the direction, the distribution, the ‘structure’ of the tension, attraction, repulsion, pressure, stress, impulse, including their changes of time; of their birth, their alterations, their disappearance. Such a state of tension can suggest itself even in a simple geometric figure, as has been shown in numerous investigations.”346

344 Margit Staber, “Concrete Painting as Structural Painting,” in Gyorgy Kepes, ed., *Structure in Art and Science* (New York: George Braziller, 1965), 175, 178-181. In addition, she showed the work of Francois Morellet who was part of the Groupe de Recerche d’Art Visuel, Otto Piene, Part of the Zero group and Max Bill in addition to historical examples by Josef Albers, Paul Klee, and Piet Mondrian, among others.


A parallel exhibition to the Olivetti *Arte Programmata* was organized by Francois Morellet and the Gruppo Enne (N) in both Padua and Paris in May 1962. It was entitled *L’instabilità*, and shows the direct influence of GRAV (which had joined the *Arte Programmata* exhibition in Venice). In these exhibitions, viewers were asked to complete a questionnaire, much as would be used in statistical analysis, or psychology or sociology. They were asked for responses to question such as what the viewer thought of the works, what would be the ideal destination for the works, and what kind of relationship the viewer had to the work. This approach is similar to Gestalt studies conducted at the time, applying a kind of scientific method, a double-sided question regarding the direct experience of the work and a reflection on how the work was perceived. Only by user participation was the work completed. Already there were connections with the *L’instabilità* exhibit in Zagreb in 1961, “Nove Tendencije.” GRAV compiled a list of artist who they considered being part of the Nouvelle Tendance which included the groups GRAV, Gruppo N, Gruppo T, followed by Enrico Castellani, Gerhard von Graevenitz and Richard Lippold. A subgroup entitled “constructivist-concrete” was formed by artists Julie Knifer, Enzo Mari, Almir Mavignier, Ivan Picelj and Dieter Roth (elsewhere spelled Diter Rot). After this was a group indicated as “neo-dada” which included Heinz Mack, Günther Uecker and Otto Piene (known as the Zero Group), finally were the Tachist painters following Michel Tapié which also included Piero Dorazio.\(^\text{347}\) From just these examples one can see the growth of a new kind of creative work. Overall there is an interest in “Structure and applied form” (the name of a 1961 article), an interest of the artist being integrated with society, often acting in a collective in an increasingly technological society.

In December of 1961, five months before the Milan exhibit, in the La Cavana gallery in Trieste there was an exhibit also called *Arte Programmata* which included Gruppo N, Gruppo T, Getulio Alviani, Giovanni Rubino, “Una meccanica a orologeria,” 31-32. [Translation mine].

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\(^{347}\) Giovanni Rubino, “Una meccanica a orologeria,” 31-32. [Translation mine].
Enzo Mari, Bruno Munari and also Dadamaino, an artist who was close to Piero Manzoni, Enrico Castellani and Agostino Bonalumi. Dadamaino also had also had a solo exhibition at the Studio Enne in 1961. Dadamaino's works were “declinations of organized structures which could be programmed and modified by the spectator.” Always of contested interest, the exhibit had a collateral event, a public discussion in which Umbro Apollonio and Gillo Dorfles held antithetical positions:

Apollonio believed that the demystification of the romantic individualism, through anonymous and programmed works would revive the traditional plastic and visual arts, while Dorfles, believed that painting could not be reformed by programmed works.348

This antithetical positions also serves to explain the choice of work in the Arte Programmata exhibit being either optically or literally kinetic, though seen from a larger point of view, the works had more in common than not and clearly were challenging the primacy of painting, seeking to move past the traditional idea of the work of art. Art would be something new, evanescent, inclusive, and dependent on the viewer for its activation.

While not directly connected to the Olivetti Arte Programmata exhibit and movement as just discussed, a parallel project immediately preceded the Olivetti project, the Zero Group. The Group Zero was founded in Germany by Otto Piene, Heine Mack, and Günther Uecker, but had direct connections with Italian and French groups: the Italian group was organized around the Azimut gallery and shortlived magazine Azimuth. The French group included the artists Yves Klein, Jean Tinguely, Pol Bury, and Daniel Spoerri. Zero was not a concept that would annul meaning, but would

348 Ibid.
be a kind of beginning from zero after the war: to evoke a zone of silence [out of which develops] a new beginning. The name refers to the countdown to a rocket launch.349

In Milan the Azimut gallery founded by Piero Manzoni and Enrico Castellani, working with Lucio Fontana and Dadamaino functioned from December 1959 to July 1960. The gallery also published two issues of the magazine Azimuth. The group organized twelve exhibits with work by Italian, French and German artists, who were considered members of the international Zero movement. While short-lived as both gallery and publication, the effect on discussions of process and the serial in art as an approach were profound. This effect is evidenced in the writings of Italian critics such as Umberto Eco and Gillo Dorfles, who discussed the conceptual underpinnings of the new work in relation to a range of the other arts, language, music and architecture. Although these critics were not unified, they shared in the idea of a “new” approach, a move away from the personal expression of the artist as evidenced in movements such as Abstract Expressionism in the States or the “Arte Informale” movement in Italy of the 1950s. The late 1950s and early 1960s was a period in which artists sought to launch art off the previous value of expressionism as both style and self-expression to a larger conceptual field.

349 Zero Italia: Azimuth/Azimuth, 1959/60 a Milano. E oggi., Renate Damsch-Wiehager, ed. in connection with the exhibit at the Galarie der Stadt Essilingen, Villa Merkel, Dec. 3, 1995- Feb. 25, 1996 (Essilingen: Cantz Verlag, 1996), 88-89. His essay is written in 1987. The magazine featured writings by Bruno Alfieri, Gillo Dorfles, Otto Piene. In this book is included the “Arte Programmata” essay by Umberto Eco as an affiliated interest, in addition to listing artists who were exhibited at the gallery beyond the founders Castellani, Dadamaino, Fontana, and Manzoni, included the familiar artist from Arte Programmata, Giovanni Anceschi, Davide Boriani, Gianni Colombo, Gabriele De Vecchi, Enzo Mari, and Manfredo Massironi.
In his approach towards the programmatic, Enrico Castellani, broke from “informal” painting in the late 1950s and began by 1960 to construct canvas relief paintings by using nails beneath the canvas to produce high points, and nails driven through the canvas to produce troughs. The canvas, thus thrown into sculptural relief, was painted in monochrome, creating a tension between the second and third dimensions. By working with the serial repetition of the rows, slight changes or aberrations in the patterns were discernible and became a comment on the potential of the serial to move towards the infinite, echoing a current move from the art “object” as such, to the predominance of ideas and concepts in the arts. Rather than a “style,” Castellani’s work represents an adhesion to a strictly drawn “method” which he would develop across the body of his work, an “operative field” that resonates directly with Mel Bochner’s concept of the serial.\footnote{Luciano Caramel, “Concretezza fenomenica e tensione al ‘essenza’,” in Zero Italia: Azimut/Azimuth 1959/60 a Milano. E oggi. Castellani, Dadamaino, Fontana, Manzoni, Galerie der Städt Esslingen, Villa Merkel, December 1995-February 1996. Cantz Verlag, 1996.} Rather than look toward the totality of the multiple in a singular work of art, or of the complex in the simple, Castellani looked to work in relation to a dynamic, living, and even lived, relationship within the variation produced in each individual canvas and in the range across his body of work. In his article in the second and last
issue of *Azimuth* of 1960, he wrote about the possibility that art could contain a semantic value that would urge interpretation of the work, not back to the original work, but in its iteration and reiteration art would emerge in the continual act of making. As such, the work would have a unique relation to the viewer. It could be quickly consumed as a bit of a larger, living totality. The parts would be seen only in time, which took the work out of the realm of the preciousness of the original and away from the myopic subjectivism of the artist him or herself.\(^\text{351}\)

Figure 116 *Azimuth* 1 and 2, 1959 and 1960. Collection Princeton University, Rare Books Collection, Marquand Library.

The Gruppo N similarly to the Zero Group had an impact beyond the work of the individual artists in that they also extended their network to other artists by means of their gallery space. Gillo Dorfles summarizes some of these relationships in his essay about Dadamaino written from a point of view decades later in which he discusses the many overlaps between the artists shown and the critics who were involved in both shaping and giving a critical voice to these movements. One such group the MAC was a precedent to the *Azimuth* groups and the programmed and kinetic art of the Gruppo T and Gruppo N but contemporary to the Forma 1 group. The MAC group sought a new

\(^{351}\) Enrico Castellani, “Oltre la pittura” in *Azimuth* 1960. Also includes a poem by Nanni Balestri.
realization or recuperation of abstraction in painting, and were related to the Swiss Konkrete Kunst movement.\textsuperscript{352}

Gillo Dorfles locates Dadamaino’s work amidst and within the history and contexts of these groups and focuses on the aleatory nature of her work. Dadamaino’s method of perforating canvases in 1958 changed in 1960 as she produced a series of works by perforating plastic sheets and misaligning them subsequently, setting up an ocular effect emulating motion. She followed a simple set of rules for the perforations and overlaps. In these simple steps, multiple and everchanging variations were produced: she found the rules liberating and not constraining to her practice. Programmed in terms of steps towards making the work, and geometrically organized, the playful overlap produced a kinetic sensation in the microvariations in the slip of the overlaps in the various strata. Her approach utilized variations on a constant module and she created, as Dorfles describes, an optically kinetic microtissue (\textit{microtessiture ottico-cinetiche}). Her methodology was interrogated by Dorfles in his essay: was her work too constrained by rules or governed by an excessive scientificism or is it that the idea of a controlled game of change (\textit{azzardo controllato}) would actually be indicative of how chance in nature reveals larger patterns and rules behind incredible variation? Could this in some way be an infinite disorder of the galaxies? Are the variations and modulations indicative of the natural? Does working in this way after the horrors of World War II reflect a deeper acceptance of the disharmonious and the asymmetrical? Does being out of phase (\textit{sfasatura}) bring a new understanding of order and beauty?\textsuperscript{353} What seems to be at stake for Dorfles and by extension Dadamaino and Arte Programmata are profound questions of choice, meaning, and chance in art and society.


Take for example, an essay written by Abraham A. Moles in 1968 for the magazine *bit international*. Entitled “Experimental Aesthetic in the New Consumer Society,” the essay affirms the interrelationship between aesthetics and politics. Moles writings paralleled and inspired the artistic movements, and he had an important role in the evolution of the artwork from the 1950s when he had published the book *Théorie de l’information et perception esthétique* [Theory of Information and Aesthetic Perception] in 1958. Gestalt psychology applied to art, and especially to Programmed Art, held that both the viewer of the work and the artwork as object and process are all necessary for the completion of the work itself. Moles’s emphasis is to re-affirm the social role of the artwork (and artist) and what he calls “experimental aesthetics.” He states:

Experimental aesthetics is becoming a discipline of considerable social importance. The importance of a social fact is determined by its “mass effect,” which is calculated, more or
less, from the number of people influenced by it, weighted by the degree of influence they each experience. It seems likely that the applications of experimental aesthetics must soon give it a considerable “mass effect” in society.

This would seem to have a relationship with Benjamin’s essay regarding the work of art that would reach a larger audience through its proliferation and dissemination. Moles discusses the changing role of the art work:

First, the surrealist revolution, then the subversive thrust of post-war values, frenzied competition for originality, and the rise of a mass media-based civilization totally overturned the place of the work of art and the very meaning we accord to it. The essence of the work of art is to be found now in the copy, not in the original. The segregation of creative artists, who speak, from consumers, who listen or who merely receive passively, has put the final touch to the dominant fact of our time: cultural alienation.  

Moles’s point is that “society consumes novelty” and that the artist can tap into this impulse of continuous novelty by inviting the audience, or the viewer to “create” the work of art. This can be accomplished by disseminating copies of a work, such as in the Venus de Milo, which he asserts is not longer in the Louvre, but has “dissipated its charms in the full range of its postcards.” In the past, the work of art was the source of originality, but he proposes a new kind of creation that reflects the “dynamism of a culture”: that is he states:

There are no artworks anymore; there are artistic situations and those situations divide, of their own accord, into clearly distinct categories: the category of creation and the category of consumption.  

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355 Moles, “Experimental Aesthetics,” 301.
Moles sees *permutational art* as a solution to this problem. Intimately connected and depending upon the “combinations of simple elements” it offers a “field of possibilities” through an algorithm for exploring that field.

It will be the function of the artist to exploit the morphemes suggested by the aesthetician by choosing a *repertoire* for himself, defining a *combinatory rule*, and shaping a *program*.\(^{356}\)

Another point that Moles brings up is important to remember: he speaks about the importance of the pursuit of novelty, what he calls the *functions of the new*, and he ties this to the search for beauty:

“It is the role of the socio-aesthetician to bring out the artistic character of the discovery of the *terrae incognitae* of the Beautiful (understood here in the sense of the original...”

He leaves us with these thoughts:

The role of the aesthetician will be to satisfy this function of consumption by exploring the unexplored channels of tactile, olfactory, thermal—or other—sensibility, by providing, in the literal sense, new thrills, since the old ones are threatened with obsolescence. The aesthetician creates new arts, then, by defining sensory combinatorics, and marks the fact that technology opens up a new field for acting on individuals for these new arts that was previously closed to them....

The artist was, in the past, unique and personal; he is now a *metteur en œuvre*, a “programmer of the beautiful.” He exploits for his own ends the work of the aesthetician who experiments on the perception of originality, on semantic or aesthetic pleasure, and their combination.\(^{357}\)

Moles further explains that the *aesthetician* is a laboratory-based social psychologist (no longer a philosopher) who

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\(^{356}\) Ibid., 302.
\(^{357}\) Ibid., 302.
defines the rules of the perception of originality, the socio-dynamic mechanisms of its dissemination, the laws of combinatorics, and the algorithms of machine programming and who enters into collaboration with the artist, works as part of his team.\textsuperscript{358}

For him the real role of the artist, like scientists is to communicate to the public new knowledge in the form of originality of works created within the contemporary technological realm, with what he hopes is done with “the requisite dose of subversions and, hence, of self-questioning, for society to progress.”

Similar thoughts were expressed nearly a decade earlier by Gillo Dorfles in the essay “‘Comunicazione’ e ‘Consumo’ nell’Arte d’Oggi” [“Communication’ and ‘Consumption’ in Today’s Art] published in 1959 in the first issue of \textit{Azimuth}, demonstrating that these issues were important over a long period of time. Speaking in similar terms to Umberto Eco and distancing himself from the current moment from the artists that were characterized by splattering paint on canvases, with marks, lines, corroded forms, relied upon to carry the aesthetic message, Dorfles sets up the importance of two key terms, \textit{communication} and \textit{consumption}. Speaking about “works of art” rather than “painting” or “sculpture” the “work of art” speaks a new language that “permits a particular osmosis of the artistic event between the creator and the public,” something that is common to all of this work and which social aspect will be seen to provide a clear connection with Programmed Art and prefabricated architecture.\textsuperscript{359}


\textsuperscript{359} Gillo Dorfles, “‘Comunicazione’ e ‘Consumo’ nell’Arte d’Oggi,” in \textit{Azimuth} 1 (1959), inside front cover. “Ma perché ho detto dianzi che le due parole: ‘comunicazione’ e ‘consumo’ racchiudono una chiave per la comprensione dell’arte odierna? Perché è soprattutto una funzione comunicativa quella che può permettere il sopravvivere d’un’arte che ha rotto ogni ponte con la rappresentatività e la...
Dorfles continued his discussion of communication and consumption in his book *Simbolo, comunicazione, consumo* of 1962. In this book he offers an approach expanding ideas from scientific applications and how they related to issues of art and architecture. In the first chapter entitled “Informazione e consumo” [Information and consumption] he outlines information theory and ties the ideas of semantic redundancy to that of aesthetic redundancy and how this was later detailed by Moles. He continues to discuss novelty and how this can be used in aesthetics, understanding the split between information and values, or criteria for judgment, and then ties this to the ideas of psychology and the macroaesthetic and microaesthetic of Max Bense. Referring to Bense’s work on “Aesthetics and Programming,” Dorfles utilizes ideas about the message or the semantics of aesthetics as a process of coding and decoding, but in all cases programming is understood as a generative principle.

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361 In addition to being covered in Dorfles’s book, Bense was also published in *bit magazine* in 1968, taught at the ETH Stuttgart and then from 1953-8 was invited to teach at the HfG Ulm. Bense’s article “Aesthetics and Programming” is translated and reprinted in *A Little-Known Story about a Movement,* 296-299. “The ‘aesthetic state,’ a ‘text,’ a ‘composition,’ a ‘graphic,’ is construed as a ‘structured set of elements,’ and the ‘entropy’ of the ‘structure’ (that is, the ‘mix ratio’ or ‘degree of disorder’) of the ‘elements’ (for instance, ‘words,’ ‘tones,’ ‘points’) is presupposed for determining ‘order’ and ‘complexity’. More precisely, we determine ‘complexity’ as ‘statistical information’ (about ‘entropy), and ‘order’ then as analogous to ‘redundancy’ for whereas ‘complexity’ can always be ‘innovative,’ ‘ingular,’ and ‘original,’ order as such must be recognizable and identifiable, that is, redundant (such as a stylistic characteristic). Important for performing the calculation is naturally that the ‘elements’ of an ‘aesthetic state’ be characterized numerically.” [Emphasis mine]. While I have tried to give a sense of the changes in connection with Programmed Art, I have only touched on a few of the important works. Others include an Gillo Dorfles *Artificio e natura* (Torino: Einaudi, 1968), Lea Vergine’s book, *Arte Programmata e cinetica 1953/1963: L’Ultima Avanguardia* (Milano: Gabriele Mazzotta, 1983) produced in connection with the eponymous exhibit in Milan contains some excellent essays including her own, Ernesto I. Fracalanci’s “Note su alcuni materiali teorici dalla avanguardie storiche agli anni ’60; a “Glossario minimo,” by Rosella Ghezzi in which she
Although Dorfles’s book is not available in English translation, it makes a critical contribution to understanding architectural typology and semantics in Italy and how to “read” these messages through information theory as he had outlined earlier in the book. His Chapter V entitled “Valori comunicativi e simbolici nell’architettura, nel disegno industriale e nella pubblicità” [Communicative and symbolic values in architecture and industrial design and advertising] is a significant contribution. Dorfles decouples sign from design (segno and disegno) and in doing so works against a holistic view of any work of architecture. He breaks down the overall work, the overall message into the smallest possible element that can convey meaning, even to the point of looking at the loss of information of an architectural element (perdita della capacità informativa d’un elemento architettonico), only to then reassemble the elements in series and examines the value of the series in constituting an industrial object (valore della serie nella costituzione dell’oggetto industriale). In addition to these all-important questions that were brought to the fore with the increasingly industrial base of society and its production is also the notion of the obsolete. Dorfles probes into the problems of obsolescence identifies and defines the important operating terms of Arte Programmata such as gestalt, estetica, information theory, and cybernetics, and an excellent essay looking at the scientific interests of the artists working in arte programmata by Silvia Tomasi, “Qualche considerazione intorno al rapporto arte programmata—scienze,” citing the works of Edmund Husserl; Gillo Dorfles, Max Bense (Estetica, 1965); Filiberto Menna, “Situazione delle esperienze cinetiche e visuali in Italia,” in Il Verri 22 (Oct. 1966): 109; Abraham Moles, as mentioned; Giovanni Anceschi, “Intorno all’estetica,” in the introduction to the translation of Max Bense’s book Estetica, (Milano: Bompiani, 1974); Umberto Eco’s Opera Aperta: forma e indeterminazione nelle poetiche contemporanee (Milano: Bompiani, 1962) and Enzo Mari, Funzione della ricerca estetica (Milano: 1970). A study of Enzo Mari’s work will conclude this chapter. [Translations mine]

Dorfles’s text then moves towards gestalt psychology and its relation to art in the second chapter, in an expanded discussion regarding the interrelationship between perception of a work and meaning. The book is far ranging in with a theoretical chapter following regarding communication in normal and alienated language, a study of symbolism and communication in American aesthetic, including and examination of “Segno e simbolo nell’estetica di Susanne Langer” [Sign and symbol in the aesthetic of Susanne Langer], after which in the final two chapters he studies the “Valori comunicativi e simbolici nell’architettura, nel disegno industriale e nella pubblicità” [Communicative and symbolic values in architecture and industrial design and advertising] as well as in advertising and film. What is most interesting to me in this context is how Dorfles makes a transition from theory and a discussion of the art work to issues that are growing exponentially to match the rapidly growing economy and the role of both industrialized building and industrial design of objects.
in industrial design. His questions about objects (and building components), thought of as being produced in series and being read as series, is similar to the mathematical assumptions and computational idea that is the inherent base of Arte Programmata. Dorfles questions production processes including the base element, repetition in series, the underlying permutative code, and even the idea of what he dubs, “the phenomenon of the custom made” (il fenomeno del ‘fuori serie’). The implications of these processes for design in the Dorfles’s time are still relevant given the contemporary use of computer-numerically-controlled manufacturing because Dorfles is pointing at the fusion of “serial production” with the “custom-made,” creating the paradoxical neologism “mass-customization.”362

Dorfles was not alone in his investigations of the implications of seriality and customization. The direct overlap of Arte Programmata to architectural concerns with prefabrication can be seen in Lara Vinca Masini’s essay “Arte Programmata e prefabbricazione.”363 In this essay, Masini, provides a clear link between the notion of seriality and modulation in art and its impact in architecture.

362 Dorfles, Simbolo, comunicazione, consumo, 205. [Translation mine] In this section on the custom made “Il fenomeno del ‘fuori serie,” Dorfles talks about the importance of the X Triennial of Design of 1954. Entitled: Prefabbricazione - Industrial Design: Esposizione internazionale delle arti decorative e industriali moderne e dell'architettura moderna [Prefabrication-Industrial Design: International exposition of modern industrial and decorative arts and modern architecture], Palazzo dell’Arte of Milano, Aug. 28-Nov. 15, 1954. He cites designers and critics who were and still are in the 1960s important to the discussion about industrialization and the arts such as Giulio Carlo Argan, Enzo Paci, Konrad Wachsmann, Max Bill, Gillo Dorfles, Giovanni Klaus Koenig and others.

Another example is found in Enzo Mari’s exhibit essay “Funzione della ricerca estetica” [The Function of Esthetic Research] from the 1970 retrospective of his work from the 1950s to the present. Mari chose the title, “Analogy between serial structuralizations and natural phenomena and the programmation of perceptive phenomena,” to bridge the concepts of the serial process with the natural permutation of forms. Mari posits a kind of organicism which is deeply rooted in the organization of serial elements whether they are animal, vegetable, or mineral, visible to the human eye or seen only with the aid of a telescope or a microscope, or understood only on a theoretical level in physics or through mathematical formulae. To Mari,

All natural phenomena of any order… are always organized according to series of numerous similar particles that are concretized in modular structures that vary according to very simple sets of rules [followed to the point] to form a new modular ensemble. Then within each system, more or less according to the original rule (as for example in subatomic particles, molecules, cells, vein structures in leaves, branches, in the forest). At each of these levels, a
series of particles tend to follow, as truthfully as possible the elementary organization scheme that it is characterized by and not vary.\textsuperscript{364}

Figure 119 Enzo Mari, 1962-1965. Sketches for the sequences used in the models for 

Mari’s essay accompanies his early works from the 1950s and 60s that are showing variations based upon simple arithmetic rules of variation and growth. The simple rules that govern the variation of pattern in his different works is what connects his approach to natural rules of growth and form. In the early 1960s Mari began to make a series of sculptural studies (each under one meter square) in

\textsuperscript{364} Enzo Mari Funzione della ricerca estetica/The Function of Esthetic Research (Milano: Edizioni di Comunità, 1970), 38-39. Title and table of contents are in English. Text throughout in Italian only. Translation into English, mine. Original text: “Tutti i fenomeni della natura, di qualsiasi ordine, [complessità e dimensione, da quelli direttamente visibili dall’uomo (minerali, vegetali, animali) a quelli fisici invisibili e solo postulati e intuiti] sono sempre organizzati secondo serie di numerose particelle uguali che si concretano in strutture modulari che variano gradatamente (secondo schemi molto semplici) sino a formare nuove unità modulari. Queste, e loro volta, si ristrutturano variando più o meno lo schema iniziale (come ad esempio, dalle particelle sub-atomiche agli atomi, alle molecole, alle cellule, alle venature delle foglie, ai rami, agli alberi, alla foresta). Ad ognuno di questi livelli, la serie di particelle tende a seguire il più fedelmente possibile, lo schema elementare che la distingue e a non variando mai. [Quando, però, due o più ordini differenti di particelle si intersecano casualmente, ogni serie varia variando più o meno lo schema iniziale (come ad esempio, dalle particelle sub-atomiche agli atomi, alle molecole, alle cellule, alle venature delle foglie, ai rami, agli alberi, alla foresta). Ad ognuno di questi livelli, la serie di particelle tende a seguire il più fedelmente possibile, lo schema elementare che la distingue e a non variando mai.]”
which he studied the variations in the depth of the sculpture (about 30 cm). Each of the works studied the variation in a simple module following a very simple set of instructions for their displacement and variation within the given frame. The outer frame gave the finite space within which the permutation of the individual module would occur.

Figure 120 Enzo Mari, projects. Left: prog. 716 (1962) (30x30x10cm). Right: prog. 744 (1964) Front and back view (70x70x30cm)

Consistent with these operational processes, an idea that is investigated at a small scale may also be explored at an entirely different scale. In fact, it is just this permutational process that Enzo Mari proposed in 1965 working in collaboration with architect Bruno Morassutti. The project is documented in an article “Arte Programmata e Prefabbricazione.”365

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Figure 121 Enzo Mari and Bruno Morasutti in Lara Vinca Masini “Arte Programmatata e Prefabbricazione,” in Domus no. 428 (July, 1965): 13-15. This diagram is the procedure for the programmed development of the simple apartment elements that are designed to fit into an overall gridded, reinforced concrete structure. The instructions are to start in the upper left and count up to 6 (each number representing an interval of how much the block is to be recessed from the front face of the frame) and then count back to 1 and begin again. The outer square constrains the movement and the three lines spiral counterclockwise at different speeds and end in the center. This is then represented by Mari/Morassutti in the other diagrams and horizontal and vertical sections, and a rudimentary set of furnished floor plans which give the project scale.
Critic Lara Vinca Masini discussed the Mari-Morasutti project of 1965 as a synthesis of different disciplines, an “organic” project fusing art, science, and technology. The project was designed (and received an award) for the In/Arch-Domosic competition. Masi believed that the project represented a way to reposition the importance of artistic language in a culture increasingly deaf to art in an increasingly technologically driven society. The collaboration between an architect and
designer/artist invested prefabrication with a full range of critical concepts that were used to describe Programmed Art. At the architectural scale the project plays on the thematic variations of the architectural spaces, the rapport of different colors in materials and variations in volumes, as well as in the kinetic aspect of the sliding volumes. This proposal for Programmed Prefabrication is intended to act against the crushing regularity that prefabrication usually offers, by planning the changes through numerically modified modular sequences. The project is analogously structured as an “organism” that is the building.

The work of Mari, Morasutti, Masini, and Dorfles are a few examples of the overlap between serial thinking and production and the implications of the aesthetic of a new technological impulse in art and architecture that was discussed, designed, exhibited, and debated throughout the decade in venues that included the exhibit for the VI Biennial of San Marino in 1967. A co-authored article in the magazine Casabella by architect Carlo Guenzi, and art critic Germano Celant entitled “Nuove tecniche e immagine,” [New technologies and images] examined the impact of new technologies and techniques on the art image. In Guenzi’s portion of the article, he speaks about a “neo-tecnica” though while technology could open new horizons but he also has cautionary words about an uncritical use of science and technology and asked the reader to consider the implications: Does technology contribute to greater dissociations between culture and ideology? Could the use of iterative operations in art be an endless game, or a dangerous form of evasion? After one sets into motion a permutational process, how would one stop the process or decide on a buildable form? This is especially important in architecture which inherently represents a different scale of value, of measure and investment than a kinetic work of art. Guenzi was clear that for architecture to make

use of technology, science and the processes germane to each: it would have to address more than the aesthetic process.

In his portion of the article, Germano Celant noted tendencies in contemporary architectural operating process that reduced the overall form to a collection of individual elements. Each formal module could be used as a cell; then through a multiplication of a simple module, larger projects can be developed into housing, neighborhoods, and cities. Celant noted that technology was used to produce a formal hypothesis and a the module which is then multiplied in an accretive manner. This process was seen at Habitat ’67 in Montreal and other projects. Each project begins with a primary element and repeats until a complex structure is derived from the repetition in what he calls a multiplication of “1+1+1+to infinity.” Celant tied this process to a reductive linguistic structure.

The linguistic process consists of taking away, eliminating, in the reduction to minimum terms, to impoverish the signs to take away intellectual content. To refuse a ‘complicatio’ in operation and in the visual. Semantic complication is renounced, the focus is no longer on the ambiguity of the real, but its clarity (unambiguousness). Representation and reflection are eliminated from the research, to move towards a language of action.367

Unlike the Mari-Morasutti project, Celant advocates for a seriality of less variability and greater simplicity. Yet seriality and the production of architectural projects via systems, technology,

367 Germano Celant “Nuove tecniche e immagine,” Casabella 319 (1967): 61. On the VI Biennial of art, Republic of San Marino, July-September 1967....menti in architettura. Il processo operativo si riduce allo sviluppo elementare di un progressione. Trovato il modulo formale, che può essere utilizzato come cellula, lo si sviluppa in abitazione, quartiere, città. La tecnologia regredisce a verifica in’ipotesi formale. Il processo si capovolerci?: verificato tecnologicamente il modulo si procede per sommatoria. Così l’Habitat ’67 di Montreal, la città cilindrica di..., le ipotesi morfologiche si Seaside di La Pietra, le ricerche sperimentale che fanno capo a Formaggio, partono un fattore primario per approdare ad una struttura complessa, derivata dal 1+1+1+...infinito. Il processo linguistico consiste nel togliere nell’eliminare, nel ridurre ai minimi termini, nell’impoverire i segni per sottrarli ad ogni scolastica intellettuale. Si rifiuta la ‘complicatio’ operativa e visuale. Si rinuncia alla complicazione semantica, si focalizza non più l’ambiguità del reale, ma la sua univocità. Si elimina dalla ricerca tutto ciò che può sembrare riflessione e rappresentazione, abitudine linguistica per approdare al linguaggio dell’azione.” [Translation mine]
modularity, and prefabrication in building systems were of critical interest in the 1960s. The stated desire, or dream of the work was to be socially engaged and the processes were meant to move towards this goal. Set against a particular time and place unique to the 1960s, this dream and these efforts reflected a deep philosophical change in regard to a dramatic increase in goods and materials in a postwar Europe. Affluence and the economic boom had enormous implications for architecture. Employment, housing, education and other means of social advancement relied upon transience, mobility, and fluidity; and all were intrinsically and conceptually linked with modularity. The work under consideration here represents a range of approaches that would ground this ephemeralization in a process and a means of production in architecture that would answer the call for millions of new housing units. In this call is also a call for a reconsideration of the philosophical understanding of a rapidly changing society.

In his book published in 1970, *Future Shock*, Alvin Toffler posited that the proliferation of modularity and the principle of indeterminacy, which encouraged the infinite ways in which elements could be brought together were symptomatic of a new “ephemeralization of man’s links with things that surround him.”368 While Toffler’s book was almost immediately translated into Italian, the author Elémire Zolla in *The Eclipse of the Individual* [Eclissi dell'intellettuale] explored the relationship between man and machine more than a decade earlier, questioning the paradoxical condition of what he termed “mass man,” in the decline in the intellectual, cultural, social, and

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368 Alvin Toffler *Future Shock* (1970) was translated into Italian the following year and marks the passage from an industrial society to what Toffler describes a “super-industrial society.” The rapid acceleration of technology and the change in ways of life were overwhelming and contributed to what he dubbed “information overload.” Italy, newly industrialized, had to have had this effect in incredible fast speed. Alvin Toffler, *Lo choc del futuro* (Milano: Rizzoli, 1971).
artistic creations of humankind under the impact of scientific advances.\footnote{369 Elémire Zolla, Éclissi dell’intellettuale (Milano: Valentino Bompiano, 1956). English translation: Elémire Zolla, The Eclipse of the Intellectual (New York: Funk & Wagnalls, 1968). Trans. Raymond Rosenthal.} What are the economic, social, political, and formal implications of the culture of a indeterminacy in architecture, and in relation to rapidly expanding urban agglomerations? And what these systems look like is the subject of the next chapter.
Chapter 5: Systems, Modularity, and the Prefabricated Component (Unit)

Systems, modularity and industrial architecture

The term “Industrialized Building,” or in Italian, “Architettura industrializzata,” became an important area of research in the postwar period. It was a concept intended to address the postwar reconstruction, the beginning of the economic miracle which created a demand for new products, expanded markets, and the new category of consumer. The X Triennial of Design of 1954 entitled Prefabbricazione - Industrial Design: Esposizione internazionale delle arti decorative e industriali moderne e dell'architettura moderna [Prefabrication-Industrial Design: International exposition of modern industrial and decorative arts and modern architecture] expanded early postwar applications of industrialization and prefabrication as a viable solution to the urgent need for shelter in the postwar period. The concept took on a more theoretical, cultural, and aesthetic investigation. The X Triennial included a full scale construction of a wooden prefabricated house built in the Triennial gardens, an experimental house, an exhibit on building standards, and building construction elements. It also included important designers and critics who became central voices in the research and design of modular building, such as Giulio Carlo Argan, Enzo Paci, Konrad Wachsmann, Max Bill, Gillo Dorfles, Giovanni Klaus Koenig and others, whose works and words will be discussed in this chapter.\(^{370}\) It codified the relationship between industrialization and the arts.

“Industrialized Architecture” is an area of research in which architecture is made up of manufactured component parts that are brought together to make a whole building system. It also raises the theoretical question of openness and indeterminacy, not only the designs themselves, but in the

\(^{370}\) See Chapter 7 on the Milan Triennale.
political idea of diminishing the importance of the role of the architect as sole designer: opening up the building system to the input of the end user. In this kind of design, smaller industrially produced building elements were to be brought together for an efficient solution to myriad design problems. Thus seriality, which we saw in the development of the Xerox machine and its design applications, here applies to the notion of *componibilità* (componenting) and prefabricated building elements.

The previous chapter referenced a housing project by Enzo Mari and Bruno Morrassuti that extended Mari’s permutational art making process. In the housing design, similar units would be modified in order to avoid numbing repetition and regularity, and create a sense of novelty. This approach presupposes a certain level of industrialized building elements. On a more conceptual level, the link between serial thinking and production implies a new aesthetic, one based on the blossoming of a new technological impulse in art and architecture. The repetition of self-similar elements based upon a set of rules which would introduce variations in a work of art has been termed programmed, serial, or permutational. These terms may be sufficient for a work of art, whether static or kinetic. However, when one applies similar concepts at an architectural scale, or at the scale of industrialized architecture, a vastly different level of organization comes into play, one that has been described as a system, or more precisely, a building system.

A new synergy arose with the advancements made in technology and industrial fabrication during the World War II and a systems theory approach. Architectural building systems in particular provide a concrete manifestation of the conceptual framework of system theory, which was developed in tandem in the biological and physical sciences. Applied to engineering and manufacturing and architecture, system theory challenged disciplinary boundaries. According to the laws of thermodynamics, a physical experiment is a “closed” system, in which a finite set of elements are in interaction and will tend towards a condition of entropy or loss of information as the system
advances towards equilibrium. In a systems approach, organic and non-organic phenomena are categorized as closed or open systems, with interactions back to and from the environment.\textsuperscript{371}

**System Theory: a general background**

A system may be any kind of entity, physical or theoretical, that is composed of interrelated parts that share common characteristics.\textsuperscript{372} There is a structure to how the component parts are arranged and a function or functions that each part performs within the larger environment of the system. \textit{Input} is taken in from the environment and follows a \textit{process} or set of procedures to produce an \textit{output}. The output then acts to \textit{feedback} information into the system from outside the system and acts to influence changes in the system.\textsuperscript{373}

The publication in 1948 of Norbert Wiener’s \textit{Cybernetics: or Control and Communication in the Animal and the Machine} (following his 1943 \textit{Behavior, Purpose and Teleology} (with Julian Bigelow and Arturo Rosenblueth) was grounded in his involvement in and exposure to the development of mechanical control systems such as servomechanisms earlier in his career, and the design of artillery targeting systems during World War II. A major challenge for the Allies was the inability of antiaircraft guns to hit targeted Nazi aircraft during bombing raids. Aircraft had gained maneuverability and speed since World War I and a new approach was desperately needed to predict how far ahead of the aircraft to aim the weapon to assure interception. The anti-aircraft weapons were fitted with “gun directors,” a kind of analog computer that would calculate the plane’s future position.

\textsuperscript{371}Bertalanffy, \textit{General System Theory}, 33, 44. In an architectural building system, a system may be open or closed. A building system is “closed” if all of the components are not interchangeable with other systems or coordinate with modular building standards. A building system may be considered “open” if the parts are interchangeable and dimensionally coordinated with industry standards and may be used in combination with parts from other manufacturers.

\textsuperscript{372} And this definition is similar to that of “organicism” as discussed in earlier chapters.

“Servomechanisms,” would then control the targeting of the guns based on the “gun director’s” output signals.374

Trajectory tables were created which calculated the variables of the gun caliber, size of the shell, and type of fuse. These tables were calculated by hand by mathematicians, who were known as “computers.” Wiener’s wartime work in ballistics was influential in his development of the theory of cybernetics and by 1948, Wiener recognized its application in diverse fields: from the prediction of flight paths, to computing machines, electrical networks, and neuromuscular behavior, among others. Whether mechanical or biological, the cybernetic system depends on feedback, which requires the communication of information within the system. The theme of self-organization and feedback mechanisms in the control of an organism or machine are clear similarities in cybernetics and system theory, and both contrast in striking ways with the received notions of science up until that point.

Concurrent to Wiener’s work in cybernetics, biologist Ludwig von Bertalanffy was gathering a group of thinkers around his notion of a General System Theory. This theory sought to develop a unified science of principles that could be applied in the analysis of any system, closed or open, regardless of whether it was natural, physical, or social. Bertalanffy’s theory was applicable (as Wiener had thought of cybernetics) to any kind of system exhibiting the qualities of isomorphism.375 It was the principles governing relationships in a system that interested Bertalanffy. Bertalanffy proposed a General System Theory to explain and demonstrate these functional principles in terms that were abstract,

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375 Definition of “isomorphism” is of having similar shape.
Chapter 5: Systems, Modularity, and the Prefabricated Component

quantifiable, and definitive. According to Bertalanffy, cybernetics could be seen as a branch under
the general principles of cybernetics, a point with which Weiner vehemently disagreed.376

Bertalanffy’s text “The Theory of Open Systems in Physics and Biology” was published in 1950, two
years after the publication of Norbert Wiener’s seminal work (he cites Wiener in his bibliography).
In this work he sought to clarify the distinction between using physical models as a basis for systems
theory and the organism as a model:

In the world view called mechanistic, which was born of classical physics of the nineteenth
century, the aimless play of the atoms, governed by the inexorable laws of causality,
produced all phenomena in the world, inanimate, living, and mental. No room was left for
any directiveness, order, or telos. The world of organisms appeared a product of chance,
accumulated by the senseless play of random mutations and selection; the mental world as a
curious and rather inconsequential epiphenomenon of material events.

The only goal of science appeared to be analytical, i.e., the splitting up of reality into ever
smaller units and the isolation of individual causal trains. Thus, physical reality was split up
into mass points or atoms, the living organism into cells, behavior into reflexes, perception
into punctual sensations, etc.…. We may state as characteristic of modern science that this scheme of isolable units acting in
one-way causality has proved to be insufficient. Hence the appearance, in all fields of

376 Peter Galison “The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision,” Critical
simulacrum of humanity—clockmakers of the eighteenth century made their pirouetting mechanical
figures, steam engineers of the nineteenth glorified their engines as versions of the body. Our age?
We make computers to calculate differential equations, open doors with photocells, and, not
surprisingly, ‘the present automaton…points guns to the place at which a radar beam picks up and
airplane’ (Cybernetic p. 40). In a sweeping totalization Wiener had, within two years of the end of the
war elevated his AA predictor to the symbol for a new age of man. Whether or not we accept
Wiener’s techno-periodization of the history of humanity, there seems little doubt that he and many
of his contemporaries saw themselves as standing at a historical and philosophical watershed in
which the Manichean sciences would undergird the cybernetic age.”
science, of notions like wholeness, holistic, organismic, gestalt, etc., which all signify that, in the last resort, we must think in terms of systems of elements in mutual interaction.\textsuperscript{377}

A system then, as previously mentioned, may be any kind of entity, physical or theoretical, that is composed of interrelated parts. Systems do not have one physical manifestation and as a general principle the term may be used for such diverse phenomena as a city, a computer, or a societal group or community. There are common characteristics that systems share. There is a structure or logic to how the component parts are arranged and a function or functions that each part performs within the larger environment of the system. Input is taken in from the environment and follows a process or set of procedures to produce an output. The output then acts to feed information back into the system from outside the system and influences changes in the system, to perform more efficiently (an issue that will be returned to later, as this acts as the sole evaluative criteria for a system).\textsuperscript{378}

The early theoretical development of system theory aligns with a paradigm shift regarding the concept of the biological organism and its interrelation with its environment or milieu.\textsuperscript{379} It is a concept that is notable because of the application of its concepts to the analysis of complex systems in a wide range of disciplines. While heavily influenced by advances in physical theories of inorganic systems elucidated in principles of thermodynamics, system theory stakes out the power of indeterminacy, self-organization, and influence from outside a system, which is not considered in

\textsuperscript{377} Bertalanffy, \textit{General System Theory}, 45.


\textsuperscript{379} Bertalanffy, \textit{General System Theory}, 18. Bertalanffy refers to the influence that Kuhn has had on his work. He states, “Following Kuhn, a scientific revolution is defined by the appearance of new conceptual schemes or ‘paradigms.’ These bring to the fore aspects which previously were not seen or perceived, or even suppressed in ‘normal’ science, i.e., science generally accepted and practiced as the time. Hence there is a shift in problems noticed and investigated and a change of the rules of scientific practice…” Thomas S. Kuhn, \textit{The Structure of Scientific Revolutions}, (Chicago: University of Chicago Press, 1962).
physical models. Biological entities alone or in interaction as societies, information, and economies exhibit a marked difference in regard to a physical system that moves towards equilibrium. A physical experiment will examine a “closed” system, in which a finite set of elements are in interaction and will tend towards a condition of “entropy” or loss of information as the system advances towards equilibrium. In a general systems approach, an organism, a society, or whatever else is considered an “open” system – a negative entropic, or *negentropy*, wherein the organism is constantly increasing complexity or change as the organism assimilates, processes, and eliminates waste from these interactions back to and from the environment, or milieu from which the organism is differentiated, through a complex process that delineates a “boundary”. A chemical and thermodynamic equilibrium as inorganic process is closed, but when considered in an organism it is an *open system*, as the organism maintains itself in, or continuously approaching a “steady-state.”

Bertalanffy’s elision of the biological and the computational aspects of self-organizing systems was already recognized in the late 1940s. The Macy’s conferences of the late 1940s and early 1950s, organized around Wiener’s cybernetics, were indicative of the far-ranging implications of the impact of cybernetics on all fields. The two terms, cybernetics and systems theory, are related and heavily debated, with Bertalanffy going as far as to have written that cybernetics was included within system theory. Both share the assumption that a mathematical abstraction of phenomena is necessary to understand or produce entities of great complexity. Both assume that mathematical relationships and open-ended combinatorial possibilities provide specific, yet abstract models that have material and social implications in the planning and analysis of societies, economic systems, computer languages, and form. Cybernetics differs from systems theory in that it is more abstract and rational in its assumptions and development of operational principles. Systems theory seeks to theorize principles

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380 Bertalanffy, *General System Theory*, 33, 44.
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but recognizes that the dynamic forces of a system and its relationship to the environment cannot all be coded as rational terms. In this way, cybernetics can be seen as a heightened emphasis on rational, abstract sets of relationships, which allows its application in diverse fields as electronic circuits, brain activity, and social organizations, connecting wildly different products isomorphically. As a means to distance oneself from concrete material relationships, cybernetics provides an approach to study, analyze, and manipulate the different relations between constituent components. Issues of organization, order, hierarchy, structure, information, control, complexity are paramount and provide the tools to quantify all range of material and conceptual phenomena. In essence, cybernetics is a study of the component elements in a system and a study of how to maintain the order in a system, whether the system is natural or artificial, in terms that are locial, consistent, and valid.

All systems in the physical world have a tendency to become entropic, to move from higher to lower states of order. Cybernetics is seen as a way for a system to feed back information from outside of itself in order to maintain order within the system, enforcing consistency and encouraging change within the parameters of the rules.382

The point of emphasis of Bertalanffy and Wiener are different, even though both share the concept of self-regulating open systems that could be applied to analyze all manner of phenomena.383 Both


383 The discussion of the different models of “organization”: biological, computational, linguistic etc. is critical and much work still needs to be done to clarify the interrelationships. It is my hope that this initial treatment of the subject will suffice for the moment and in the context of this paper. It is my intention to continue to clarify the differing positions and their implication in architecture in my future work. Donna Haraway proposes an example that could be interesting in bridging the divide between biology and computation. She cites British biologist Lewis Wolpert regarding the notion of polarity as “an ordering relationship that involves a system of coordinates with directional information. Polarity defines direction of measurement. (p. 52) She clarifies his basic argument, stating that a field is a kind of system. All measurement of elements are defined in relation to a point or points of reference. What she states that is critical here is that Wolpert links contemporary (1970) science with its emphasis on code, to an earlier generation, who saw gradient and polarity in a field
were interested in what W. Ross Ashby described as a self-organizing system, which refers to a system that starts with separate parts or elements, and whose parts begin to act so that they begin to form connections essential to feedback and communication within the system itself. However, the cybernetic approach focuses on the abstraction and reduction of physical matter to mathematical analysis.\footnote{W. Ross Ashby, “Principles of the Self-Organizing System,” in \textit{Principles of Self-Organization: Transactions of the University of Illinois Symposium on Self-Organization}, Robert Allerton Park, 8 and 9 June, 1961. ed. Heinz Von Foerster and George W. Zopf, Jr. (New York: Pergamon Press, 1962).} In order to understand the relationships between elements, one must have a clear notion of difference or distinction between the elements. This notion has lent currency to the utilization of binary elements (on/off, “0”, “1”) to distinguish difference. A “General Systems Theory,” includes this focus on these abstract rules of order but emphasizes that a complex system, open or organic, may not be adequately described in rational terms. Bertalanffy’s theory posed the question of the system, the boundary, and the environment and the complexity of modelling. It would appear again with complex scale projects such as city planning or regional planning, as well as in site specific designs and especially as the factor of environmental impact questions arose in the early 1960s.

This important distinction between open and closed systems would become highlighted in architectural building systems as the process made visible the benefits and pitfalls of systems theory and cybernetics as applied to building. The focus in architecture was on the interchangeable element that allows for an “open system.” Logic and abstraction were essential to understanding and producing an architectural building system, component, manual, or project, but Bertalanffy’s “open” system, like the complexity of the organic, the interactive, the indeterminate, and the material also required a term of reference in the equation.

as a problem of form. The work on molecular genetics was the preeminent science at the time and had taken over from a more formal/material discussion of life. It could be understood that the genetic or code approach is mechanistic and that of form, organismic. Here is perhaps a way to link the two approaches to develop a fuller sense of material and information.
Bertalanffy presented General System Theory in succinct and highly functional terms: it was a means “to derive, from a general definition of ‘system’ as a complex of interacting components, concepts characteristic of organized wholes such as interaction, sum, mechanization, centralization, competition, finality, etc., and to apply them to concrete phenomena.” Bertalanffy continued, “‘Analytical procedure’ means that an entity investigated be resolved into, and hence can be constituted or reconstituted from, the parts put together, these procedures being understood both in their material and conceptual sense.” The connection between the parts needs to be “weak” enough so that the parts can be isolated, analyzed, and put back together again. The parts need to be “worked out” as Bertalanffy puts it, “actually, logically, and mathematically.” Additionally, the relations between the parts (in interaction), even though immensely complex, need to be understood linearly so as to be able to be analyzed mathematically. Equations may describe the behavior of the parts, and “partial processes can be superimposed to obtain the total process, etc….The prototype of their description is a set of simultaneous differential equations, which are nonlinear in the general case. A system or ‘organized complexity’ may be circumscribed by the existence of ‘strong interactions’ or interactions which are ‘nontrivial’, i.e., nonlinear.”

The appropriation and application of these terms from Bertalanffy provided a new model for thinking about building as a set of parts in both their material and conceptual sense, which could be “isolated, analyzed and put back together...worked out actually, logically, and mathematically,” as well as geometrically.

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385 Bertalanffy, 19. Only numerical analysis can solve such and requires the use of computer.
386 I believe that architecture provides a profoundly interesting application of system theory and that with the introduction of the material reality of component building parts, geometry and physical relations form a kind of material computation that then can be fed back into the abstract mathematical model. This is of continued interest in contemporary architecture as I will discuss in the Conclusion.
Self-similar modules: open possibilities of similar parts produce a proto-self-organizing system

Gyorgy Kepes, in his 1956 essay “Symmetry, Proportion, Module” in his influential edited book *The New Landscape in Art and Science*, brought yet another way of looking at the module or part in relation to the architectural whole. This wide-ranging essay looked to symmetry and proportion as means (and visual indicators) of the continuous process in all phenomena of what he termed a “duel between opposing tendencies.” He discussed current cybernetic thinking (he referred to the publication of the 8th Macy Conference of 1951), and how the concept of biological regulation is a model for evaluating other phenomena. He pointed to the essential ideas of self-regulating systems, circular causal processes, and the interdependence of elements. In order to be in harmony, both literally and figuratively, it is necessary to balance the outward flow of energy in proportion to the inflow of information in order to attain one’s goal without “overshooting” or “undershooting the mark”—both positive and negative feedback.

Every purposive movement is composed of two processes, not one; their symmetry in action is the measure of its success. The ‘elegant’—or most successful mathematical solution is that which has involved the least amount of hunting, as shown by its minimum number of steps. Kepes evolved a discussion of historical architecture in which an emphasis is noted in the harmony of opposing parts. He related a kind of mini-history of Greek architectural proportion and Pythagorean geometry and a discussion of the perfection of Platonic solids in order to discuss a number of architectural examples (from an analysis of the geometry of Palladio by J.F. Blondel to Le Corbusier’s *Modulor* to the *Monument to the Dead of Mauthausen*, based on the Golden Section proportion by B.B.P.R.). He proceeded to a discussion of modular principles based in the material

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388 Kepes, 328.
and fabrication of architectural elements with examples as diverse as a Gothic mason’s mark and tatami mats. This background brought him to a discussion of the impact of modular coordination in industrialized societies, and he stated that standardized products and the attendant manufacturing processes are inherent to our time. This discussion is, of course, based on economy of means as the evaluative criteria, which posed a dilemma for Kepes. Modularity can lead to a monotonous self-sameness. Yet he stated that the “less difference there is between standard parts, the easier it is to combine them; when the parts are simpler, the possible combinations are broader and the whole more flexible.” In starting from an interest in the potential for units to interconnect in various ways led Kepes to discuss the possibility of modules with the “greatest combinatorial possibilities.” Similar modules can be joined together at different angles for a rich possibility of variations in overall form. Variously shaped modules can fit together in various ways as well. The factors under consideration are either module or joint. Kepes sought a precise set of criteria to design and evaluate modular constructions so as to avoid the negative aspect of the similarity of industrially produced elements and the “starvation of the eye” that can result without a conscious

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389 These issues will be central to the pedagogical approach at the Hochschule für Gestaltung at Ulm (HfG Ulm) most notably after Tomás Maldonado becomes a co-Rector after 1956. This is discussed in detail in a following section in this chapter.

390 Kepes, 346.

391 Kepes, 334.


In the appendix to this work, Canguilhem discusses various ways of thinking of the cell, or unit. He discusses Leibniz’s work on the monad and its relation to cellular theory, an essay “Note sur le passage de la théorie fibrillaire à la théorie cellulaire” and importantly, the text from Jean Bernoulli (Naples, 1734) from his *De Motu Musculorum*, (translation is mine) “muscle fibers are cut in straight lines by parallel transversal fibers that form a reticulated texture. The muscular fibers (motrice), at the moment of their dilatation – (that is to say, their contraction) are cut off into regular intervals by transversal fibers and thus their interior (cavum) areas are separated by a sort of ligature in equal internodal spaces that form many cells or vesicules.” The individuation and separate consideration of the cell and the intercellular “grid” is an essential topic to be further elaborated upon in my future work. This brings up parallel issues of xenophobic and xenophilic tendencies in relation to the effect of a grid to unify diversity.
effort to bring a “vital variety” to the man-made environment.\textsuperscript{393} Kepes used many different visual examples from art and architecture in order to illustrate his notion of the richness of modularity that he saw possible.\textsuperscript{394} It is necessary, he believed, to find richness in modularity to address what he deemed a natural result of modern society. “Standardization,” he wrote, “both of basic structural elements and of household utilities, has been highly developed in order to provide the flexibility need by an expanding, mobile society.”\textsuperscript{395} This is a refrain that really defined the period of the economic boom, and will be discussed in the remainder of this text.

Kepes concluded this essay with some thoughts on standardization. Biological processes of growth and the \textit{system} in nature of organisms were important models regarding the diversity of modular arrangements. Studies of modular construction in building focus extensively on issues of the interlocking and packing of modules. Kepes looked to nature to study the influence of symmetry and the mathematics of space packing that aid in the creative design of modular systems. He found particular richness in the study of crystalline structures: individual elements are arrayed in repetitive patterns, inflected by “repetition, reflection, rotation and translation in space.” These factors are shown clearly in space frame structures which use a minimum of material and an efficiency of connections to produce structures of great complexity. “A higher level of organization,” he concluded, “a \textit{unity and continuity}—results. The unity of these structures—their structural, functional and visual rhythm—is in the combinatory connections of their modular parts…recognition of

\textsuperscript{393} Kepes, like Max Bill, the first Rector at the HfG Ulm was very concerned with human perception as the evaluative criteria of a work of design. Bill was also concerned with the underlying correlation between natural and man-made systems, but he shared with Maldonado a thirst for making a connection between new discoveries and new scientific disciplines and their overlap with the arts (visual, verbal, aural, kinetic, etc.)

\textsuperscript{394} Artists include early examples of organic architecture, Van de Velde, Sullivan, Mackintosh; modern artists, Kandinsky, Pollock, Calder, Klee, Arp, Bayer, Max Bill; modern architects using organic forms, Torroja, Le Corbusier, Saarinen, Eames, Catalano, and engineers using modular constructions to achieve “organic” like form such as Nervi, Wachsmann, and Fuller.

\textsuperscript{395} Kepes, 352.
potentiality, a realization of latent form…a ‘fluid continuity between members that serve different functions.’”

A space frame, then, by definition is a structure that is assembled by a series of interrelated similar parts which act together as a whole. A space frame may be seen as a concrete example of a system in action. While seemingly static, the forces operating in the structure are dynamic and in accord with Bertalanffy’s description, the whole is more than the sum of the parts. A space frame structure made of tubes and joints is indeed a system, as numerous projects that provide variations on the interchangeable parts that may be combined to construct and architectural whole, something that is an alternate organic approach to building.

The Packaged House as system

The Packaged House, designed by Konrad Wachsmann and Walter Gropius in the United States during World War II, will be explored as an example of a building system related to the scientific terms. Though it is not confirmed that this is the one of the building systems that Bruno Zevi had referred to as an example of industrialized architecture having the organic qualities that Zevi

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396 Kepes, 352.
397 Z.S. Makowski, “Space structures and the electronic computer,” pp. 8-9 and “A survey of recent three-dimensional structures,” Architectural Design (January, 1966): 10-43. Also in his book: Z.S. Makowski, Steel Space Structures, (London: Michael Joseph, 1964), 18-20. Indeterminate structures, is a term used by Makowski in terms of the structural characteristics of space trusses. I am interested in using the term here, and in fact was first drawn to his work because of the overlap with Turing’s theories and other notions of indeterminacy in systems theory. While one would imagine that structural engineering is a precise science, it is really quite open, and must predict future loads and stresses. In doing so there is a keen sense of approximation of the requisite structure required to deal with the dead and live loads of the structure. This is to me an excellent example of the co-presence of an open (indeterminate in future use and loads) and closed (calculated to exceed maximum expected forces, and built in that particular configuration.
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outlined, it is an excellent example of what is at stake in the discussion, and it is likely that Zevi knew the project. As highlighted in Chapter One, Zevi wrote in the Italian version of *Verso un’architettura organica*:

> But in America various designs of prefabricated houses have perhaps opened the way for a new solution: one needs to prefabricate the base unit, baths, kitchens, plumbing and heating systems, bedrooms, perhaps all of the spaces, separately. These units then get assembled together according to the various needs of the inhabitant who will live there. There needs to be the possibility to add and subtract units or spaces, to substitute larger rooms for when the inhabitant outgrows the smaller rooms and vice versa, meaning that the principle of flexibility must be respected, and that of organic growth and reduction.\(^{399}\) [Emphasis added]

As discussed previously, Zevi wrote of the possibility of prefabricated building systems to exhibit organic qualities in their capacity to grow and change according to an inhabitants’ needs. They were seen as bringing a democratic and hence organic quality to postwar, industrially undeveloped Italy in great need of building for the reconstruction. Zevi looked to conflate the notion of democracy with the freedom of individual choice. The following quotation, in translation from Zevi, speaks to the discussion of individual design choice within the larger group (culturally and architecturally) that would be a focus of discussion in the 1960s in a climate that became increasingly anti-planning and focused on the development of a participatory approach to urban design and large scale housing.

> It is evident that we are dealing with two tendencies that value life (lifestyle) in opposite modes. The first is an absolutist tendency, totalitarian in field of housing; the second is elastic and leaves space for life. The first imposes on all inhabitants a suffocating uniformity a total rigidity of life; the second proposes to give to all the means, materials, and equipment in order to have a comfortable house at low cost, but leaving the individual freedom and variety.\(^{400}\)

\(^{399}\) Bruno Zevi, *Verso un’architettura organica*, (Torino: Einaudi, 1945), 70. [Translation mine].

\(^{400}\) Ibid., 70. Original text:

“È evidente che si tratta di due tendenze che valutano la vita in modo opposto. La prima è la tendenza assolutista, totalitaria nel campo delle abitazioni; la seconda è elastica e lascia spazio alla vita. La prima impone a tutti l’uniformità soffocante, l’irregimentazione totale; la seconda si propone...
So whether this is the exact project Zevi was thinking about, the Packaged House system exhibits
the qualities of flexibility which for Zevi is emblematic, and exemplifies what Bertalanffy had cited as
an “organic” approach.401 Wachsmann was an important figure in postwar Italy, due to his physical
presence in the country, the Italian translation of The Turning Point in Architecture, and his numerous
articles in various magazine and journals that were circulated in Italy.402 Prefabricated, quickly
deployable building systems were necessary during the war to house American troops and strategic
equipment in the field. Prefabricated building systems were also needed to house large numbers of
migrant workers adjacent to the factories producing aircraft, equipment, and weapons in the United
States. Even during the war, there was the notion of 194X, or the unknown, but eventual end year
of the war, in which the stepped-up wartime factory could be retooled to produce low-cost
prefabricated housing for returning veterans and their families.403

401 Zevi ≠ “Alternate Organic” Zevi’s issue is that he colonized the term but was far too limited in
his understanding of “organic”—Hence Moretti’s principles of computation were excluded and
Semino and 10 others were not seen as organic. My point is to reclaim the term and expand it to
include Moretti, Semino and many others—Hence an “alternate organic” that is defined more
broadly and yet more clearly as the practice of distilling/abstracting processes from Nature—
playing/working/applying/experimenting with them.—
Zevi’s ideas on democracy are likewise too narrow—freedom of choice ≠ democracy. He makes
the same mistake in “democracy” that he made with the term “organic.” He’s too quick to say he
understands the term. (Wright was probably guilty of the same thing)—in design and democracy.

402 Konrad Wachsmann, Una svolta nelle costruzioni (Milano: Il Saggiatore, 1960), G.C. Argan,
Introduction. Konrad Wachsmann, The turning point of building: structure and design. Translated by
Original German text, Konrad Wachsmann, Wendepunkt im Bauen (Wiesbaden, Krausklpf-Verlag,
specifically shows the Packaged House on page 31. See also Bruno Zevi, “La ricostruzione in
guerra americane” in Ricerca scientifica e ricostruzione: rivista del Consiglio nazionale delle ricerche:
L’insegnamento delle costruzioni di guerra americane no. 6 (1946): 532-543.

403 For the first detailed study of the period of World War II see Jean-Louis Cohen, Architecture in
Uniform: Designing and Building for the Second World War (Montréal: Canadian Center for Architecture,
co-published with Hazan), 2011. (find origin of 194X). Peter Galison “The Ontology of the Enemy:
System theory and the production of architectural building systems in the U.S. are related through the adaptation of pre-World War II manufacturing practices, such as of automobiles, and knowledge both acquired and transformed during the war and in the immediate postwar period. The Packaged House by Konrad Wachsmann and Walter Gropius represented a new building system for housing developed during the war. This building system illustrates the unique manner in which systems theory as a concept linked vastly different fields and was appropriated by and adapted for use in the field of architecture. Advancements made in technology and industrial fabrication during the war had a synergistic effect when coupled with a systems approach in architecture. Architectural building systems became essentially a concrete manifestation of the conceptual framework of system theory.

Figure 125 The Packaged House System. In László Moholy-Nagy, Vision in Motion (Chicago: Theobald, 1956), 112.
Bertalanffy’s phrase *systems of elements in mutual interaction* is clearly demonstrated in the design of the Packaged House. The system is a perfectly coordinated set of parts that can be brought together in myriad ways. The jointing system was based on 2, 3, and 4 way connections between panels. All of the building surfaces were to be created from the same panels: exterior walls, interior partitions, floors, ceilings and the roof. Using the modular bay of 3’-4”, seemingly infinite configurations could be made with the system. An impressive aspect of the project lies in the “abstract” qualities of the house, in its uniformity and precision. The Packaged House provided a new level of three-dimensional sophistication.
It is often claimed for panel systems that they are flexible—i.e., that any plan can be approximated or that walls can be removed, windows swivelled or rooms added with much less labor than in conventional building. In theory, this is true; but a close scrutiny of a given panel system often reveals that such changes are actually as troublesome as obfuscated remodeling. The system is set to be only partially panellized, vertical joints will differ from horizontal ones, or disassembly may be difficult because joints are sealed, cemented or screwed. The Wagners—Gropius design avoids all these limitations. Not only is the entire structure panelized, the panels are also identical in proportion, edge profile and method of connection. That system is, in this sense, genuinely flexible.

They employ a steel connector composed of four elements which lock together like a Chinese puzzle to form a rigid structure. Despite the fact that the connector assembles easily and comes apart even easier it yields an unyieldingly strong joint: in recent laboratory tests, the panels always broke before the connector gave way. Each of the connector's elements are forged-in-place in the edge of the panel: this is true determines the sequence in which the four structural elements are assembled.

However, this connector's strength is a function of the thin and continuous bearing surface of the connector's "universal" joint. This is achieved by having every intersection, edge or corner composed always of four complementary structural membranes: each square element is assembled in this way. These elements always fit together in the same sequence and are not effective structurally until the fourth is slipped into place. This is what determines the erection sequence of a General Panel building. The last element placed constitutes a sort of keystone and—working backward from it—the entire building can be quickly and easily dismantled.

Figure 126 "The GENERAL PANEL system locks together like a Chinese puzzle." From *Architectural Forum* (February, 1947): 116.
Figure 127 “Adaptability of General Panel’s system to a wide range of plan problems is demonstrated by design of well-known architects.” From Architectural Forum, (February, 1947): 120

Originally apprenticed as a cabinetmaker, Konrad Wachsmann studied at the Arts-and-Crafts schools of Berlin and Dresden and at the Berlin Academy of Arts (under the Expressionist architect Hans Poelzig). He worked for the timber building company Christof and Unmäck, where he was
designer for wood prefabricated houses. In 1929 he persuaded Albert Einstein to use the Christof and Unmäck system for the house offered to Einstein by the city of Berlin. Wachsmann was held in an internment camp in France and on May 16, 1941, his fortieth birthday in Marseille, he received a visa to go to the U.S. He arrived in New York City by boat and Gropius wired money for him to get to Boston, where they collaborated for several months on various projects including a recreation center in Key West. That work was abruptly stopped by the attacks on Pearl Harbor on December 7, 1941. Wachsmann relates those days and the impact the attack would have on The Packaged House system:

The next day Roosevelt declared war on Japan and within a few days Germany and Italy declared war on the United States.

“This ends everything,” Gropius said.

“No,” I answered, this will be the beginning. Now people will come to their senses. They will be forced to be rational.”

Wachsmann continues:

Walter Gropius was quite desperate, but I cannot explain why I sensed that now the great opportunity had arrived. That evening on December 7, returning home, I told Gropius for the first time that I had developed during time in the internment camp in France a universal system of industrialized building components, of course in the metric system. I had thirteen small ink drawings with me of that project as well as twelve sketches of the tubular steel structure system which I began to develop in Grenoble and continued “aux Cambreniers.” When I had arrived in New York, my friends suggested to throw these drawings into the Hudson River, since they were sure that nobody was waiting for my ideas and designs. Those drawings were the only precious things I had brought over from the Old World, and I certainly was not going to throw them away.

We talked after dinner until late in the night about it, and he became so interested that he said he would like to help, in fact to participate. And we decided to start to work at it immediately and together.

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405 The key here is the idea of the rise of the rational.
So together, Wachsmann and Gropius, both German emigrés to the United States, began to collaborate on a project for industrialized modular housing, The Packaged House. Wachsmann's “universal Joint” lent great structural stability to the joining of prefabricated panels. Again, the jointing system was based on 2-, 3-, and 4-way connections between panels. All of the building surfaces were to be created from the same panels: exterior walls, interior partitions, floors, ceilings and the roof.

In February of 1942, the U.S. National Housing Agency allocated $153 million for the housing of displaced defense workers. There was a production target of 42,000 houses, and in September of 1942, the General Panel Corporation was set up to begin the manufacture of the Packaged House. The test house that Wachsmann and Gropius showed in Somerville, Massachusetts, followed the guidelines of the TU1 house.

The house system is quite simple, and architecturally modest. In general it is conceived as a single-story, with a rectangular plan, with a shallow pitched roof and inset porch. What is interesting about the house is that the entire house is not conceived as a single repetitive unit, but that using the modular bay of 3’-4”, infinite configurations could be made of the system, adapting to various climatic and site conditions, and to the taste of the architect and the owner. An impressive aspect of the project lies in the “abstract” qualities of the house, in its uniformity and precision. Great lengths were taken to make the system known to the public, and it was used as a basis for design studios that Gropius had led at the Harvard Graduate School of Design.

Historian Gilbert Herbert, in his book *The Dream of the factory-made house: Walter Gropius and Konrad Wachsmann* discusses how the concept of “system” was beginning to enter into the “architect’s thinking at the time, although the term itself was not then in common usage.” He attributes its emergence to the intellectual climate of the 1920s and 1930s and the work of Alfred North
Whitehead and his “analogous theory of organic mechanism,” Bertalanffy’s foundation of a general systems theory, Arthur Tansley’s concept of an ecosystem, and also Gropius’s Idea and Organization, his philosophy of total architecture, which Herbert believes is in essence “a comprehensive systems theory of architecture.”

One could easily say that the Packaged House system was in fact a closed system, in that there are a finite number of elements that can be manipulated within the system. It is true that the Packaged House would certainly be considered a closed system from this point of view. In prefabricated building systems, closed systems are made of proprietary building materials designed for that system only. Often, as was with the case of the Packaged House, even the metrical organization is not aligned with building industry standards. The Packaged House panels, for example are 3’–4” wide x 10’ high (vertical heights could be determined in 3’–4” increments, 3 of which make the 10’ module), while logical within the system, does not correspond to the industry standard of 4’x8’ plywood panels and other modular elements. Thus windows, doors, and all other architectural fittings would be modular only to the system. An open system is one in which the metrical dimensions would coordinate with a vast array of industrially produced materials and equipment.

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*Gilbert Herbert, The Dream of the factory-made house: Walter Gropius and Konrad Wachsmann. (Cambridge, MA: MIT Press, 1984), 7-8. Herbert cites his own work, Holism, the Ecosystem and Architecture: Towards a Philosophy of Architectural Design of 1975 as a summary of the emergence of the idea of systems. I have not been able to identify a location to consult this work. Herbert’s book is the most comprehensive study of the Packaged House, but other references are Konrad Wachsmann The Turning Point in Architecture, 1959-1961: English translation; Michael Tower’s reprints and description of the original drawings in Perspecta Vol. 34 (2003); ‘Peter Cook’s Experimental Architecture; and various publications from the time such as L’Architecture d’Aujourd’hui, Architectural Review and New Pencil Points. It is also discussed from a point of view which examines and emphasizes Walter Gropius’s role in the project in doctoral dissertation by Dora Epstein Jones in the chapter “Case Study 2: “A Fusion of Art, Science and Business” Walter Gropius and the Packaged House System, 1942-46. “Architecture on the Move: Modernism and Mobility in the Postwar” (U.C. Los Angeles, 2004).*
The Packaged House, while closed in the finite elements (in design and coordination, not in number), is actually an open system in that its goal is not determined in advance, but in the hands of each designer, and a particular time and place. And in this sense, it is an organic model, one that exhibits properties as Bertalanffy had outlined. The Packaged House system serves as a perfect case study with which to discuss the role of prefabricated building during World War II and to enunciate the extension of systems theories into construction.

In prefabricated building systems, a closed system is one in which each of the parts are proprietary and designed for that system only.408 This is the case of the Packaged House, where the very metrical units are not coordinated with building industry standards. An open system is one in which the metrical dimensions would be coordinated with a vast array of industrially produced materials and equipment.

The Packaged House, is, in this light, a closed system and one that is utterly constrained to the use of the component parts, yet it is simultaneously also exemplary as an open system. To follow Wiener’s notion of a closed system, one would have to have the end-goal in sight. That is, as a physical model of a system, the goal would be determined by the performance of the system. The missile would make its mark; the house would be determined at the outset by the system of parts.

Yet this is not the case. The system of parts exhibit pure potentiality: in and of themselves they do not predict the “organism” that is the building. Rather, the goal, or the teleological drive, is in fact introduced case-by-case in its design, with each architect who would work with the parts. It could be argued that the goal of the system is to create enclosure, and that is certainly a concern that it addressed. But unlike other prefabricated building systems of the time in which the unit was

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408 Gropius assigned the components of the Packaged House to his students at the GSD. See also Architectural Record issue that had Neutra and other architects experimenting with the system.
conceived at the room-scale, the Packaged House provides an almost unlimited variety of ways to enclose space, without the preconceived design of the room.

The lesson to be taken from systems theory and cybernetics can be used to test the physical component systems of the Packaged House. The panels are prefabricated, and are thus already complete entities, and are brought together to make the body of the structure through the locking together of the joints on the lateral edges of the panels. This is very different than a space frame in which linear elements are brought together at the extreme ends of the steel tubes at a joint. The space frame structure must then be clad with other kinds of covering whether metal panels, glass, or other kind of materials. While the space frame does provide a new level of three-dimensional sophistication, the Packaged House does this in a different and more compelling manner.

The Packaged House was an excellent example of a reaction against the repetitive, barrack-like prefabricated housing that was prevalent in short term housing during the war. After the war, the Packaged House would become a crucial tool in nurturing individual expression within a closed system of parts that would become open in the potentially infinite possibilities of combinations in the hands of the architects, who became arbiters of taste and necessary players in the construction and variation in individual freestanding housing. This postwar model was entirely different in war devastated Europe, in which larger housing blocks were necessary to house displaced people, and in Italy in particular, where the population relocated en masse from small towns and rural areas to the major cities. It is in this way that Zevi’s contribution might be seen as prescient, or at very least, becomes a way in which an American notion of individual liberty and expression would be met with a more communal way of life in Italy. With that said, however, the omission of these parts of his text in the English translation was an error that has been discussed more thoroughly in an earlier chapter. And much of the way that Verso un’architettura organica is organized focused more on formal
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characteristics of the way that the organic “looks” versus how the organic “performs” or is “performed.” It is this aspect, a systems idea of how the rules or laws regarding “organization” are utilized and made manifest, that is an example of the organic in architecture.

Alternative “organic” is alluded to by Bertalanffy, Moretti, D’Arcy Thompson, and others and is a relational term: principles are derived, distilled, and abstracted, from science and used in engineering, in architecture, in art, and in essays. The “organic” is a way of thinking about open systems, creating an open system of architectural planning, adoption/selection of parts from science and applying these rationally but also recognizing that not all can be total and rational.

What was a postwar push towards the single family house in the U.S. was countered in Europe by a need for high-density multiple family housing. This need to house the ever “Greater Numbers” of the postwar population boom, with a particular focus on the discussion in Italy, will be examined.

We can see in housing the extension of seriality, with a heightened awareness of cold standardization.

“Industrialized Building” studies at the Hochschule für Gestaltung (HfG Ulm)

In its planning stage being in 1947, two years after the war and partly sponsored by European Recovery Program (Marshall Fund) subsidies, the Hochschule für Gestaltung (HfG) Ulm first opened its doors in improvised spaces in the city of Ulm in 1953. The new building, sited on a

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409 It is not that Zevi illustrates his idea of organic architecture inasmuch that he uses projects throughout which can be understood, and I think fair to say, should be understood as his intent to illustrate his text which in fact does not necessarily discuss the physical attributes of organic architecture, but emphasizes the much more difficult concept of the social nature of organic architecture.

410 René Spitz, hfg Ulm: the view behind the foreground: the political history of the Ulm School of Design, 1953-1968 (Stuttgart: Edition Axel Menges, 2002), 58. “The merger of the three western occupation zones had been prepared by the agreement between the American Secretary of State and the British Foreign Secretary, on 2 December 1946, to establish the British-American Zone. Half a year later, on 5 June 1947, the American Secretary of State George Marshall, in a speech at Harvard University,
grassy hill outside the city, opened its doors on October 2, 1955, coinciding with what is often considered the official opening of the HfG Ulm.\textsuperscript{411} The first Rector, Max Bill, was appointed in 1954. Being privately funded, it was able to operate independently from public bureaucracy. Max Bill, who had been a student at the Bauhaus, looked to reexamine the Bauhaus curriculum for a postwar period with a goal of understanding “Good Form” through the consumer object.\textsuperscript{412} A discussed the essential features of the \textit{Marshall Plan} that were named after him. Foreign policy after the beginning of the Cold War began to take to task the democratic reform of German society because Germany would now need to be tied to the West permanently and firmly in order to ‘strengthen the Western alliance in a possible confrontation with the Soviet Union and to prevent a return to circumstances between the wars. This meant that from the U.S. perspective a German seesaw policy or the neutralization of Germany that could only end in Soviet dominance had to be ruled out in principle’. On 3 April 1948, American President Harry S. Truman signed the Foreign Assistance Act, after which financial aid flowed to Germany via the Economic Commission Administration (ECA).” See also 69-70, 113.


\textsuperscript{412} Spitz, \textit{hfg Ulm}, 14-5, 113. Spitz discusses the motto \textit{Die gute Form} of the Swiss Werkbund between 1949-1969, whose tenets were brought by former Bauhaus student, Max Bill to the founding principles of the HfG Ulm. Max Bill is quoted by Spitz having given a talk at the 1948 conference of the Swiss Werkbund on “beauty as function and based on function.” The idea of \textit{Good Design} went so far as to make claims to have a social goal on par with organic architecture, that is, that \textit{Good Design}. Spitz before quoting Max Bill, cites J. C Friedrich von Schiller’s (1759-1805) “Letter on the Aesthetic Education of Man.” Schiller’s 25 letters \textit{On the Aesthetic Education of Man in a Series of Letters (Über die ästhetische Erziehung des Menschen in einer Reihe von Briefen, 1794)} are part of his larger body of work, “resting upon Kantian principles” where he upholds the moral character of the aesthetic, investigating the parallels between beauty in nature and in the human made, tied to the beauty of the human mind which is then addressed in a science of aesthetics. (Fredrick Schiller, “Introduction” \textit{Aesthetic and Philosophical Essays}, http://www.gutenberg.org/files/6798/6798-h/6798-h.htm#link2H_INTR). In Schiller’s Vocabulary of Terminology, \textit{Aesthetics} is defined as “The science of beauty; as ethics of duty,” mirroring Emmanuel Kant’s that “the beautiful is the symbol of the
central premise of the curriculum was that in order to understand and facilitate the relationship between society and industry, design would require new visual and linguistic vehicles of information, and make real and productive connections with industry. The aim was to produce factory-made consumer goods, both freestanding products and architectural components, that would no longer look as if they were produced in a craftsman’s workshop. This is reminiscent of the Deutscher Werkbund carrying over many of the concepts of restraint in material choices, practicality, or harmoniousness. In the matching of function and form, it was able to be produced in quantities such that citizens of all classes would have access to consumer products, and good design at a good price. This is the overarching moral tone that was in the founding of the HfG Ulm, but this still presupposes the primacy of the designer.

Initially, the pedagogy of the HfG Ulm, still aware of its relationship to the Bauhaus but aware of its possibility to see things anew in the new postwar period, sought distance from the previous conception of the design and reception of form as evolving from a strict adherence to the expression of function. Instead, it has been noted that there “arose a complex edifice of ideas morally good….” In Emmanuel Kant, “Dialectic of Aesthetic Judgement, The Critique of Judgement, James Creed Meredith, trans. (Oxford: Clarendon Press, Oxford, (1928) 1952, 1992), 223 (section 353). Spitz then continues and quotes Bill who stated the social goal behind the ideal of Good Design “implies an unspoiled social order, democratic, rational, clear, and transparent, without guile and tricks, knowing no misguided emotions. Typically the ideal is conceived shortly after the Second World War, just after the second social catastrophe of our century.” (quoted in Spitz, 15) 413 Spitz, hfg Ulm, 13.

414 For a detailed study, well after Max Bill’s departure from the HfG, see the article by Tomás Maldonado, “Is the Bauhaus Relevant Today?,” in ulm 8/9 (1963). Then in the letters section “To Ulm,” in ulm 10/11 (1964) a series of comments and letters titled “Comments on ‘Is the Bauhaus Relevant Today?’” This includes letters from Josef Albers, Gillo Dorfles, and Reyner Banham, and a series of letters between Maldonado and Walter Gropius. Dorfles discussed how after the war the “Epoch of the Bauhaus” had ended and that it was impossible to “insist on the application of methods and systems which have already had their time,” but that certain of its ethico-social concerns should be retained: “The ‘antifunctionalist’ and ‘Neo-Liberty’ reaction, which spread in Italy during recent years, owed its existence proper to similar stipulations. It was unfortunately a reactionary movement: it was unaware of the indeed considerable dangers to which it was exposed,
regarding functionalism, which adopted a moral undertone” and one could speak of the “truth of
the object.” Additionally, the idea of *Good Design* was such that Max Bill stated that the aesthetic
and the moral dimension of an object were reciprocated in the other, going so far as to say that there
was “only a quantitative difference between ethics and aesthetics.” In the early years the
curriculum at the HfG Ulm focused on the tension between the custom-made versus the
standardization of design products and architecture with the intent to develop an experimental
attitude towards design and a critical approach to society.

With a capacity of 150 students, all at HfG Ulm were enrolled in a year-long Basic course before
choosing one of four specialized departments: Product Design, Visual Communication, Building,
and Information. The entire curriculum was characterized by a dual interest in both theoretical and
practical subjects. After 1955, the curriculum moved distinctly towards the emphasis on exact
mathematical and geometric principles and their practice in design methodology. Argentinian
architect Tomás Maldonado came to the HfG Ulm initially in 1954, but quickly clashed with Bill’s
approach. Though Bill focused on *Good Design*, for Maldonado, the emphasis on functionalism
produced a kind of neo-functionalism that still depended too much on the designer mediating what
is in fact good design and tied in a similar way to then historical approaches of the Werkbund and
the Bauhaus. Bill’s approach, such as we saw in Zevi’s polemical statement at the GSD, still
emphasized the person and personality of the designer as an individual rather than in a more
complex network of associations. His believed that the pedagogical approach that had prevailed at
the Bauhaus had been to codify a language of rationalist aesthetics in industrial production, to

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establish a new repertoire of a style that is identifiable as “formally pure”. Ultimately, for Bill this was an expression of a neo-academic formalism and he pursue a more evolved version of the Bauhaus approach.417

Maldonado, though, questioned the fundamental question of whether a neo-academic approach was valid at all in the design of products for mass consumption, suggesting that rather than the aesthetic value of an object based only on abstract qualities it is really an image of socially recognizable symbols, tied to the use of the object. In these points, Maldonado was responding to Reyner Banham’s writings on American “styling” in the years 1930-1950. He disagrees with Banham’s point that there was an opposition between “styling,” attributed to popular art forms and an elitist art, that of “good design.”418 For Maldonado, formalism, neo-academicism and “styling” are equally responsible for the crisis in industrial design as they each give preference to the formal attributes that are involved in the creation of a product. Some of the most factors that lie behind such as production, construction, economic and even symbolic factors are not accounted for. As such, under Maldonado’s direction, the formal or aesthetic aspect of design is not eliminated, it is just placed in relationship to the other factors that a designer in the contemporary world must understand and negotiate in the design of aesthetic objects and environments.

Already these concerns were operative in the “Building” department, the architectural design area of the curriculum. Konrad Wachsmann was a visiting instructor at Ulm in the academic years 1954-55 and 1955-56. Following on the study of modular and prefabricated building systems from earlier in his career, Wachsmann brought his interpretation of modern building to Ulm. He critiqued the idea of establishing a traditional architecture department at the HfG Ulm, arguing that doing so would

duplicate a curriculum that was offered at many other universities and schools throughout Germany. Rather, he proposed a specialized field which studied the possibilities of the industrialization of building and applied the research through specific design projects, starting from the component part and developing modular, factory constructed building components.\(^{419}\)

In 1956, Konrad Wachsmann and Herbert Ohl transformed the Department of Building, which Max Bill had envisioned as part of the curriculum at the outset, to that of the Department of Industrialized Building. Course work emphasized the design and prototyping of modular construction units and extended to study methods of modern production and techniques of construction. The focus was predominantly on prefabricated buildings, modular coordination, and standardization. Herbert Ohl was nominated the director and other faculty included Bruce Martin, Matthew Wallis, Joseph Rykwert, Christian Norberg-Schulz and the Italians Giuseppe Ciribini and Giulio Pizzetti.\(^ {420}\) Wachsmann and Ohl’s “Industrialized Building” department remained in place from 1954 throughout the life of the HfG Ulm, with changes in its curriculum integrated with and corresponding to the many changes in the curriculum and emerging areas of study that were to come. In 1964, at the fever point of industrialized building, a large portion of the magazine \textit{ulm} 10/11 was dedicated to Industrialized Building.\(^ {421}\)

\(^{419}\) Ibid., 11.

\(^{420}\) Ibid.

\(^{421}\) \textit{ulm: Journal of the Ulm School for Design} 10/11 (1964)
While Maldonado initially came to the HfG Ulm as an observer and then instructor, in 1956 he became co-Rector with Otl Aicher, Max Bill, Hans Gugelot, and Friedrich Vordemberge-Gildewart. Due to irreconcilable differences regarding the structure of the curriculum and pedagogical approach, Max Bill left the HfG Ulm in 1957, and in 1958, the directorship was reduced to three co-Rectors, Otl Aicher, Hans Gugelot, and Tomás Maldonado. The curriculum became more specific and increased in theoretical subjects, and the leadership varied until 1964 when Maldonado became the sole Rector until 1966 when Herbert Ohl took over, and in 1967 when Maldonado left the HfG Ulm after 13 years and one year before its closing in October 1968.422

422 Lindinger, Ulm Design, 16-27. See the illustrated Chronology that starts with the roots of Ulm in 1943, during the period of its planning and opening in 1953 and its closure in 1968. This history of the complex factors that contributed to the closure of the HfG Ulm is well-documented in René
Within a few years of its founding, and under different leadership, with the strong intervention of Maldonado, the focus shifted to the designer being one member of an interdisciplinary design team. No longer could the needs of the public be predetermined. New scientific methods of analysis of data would provide a different model of feedback assessing the consumer’s desire against the output of design, a complex network. Max Bill, departing the HfG Ulm in 1957, lamented the loss of the aesthetic component, “the totality of functions that needed to be fulfilled […] should form a harmonic whole and thus give an aesthetically flawless overall impression.” But perhaps Bill did not see how these concerns had been subsumed within a larger pedagogical approach that turned outward to try to understand and incorporate the dramatic changes in technology, science, and organizational strategies that were occurring throughout the rapidly developing postwar context in Europe and beyond.

As of 1958, under Aicher, Gugelot, and Maldonado, a scientific approach to the design courses was dominant, emphasizing the scientific over aesthetics (as Bill had understood) and the study of techniques of mass production, and the role of the designer as only one collaborator in a much larger network of intersecting disciplines. Correspondingly, Maldonado proposed a reorganization of the core curriculum at the Hfg Ulm. Courses were reorganized around topics and processes borrowed from the social sciences including the quantification of data, and the study of architecture was shifted to the subject of technology and relationship to industry. This also signaled a close relationship between design, science, and technology. The new pedagogical approach left the designer in a more modest role as part of a team of scientists, publicists, researchers, and technicians. In a break with its early formation and with the approach inspired by the Bauhaus, the

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423 Spitz, hfg Ulm, 15.
*Gestaltung* was envisioned as a socially responsible program for shaping the environment, using tools developed from the emerging disciplines of perceptual theory and semiotics.

The overall movement used a mathematical method to analyze data and phenomena and then apply this to industrial design. Implied in this strategy was also a logical method of organization of form, which related all the areas of the curriculum. This may be seen in the application of the modular method in the Industrialized Building department, in stereometric exercises with three-dimensional modules and the studies of progressive deformation of grids in the Visual Communication department. Its influence is seen for example in a conference organized by Hans Gugelot in London in November 1962 entitled “Praxis of Industrial Design.”

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With the various new approaches, all departments saw change. The Visual Communications department in technical and semantic problems was influenced by Maldonado's interest in semiotics, which he investigated in a seminar in semiotics offered from 1957-60. The pages of *ulm*, which began publication in 1960, records ample evidence of this influence. Philosopher Max Bense, known for his writings on aesthetics, semiotics, and philosophy of science, developed a theory of praxis which related theory and saw its elaboration in design praxis. Bense also was the anchor for the dissemination of information theory which influenced all at the HfG Ulm. It shows his interest in applying scientific disciplines in the work in the diverse areas of the school.

From 1962-66, Maldonado and Aicher were to return to try to reassert a balance between science and design, between theory and practice. In this period, other influential designers and scientists were crucial to the research such as Gui Bonsiepe, Herbert Lindinger, and Abraham A. Moles.  

\[425\] Max Bense developed an idea of “existential rationalism.”

\[426\] Bistolfi, “La HfG di Ulm,” 11. This is also covered by René Spitz, *HfG Ulm: the view behind the foreground: the political history of the Ulm School of Design, 1953-1968* (Stuttgart: Edition Axel Menges, 2002) and Ingeborg M. Rocker dedicates a large section of her dissertation to the work of Max Bense. This work is valuable because of the dearth of translations of Max Bense in English.

Ingeborg M. Rocker, “Emerging Structures: Information Aesthetics and Architectures of the Digital Medium” (Princeton: Princeton University Dissertation, 2010). Rocker points out that the reception in Italy of Bense’s work is known in Italy through Giangiorgio Pasqualotto’s *Avanguardia e tecnologia: Walter Benjamin, Max Bense e I problemi dell’estetica tecnologica* (Roma: Officina Edizioni, 1971), and that is the case. She also in her section on the influence of the HfG Ulm in Italy focuses almost exclusively on Manfredo Tafuri’s reception of Bense’s work as made accessible through Pasqualotto. What she doesn’t note is that Pasqualotto’s book was in a series directed by Tafuri and that Italians would also have known of Pasqualotto’s work from essays published in *Contropiano* in a similar time frame. Giangiorgio Pasqualotto, “Ideeologia e tecnologica,” in *Contropiano* 3 (1970) and Giangiorgio Pasqualotto, “Teoria dello sviluppo e ideologia dell’integrazione,” in *Contropiano* 3 (1971). His main text is Giangiorgio Pasqualotto, *Avanguardia e tecnologia: Walter Benjamin, Max Bense e I problemi dell’estetica tecnologica*, (Roma: Officina Edizioni), 1971. Number 4 in the series “Collana di Architettura” directed by Manfredo Tafuri. On another note, and a project I will work on in the future is that the reception of Bense’s work in Italy is transmitted perhaps by Abraham Moles, who, writing in French was more accessible to the Italian speaker. Additionally, Moles studied with Bense and was very active in Italy, published frequently in *Casabella* and other magazines and as discussed in Chapter 4, he was very influential and active in the art world and the Arte Programmat movement.

Chapter 5: Systems, Modularity, and the Prefabricated Component
Moles, as discussed in the previous chapter, was a French philosopher and specialist in communication and information theory, whose writings were quite influential in Italy in this period.427

**The Ulm diaspora and Italia**

This radical rethinking of architecture was disseminated in various modes outside of Germany through publication in the magazine *ulm*, which had a large readership in Italy during the period that the HfG Ulm operated. Upon its closure in 1968, there was a migration of many to other institutions, as instructors opened studios in all parts of the world. There was a natural migration of many to Italy and in particular to the north to work at the Olivetti, or in the blossoming Industrial Design industry in Milan.

Theorists and designers active at Ulm such as Abraham Moles, Enzo Frateili, Giuseppe Ciribini and Giovanni Anceschi, and Andries van Onck, among many others who crossed between the art and architectural worlds, increased the reach of the work of the Ulm school.428 Additionally, there was a moment when Tomás Maldonado, Martin Krampen, Gui Bonsiepe, and others ran a design studio at the DAMS of the University of Bologna that was based on the Ulm Model. Herbert Ohl continued his research on automobile design at the Centro “Pio Manzù” in (Pio Manzù also studied at the HfG Ulm under Maldonado). The authors boldly state that:

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Dramatizing the situation a little, one could practically dare to say that Italy played a similar role for Ulm as that which the United States played for the Bauhaus.\textsuperscript{429}

The draw of Ulm was notable, as recorded in a site visit by a group of Italian critics, architects, and designers, in June 1959 organized by the Collegio Architetti di Milano, led by Tomás Maldonado and Herbert Lindinger, with visitors G. Frattini, R. Crespi, E. Frateili, P. G. Castiglioni, Franca Helg, G. Pozzo, G. Castelli, J. De Pas, and Marco Zanuso.\textsuperscript{430} This visit is documented by Enzo Frateili in the special issue of \textit{Rassegna}. Frateili also included two sketches in this essay that he had drawn from Konrad Wachsmann’s \textit{Holzhausbau} and from the \textit{Bauhausbuch}, n. 3.\textsuperscript{431} He recounts the wealth of information available in the library at the HfG Ulm, a resource on modern architecture only dreamed of in Italy. In discussing the visit with the Italian group he immediately wanted to remain in Ulm longer:

\begin{quote}
The reason? I stepped into the library of the School and I found a Promised Land of unexpected sources, as if a whole cultural background, whether figurative, technical-scientific, with branches at the architectural scale, and focused on the last century, on design. I had just begun to write in \textit{Stile Industria}, [and the wealth of sources] and the fact that they were open all day [was tempting]. I began sketching, making photocopies and negatives at Blumenschein in the city, a real fight against time.\textsuperscript{432}
\end{quote}

\textsuperscript{429} Anceschi and Tanca, “Ulm e l’Italia,” 26.
\textsuperscript{430} Enzo Frateili, “L’incantesimo del Kuhberg,” 28. This is based upon the caption to a photograph, but on can also look at Spitz’s book which has an attempt of a list of all instructors, students and visitors to during the entire period of the HfG Ulm.
\textsuperscript{431} Enzo Frateili, “L’incantesimo del Kuhberg,” 28.
\textsuperscript{432} Ibid. “La ragione? Avevo messo piede nella biblioteca della Scuola a vi avevo trovato una tale Terra Promessa di fonti insospettate, direi di un grande retroterra culturale—sia figurativo, sia tecnico-scientifico, con estensione alla scala architettonica e scendendo fino a la storia dell’ultimo secolo—sulla letteratura del design, della quale da poco mi ero occupato debuttando su \textit{Stile Industria}, tanto che decisi di farvi orario continuato. Riempivo fogli di annotazioni e di schizzi andando poi a fare fotocopie e negative da Blumenschein in città, in una specie di lotta col tempo.” [Translation mine]
Frateili recounts that he was immediately drawn to the section on prefabrication, technical construction, experimental building, from the 1920s on. Here he found sources such as the precious Holzhausbau of Wachsmann, when he worked as technical director of Christof and Umack, materials on Gropius’s houses made of preproduced elements at the Weissenhof Siedlung, to the “Haus am Horn,” by Georg Muche, as well as many books on architectural modernism and its extension into the various decorative arts, all pointed towards a more comprehensive view of design, as he relates. He describes his time there as a silent meeting with the protagonists represented in the books, and with students, graduates and faculty. A memorable meeting was with Claude Schnaidt, who had just graduated after studying with Wachsmann with a design for a componentable system of standard panels with a universal joint, the Verbindungssystem. He met graduating students Herbert Lindinger and Andries van Onck, who was preparing his thesis on “curves in objects.” In his short visit, Frateili saw the Hochschule as if it were a “central node of a railway network of the international design culture.” He met with Wachsmann in his apartment in Neu Ulm, who showed off his great agility by untangling impossible knots in string. He also spoke with Robert Le Ricolais, as he calls him, the great designer of the “basket” space structures, and with Vordemberge-Gildewart, last representative of De Stijl.

Frateili also spoke about being impressed by the pedagogy of Ulm, of an “overturned functionalism’ of the product (constructed) by the user.” It was as if it was Max Bill had wanted, an impeccable “object” in its gute Form in the building of the HfG and that somehow, those who were working inside the different building forms, repetitive modules arranged almost informally on the hill would transfer to the user an invitation to simplify one's behavior in the communal study and living setting.
to be social but polite, in “consuming the Grand Rite of functionally inspired design.” Frateili ends his essay pleased to have met Maldonado and understand the four-dimensional aspect of the HfG Ulm. For Frateili, it was not necessarily a “conversion” to the Ulm way, but what he saw in the intersection of pedagogy, resources, and the individuals had changed him to his core, and continued to have a lasting and deep effect on his work. But he too has his doubts, which will be examined in his contribution to the text “Architettura Industrializzata,” in the magazine Marcatré in 1965 shortly. For the moment he muses:

It was strange in the end, and captivating at the same time. This autonomous rhythm of the School, not at all synchronized with the efficiency-oriented time of the Federal Republic that, just having left the period of the reconstruction behind them, we launching themselves at full speed into the economic “boom”!

The changes in the Ulm curriculum and leadership paralleled the crises and changes in pedagogy and philosophical approaches that occurred in the 1960s, but perhaps as Frateili points out, that as an academic institution, the HfG Ulm could never be fully integrated with society even as the pedagogy sought to reflect contemporary methods and techniques of production and communication. The contribution of the studies and experiments at the Ulm school, which were conducted by an international and varied group of architects, engineers, cyberneticians and scientists, had an enormous influence on architects. Looking toward system theory, cybernetics, and linguistic systems, the role of the designer became more of a coordinator of various experts. This shift paralleled the changes in response to late consumer society on the part of artists distancing themselves from their

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433 Ibid. “Un’altra impressione riportata…riguardava il ‘clima’ pedagogico, nel quale mi parve di indovinare la suggestione esercitata dall’ambiente architettonico su chi viveva al suo interno, una sorta di retroazione che vorrei chiamare: “la funzionalità ribaltata’ del prodotto (costruito)sul fruitore.” [Translation mine]

434 Ibid. “Ed era strano in fondo, e accattivante, questo ritmo autonomo della Scuola, per nulla sintonizzato col tempo efficientista di una Repubblica Federale che, uscita dalla ricostruzione, si lanciava allora a piena andatura nel “boom” economico!” [Translation mine]
role as a visionary humanist. How would one design and give visible form to objects and buildings in a fully industrialized world dominated by commodities and media?

In the years just prior to its closing, the postwar economic boom had changed all aspects of life in Europe and the reception of a purely “functional” architecture and product design, to satisfy in a minimum way demands to make housing and goods available for all reached a crisis point. Abraham A. Moles who had been a faculty member at the HfG began to question the role of the designer in improving the world, after the closing of the HfG Ulm.

He wrote:

The idea of functionality included a certain asceticism of function, first in the way it was implemented, but also in a refusal to encourage a proliferation of functions that would necessarily end up being unproductive.

And again:

The theory of functionalism could no longer be heard in a society of overconsumption. This society was more interested in creating new needs than in satisfying the basic needs in a perfect way and directing its efforts toward analyzing what is truly fundamental. This is the philosophical basis of functionalism; through economic power play, the search for what is needless gains the upper hand over the search for function. […] In my opinion it is this crisis of functionalism, even more than the politico-economic struggle, that, in the historical context of the German economic miracle, contributed not only to the closing of the school, but above all to its breaking up into other institutions that are scattered all over the world,
from Brazil to Japan, from the US to Israel, where it continues to exert its influence as an essential component of Western thinking.\footnote{Spitz, bfg Ulm, 15. In this section, he is quoting from Martin Krampen and Günther Hörmann, ed.}

In another essay by Abraham Moles, “Products: Their Functional and Structural Complexity,” published in \textit{ulm} 6, 1962, he reflected deeply upon the industrial design of products. Adopting a structuralist approach, Moles discussed fundamental aspects regarding the perception and production of things in the world. Through the use of scientific method, which he called “the essential form of the understanding of the world,” this would allow the mind to structure the world with the tools of \textit{measures} and \textit{forms}. He introduced cybernetics as a:

\begin{quote}
    general science of \textit{organisms}, a science of the nature of the \textit{organs} which constitute organisms: its object is to find the properties resulting from the putting together of organs, to find in what way precisely the whole is greater than the sum of its parts.\footnote{Abraham Moles, “Products: Their Functional and Structural Complexity,” in \textit{ulm: Journal of the Hochschule für Gestaltung} 6, (1962): 4. [Emphasis throughout is in the original].}
\end{quote}

He explained that cybernetics was a science that has both quantitative and qualitative aspects, and was:

\begin{quote}
    a structure-creating system, a theoretical science transcending the physical content of the elements studied, but whose essential effort must be concentrated, after a certain initial theoretical developments, on research into autonomous \textit{dimensions}.\footnote{Moles, “Products,” in \textit{ulm} 6, 4-5. [Emphasis in original].}
\end{quote}

Having just discussed the science of organisms, he then discussed that the bringing into order of the organs which constitute an organism is a process that is statistical, dealing with “producing average values from collections of individual things.” It is in this act of bringing together a “common denominator” of a form that its aspects and functions are brought out. This is a very different idea than making a form that is made as a whole from the outset, with the parts contributing to the overall form. He tied this together with concepts borrowed from information theory, stating that it...
is in fact another kind of structural theory, but one which produces “mental form” (‘forme mentale’) imposed by the mind on reality.” It is another way of understanding that an object communicates a certain meaning by involving the observer in the act of making, a way of thinking that is familiar from the analyses of Programmed Art.

In this complex article, Moles then lays out what he described as the functional description of organisms, founded on the response “it’s for.” He shifts from speaking of natural organisms to the idea of artificial organisms, or machines. He believes that the term “machine,” simply understood as operating in place of a human being, is only clear when it is a dynamic and sociological idea that changes over time and increased technological capacities and advances. A typewriter, for example, has a range of “degrees of liberty” limited only by the maxim ‘to make use of is not to destroy’ and consequently by the existence of normal functional limits...

All of this analysis served for Moles to speak of what he termed a chart of the world of machines, wherein machines, which augment or replace human action, are an intersection of great functional complexity with a reduced structural complexity, unlike a puzzle as he suggested, as the puzzle with a very large number of parts has only one way of being completed or used. He extended the biological metaphor to describe the organs, rather than coordinated parts, with degrees of liberty, such that:

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438 Moles, “Products,” in ulm 6, 9. “If the machine—or organism—is considered as a message offered to the observer by the outside world, one sees the possibility of applying information theory, whose precise task it is to measure, under the name of information, the complexity C of a message composed of an assembly of N elements drawn from a repertoire of n symbols, with a frequency of occurrence $f_i$ for the $i^{th}$ symbol. Thus an objective measure of the complexity of machine-forms is available. The ‘repertoire’ will then be the catalogue of detached elements which serve to construct the machine, and we know that the machine is constructed by taking $P_1$ organs of type 1, $P_2$ organs of type 2 and $P_n$ organs of type n and putting them together.”

439 Ibid., 10.

440 Ibid., 7.

441 Ibid., 11.

442 Ibid.
The typewriter with its 1,000 organs, the television receiver (3,000 organs), the space rocket (300,000 organs), the IBM computer (20 million parts), mark out this field of technological conquest and illustrate an essential aspect of its difficulty. It is shown e.g. that, considered on the large scale, the problem of defects is linked to structural complexity, rather than to an absolute number of constituent parts.\textsuperscript{443}

It is really the underlying order that allows a machine to perform as would an organism, much more than a collection of competing parts, the different roles are coordinated to produce a desired effect. This is a description of complexity versus the complicated.\textsuperscript{444} In a subsequent article in \textit{ulm} 12/13 (1965), Moles referred to his earlier use of the term “a map” of the world of technical objects. Rather than producing singular hand made tools and products, the “technical civilization” had moved to the idea of “assembling simple parts and of combining them into complex wholes, the properties of which exceed those of their parts.”\textsuperscript{445} The implication of this for the theorizing a new organic architecture seem clear and is one of an organic rationalism, understood through analogy with the natural world of complex systems, filtered through the rhetoric of technological progress. This would be both the great advancement in the work, but also its weak point that would be open to critique. Moles became one of the clearest voices in weighing the myriad aspects of the problem in the arts and architecture, one of the chief advocates of technological advancement as well as one of its most articulate critics, whose work was deeply influential in Italy.

\textsuperscript{443} Ibid., 11-12. The text concludes with this note: “This article, extracts of which are published here with permission of the author, appeared under the title “La Notion de Quantité en Cybernétique” in the journal \textit{Les Études Philosophiques} No. 2, (April-June 1961).

\textsuperscript{444} Moles, “Products,” in \textit{ulm} 6, 9. “On the other hand a system is complex (zusammengesetzt)—without necessarily being complicated besides—when it is composed of a large number of elements either identical or belonging to a very limited number of categories, all connected in an identical way. Thus, a telephone exchange is complex, because it is the putting together in an ensemble of a very large number of \textit{elementary} similar circuits. The human mind can assimilate a complex system, because it can understand its structure independent of the elements composing it, whether because the latter are not very complicated, or because the mind leaves them to be studied by specialists.”

Limits of the Ulm model

The problem with the weight given to a mathematical method was under great debate in the early 1960s at Ulm. It was even taken to a deeper level with the protocomputational work of Horst Rittel and the clear link between mathematical method and computation. However, there was also a critique of neo-positivism that was developing. The rapture with which system analysis, mathematical, statistical, and logical methods were adopted in the service of providing socially engaged design ran the risk of degenerating into a cult, or uncritical adoration of the method. At the HfG Ulm, this caused a divide between the purer idea of the study of a methodology of design based upon scientific method versus a pragmatist approach which sought to study the role of the designer as part of, if not in service to industry and the possibility of influencing the consumer market.

In his introductory essay to the special issue of *Rassegna* of 1984, entitled “Ulm rivisitato” (Ulm revisited), Tomás Maldonado spoke as protagonist and of the impossibility of the task of stepping out of his complex involvement in the history of Ulm to be able to, twenty years later, reflect on the history of Ulm. His reflections are interesting from the point of view regarding the possibility to speak objectively about an institution, the people involved, and the products made without a subjective point of view. He begins his essay:

> There is a rule that in this case and in all other occasions I think it wise to respect: to not constrain a protagonist to assume the role of the historian. In my opinion, the protagonist, might be, though is not always, a useful chronicler of the facts that he has lived in first person. It is rare however when he can become a reasonably trustworthy historian of the same facts. The reasons are rather obvious. The protagonist, whether or not he is aware of it, always searches to give a reading of the facts that are favorable to him, or better, favorable to

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447 See Ingeborg Rocker, chapter on Horst Rittel.
448 While of immense interest, I will have to return to this subject at a later date, as it is a quiet complex story in the Italian design culture, some of which I will touch on in a later section.
his passions, and to his own interests. So the fragmentary annotations that I present here certainly reflect my passions and interest of the time, but also, and maybe above all, my actual passion and interest towards that experience.”

Putting his ideas in context, Maldonado acknowledged that both the products design by students and faculty at the HfG Ulm, as well as the dissemination of its theories, were widespread. He believed, however, that little or no attention had been paid to the cultural influences of the school. Rather than viewing the HfG Ulm in its own right, it was constantly being compared and conflated with the Bauhaus. It is true that there were certain disciplinary connections and modes of work and thought that were connected to the pedagogy of the Bauhaus. However, he pointed out that what he believes set the HfG Ulm apart was an unbounded curiosity on the part of the faculty and students alike toward all that was new, or at least was new to them. He said that there was an eager, feverish curiosity, that above all privileged emergent disciplines: cybernetics, information theory, system theory, semiotics, and ergonomics. But also, and not in a lesser way, other more consolidated disciplines such as philosophy of science and mathematical logic. The driving element behind our curiosity, our studies and difficult theoretical work was founded on our desire to form a solid methodological base for our design work.

Maldonado reflected that this urgency to relate theory with design was premature, that in fact they were unable to manufacture products and architecture that was as sophisticated as their theories and what resulted was something that was more handcrafted, more artisanal. At the time, they did not have the appropriate tools or what they would have at the time of the writing of this essay: the personal computer.

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450 Tomás Maldonado, “Ulm rivisitato,” 5. [Translation mine].
But Maldonado points to many of the problems with this utter fascination with emergent scientific disciplines. In addition to missing instrumentation and advanced machinery and computers, he believed that they were missing a mature elaboration of “bounded rationality,” as was just being developed by Herbert Simon at the time. Maldonado begins, at this point in the essay, to speak more directly about his experiences and his personal ideas. He stated that he and others remained imprisoned by theoretical generalities of problem solving (in English and emphasized in the original) that did not go beyond a “discourse on method” of cartesian memory. He calls this a “methodologism” citing that one could already see the danger of “methodolotry.” On a more positive note, he points to work at Ulm that also was involved early in the design interfaces for the rapidly developing field of information technology and computation systems that blossomed after 1963. A strength in the work of Ulm was a symbiosis between “calculation” and “graphicization” (or visualization) in all matter of problem solving in all of the departments at the HfG Ulm, including a premonition of the importance of miniaturization in all aspects of the complex system of industrial objects in an advanced industrial society that was beginning to emerge at the beginning of the 1960s.

This was a period of an “ideology of positivism” which Maldonado posited as being at the far end of the spectrum of what he called the “ideology of the negative,” in the 1980s. The ideas of Ulm may be seen to be fastidiously “edificanti” as Maldonado states, which may mean that the works, words, and intentions of the people involved at Ulm were admirable, but in a double meaning in the Italian original, it could be that at all costs, one should make, build, fabricate, disseminate to the mass consumer culture. That critique, Maldonado pointed out is only justified in part. He believed that the “positivism” at Ulm was never conformist, but always critical. He does not believe that is the case of a certain “negativism” of the present day.

With that said, Maldonado continued his critique, stating that at times he and many of his collaborators tended towards pontificating, but he felt it necessary, because they believed so vehemently in their ideas. But one idea that was commonly held but that he never adhered to was that “design” was a means of global redemption of industrial society. He does not believe in this kind of design chauvinism. He thought that one can say that one of the enduring strengths of the HfG Ulm was that industry and culture were not to be separated, and that by designing for contemporary society, one would participate in industrial culture. Part of Maldonado’s thinking is tied to larger philosophical issues, citing that in the 1950s he was attracted to the cultural orientation

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451 Maldonado calls this “razionalità limitata” which is known as “bounded rationality. This area needs more research but Herbert Simon, an economist, evolved this theory to “satisfice,” to be able to operate and make decisions without having and assimilating all the information needed to make a decision (which he believed was an impossibility anyway). Perhaps Maldonado is wistfully saying that rather than attempt to know everything about the parallel disciplines to design that were being studied at the HfG Ulm, that the designers should have moved more quickly and with what may have been partial understandings.

452 See the design by Maldonado and Ettore Sottsass at Ulm for the Tekne 3 model of 1960, and Olivetti Elea9003 mainframe computer of 1960.
of the Frankfurt School, especially to a neopositive tendency such as he saw in the writings of Carnap, Neurath, Schlick, Morris, Wittengenstein, and Reichenbach. Maldonado mentions that Adorno’s presence in Frankfurt was a great factor for him, in what he called a contradictory intellectual upheaval (contraddittorio turbamento intellettuale). He stated, “I must confess that Adorno’s involuted and fertile speculations, his slightly cryptic aphoristic and provocative writings fascinated me in a way that was anything but rational.” He recounts an aphorism that Adorno delivered to him over the dinner table in an Italian restaurant in Frankfurt, trying to calm his enthusiasm for the utility of systems in the design of industrial objects:

L’utile è logoro ma il mero utile inaridisce il mondo.
(The useful is worn out, but the merely useful dries up the world.)

Taking this in stride, Maldonado referred the reader to the work that Adorno was pursuing in that time period, especially in his conference on Functionalism of the Werkbund that took place in Berlin. While Adorno was a key reference for Maldonado in the 1950s, he would turn to Jurgen Habermas in the 1960s, looking at the relationship of industrial culture and the culture industry, which inspired him to think critically about the role of “design” between these two realities.

As he looked back at the Hfg Ulm, he mused that in the final analysis some things have changed, but others not. He still believed in the model of Ulm as a way to train designers for “instrumental goods,” of production or communication. But one thing that he felt he undervalued at the time is that:

the reality of objects that Adorno situated in the hackneyed or tired realm of the useless. But these are objects that one needs nevertheless: the attempt to liberate them from oblivion is legitimate, even desirable, a surely difficult task, because the unlimited liberty of the useless favors the most elite extravagances. But let’s speak the truth: it’s also difficult to avoid the fact that even the useless dries up the world.

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453 Theodor Adorno, colloquially related by Maldonado.
Maldonado ends his essay with some thoughts and question which will be seen in other writers and architects throughout the 1960s, on the ride from the high positivism of the early part of the decade to increasingly questioning the role of the designer in advanced technological societies. One such place is in the heated discussion on “Industrialized Architecture” published in 1965, in which we see the discussion move from the more practical to the more theoretical. This discussion included the architect Enrico Frateelli who had declared an elective affinity with the pedagogy of the HfG Ulm, as well as Gillo Dorfles who was in correspondence with Maldonado and well aware of the larger trends occurring at Ulm and in the international design culture.

Marcatré: Architettura Industrializzata

In an important article in the Italian magazine *Marcatré*, many of these questions were addressed in response to what is “Industrialized Architecture”. Gillo Dorfles, in conversation with Enrico Frateelli, Roberto Orefici and Vittorio Gregotti discussed “Industrialized Architecture,” articulating the relationship between building elements and their rules of combination to a the rigor of a linguistic and structuralist model. They adopted Eco’s concept of the “open work” to discuss the openness of combinatorial possibilities: opening the question of seriality to architectural practice.

difficile, perché la illimitata libertà dell’inutile favorisce le più elitarie stravaganze. Ma diciamo la verità: difficile è anche evitare che l’utile inaridisca il mondo.”

455 This section relates the content through translation of Maldonado’s one page essay, “Ulm rvisitato (Ulm revisited). All quotations in this paragraph are from Tomás Maldonado, “Ulm rvisitato,” 5.


458 *Marcatré* 16/17/18, July-August-September, 1965: 165-174. *Marcatré* was founded as part of the Gruppo ’63 another influential movement that crossed previously defined boundaries of art/literature/poetry/architecture/theater, etc.
It is possible that this conversation is in response to an article in *ulm* 11/12 also published in 1965, in which Abraham Moles discussed combinatorial assemblies as part of the complexity of the technical civilization. His essay, “Theory of Complexity and Technical Civilization,” as previously mentioned, Moles discussed that a key characteristic of the Technical Civilization was the obsolescence of the individual tool and the preponderance of functional and structural complexity that was evidenced in new objects that really were systems, as his examples of a typewriter, with its “1,000 organs,” versus the “IBM computer, with its 20 million parts”. The idea of an industrial product, while identifiable as a singular object, is really constituted of myriad, interconnected, communicating parts, which contribute to it being a complex system. In his 1965 essay, he related this back to the world of industrial production and the idea of machines as “purposeful objects,” intersected with the “field of human needs,” ranging from a theoretical analysis of new means of production to a critical look at the “breviary of technical civilization,” or the idea of a catalogue of the vast array of consumer products available to the “insatiable consumer”. His writing is important to reconsider especially in light of his simultaneous close analysis of the consumer object, but also in regards to his critique of the larger questions of mass consumption, the role of advertising, and the excesses of the time and how the designer might negotiate this new complex, post “boom” world. Some of this may be seen in the different threads of the conversation in Italy and seen in the *Marcatré* essay.

Critic Gillo Dorfles begins the conversation on “Architettura Industrializzata.” This term has two meaning in Italian, one is descriptive as in “Industrialized Architecture,” but the second gives more agency to architecture, that is, Architecture that is industrialized. So the term is really both a

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459 Moles, “Products,” in *ulm* 6, 11-12.
discussion of the actual study of building components, and is the intent of what Wachsmann and
Ohl had proposed at the HfG Ulm, but the Italian conversation, picking up on what was being
discussed in the pages of *ulm* by Moles, Bense, Maldonado, and others, is that there is a much larger
cultural aspect of industrialized architecture that will be emblematic of the conversation seen in
Italian architects and critics in the years from 1965-1969 in the pages of *Casabella, Stile Industria,* and
*Marcatré* as a few examples that will be used here and in the final chapter as evidence of a robust
critical discussion versus technology, architecture, and culture in this period.

Dorfles thought that, within a period of twenty years or so, to speak of industrialized architecture
would be completely outmoded. 461 He tied the discussion to the “economic-aesthetic” question.
Since artiginally made works are too expensive to produce, how could the aesthetic remain in play
with an industrially-produced object or building? He proposed that rather than applying industrial
processes to construction, to rethink from the outset the industrial processes. As has been discussed
in the preceding chapter on Arte Programmata or in the studies at the HfG Ulm, Dorfles’s
comments echo an already prevalent way of thinking that had been experimented with in design and
form as well as in theoretical treatises.

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461 Gillo Dorfles, Enzo Frateili, Vittorio Gregotti, Roberto Orefici. “Architettura industrializzata,”
*Marcatré* 16/17/18, July-August-September, 1965 (Milano: Lerici Editori, 1965): 165. I believe that at
forty years past the date of this essay, this is exactly the same conversation that is dominating
architectural discourse with a seemingly new fascination with technical civilization made possible
through computing and the possibility of systems and forms of great complexity, tied in with the
blossoming of the possibility of the computer-numerically controlled fabrication of the parts of
architecture. There is a new emphasis on components and systems that echoes the discussion of this
earlier period, though I would venture to say that the discussion in the 1960s was infinitely more
aware of speaking about the political, social, and economic implications of the advanced
technological world and the possibility to produce products of immense complexity and aesthetic
beauty. A contemporary justification in much work has been about emulating biological systems so
as to produce building skin assemblages that are “smart” skins, economically affordable, approaches
to sustainability. See the Conclusion for a further discussion regarding grounding this historical
investigation in the contemporary moment.
Enzo Frateili, as an architect, brought up an important point in grounding the conversation that would be echoed by Vittorio Gregotti: grounding the conversation on Industrialized Architecture. There are two important points. One is that the essay uses the term “Architecture” rather than “Building,” which was the name of the department at Ulm. This in some ways belies the bias of the importance of the overall architectural building and not to remain focused, as had been the case in both Wachsmann and Ohl, on the component parts. Frateili addressed this in teasing out the distinction between architecture, which in his view, was an autonomous entity that was constituted by bringing together different elements, and is used by inhabitants and is not directly consumed as would be a consumer object. He believed that unlike an automobile, or other machine which is a closed system of parts, architecture is in fact open, of multiple building elements being brought together. The process of industrialization in architecture, except perhaps in the “unicum” of shell-like buildings made possible through the use of plastics, as Dorfles pointed out, referring to the work of John Johansen, is typically predicated on the modularity of parts that are brought together: architecture is not built as a whole, but is constructed and may be modulated to accommodate various needs. A building, Frateili continued, is understood as a functional complexity of many three-dimensional parts, with the idea of the cell as the smallest unit. Depending on the scale of the component element, and how it is arranged with other in various combinations, it acts like a “variable organism” in all possible senses. Combined with the functional adaptation metaphorically compared to a living organism, this organism has variations in its skin. This is more possible in a building made of component parts than a building conceived of as a monocoque (guscio), shell, or “mono-block” construction.462

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462 Enzo Frateili and Gillo Dorfles, “Architettura industrializzata,” 166. [Translation mine] I would say that Rinaldo Semino was looking for something similar, but had a more radical proposition. Frateili, discusses only the outside skin being responsive to the environment. Semino had proposed
Architects Vittorio Gregotti and Roberto Orefici weighed in pointing out the actual complexity of industrialized architecture is in that there are different types of prefabrication, the organization and rationalization of the work site, all of which are tied into larger economic cycles. Gregotti also reiterated the difference between architecture and industrial product design, but signaled a cross-over in the potential of industrial prefabrication of component parts especially in “total environments,” something that will rapidly develop in the component environments of Gianni Colombo and other designers largely based in Milan in the late 1960s and through the 1970s. This will be recognizable as an important movement as seen in the well-known 1972 exhibit at the Museum of Modern Art in New York, *Italy: The New Domestic Landscape*. This exhibit will be discussed as will another venue for architecture and product design, the XIV Triennial of Milan in 1968 on the topic of the “Greater Number,” or “Il Grande Numero,” in the final chapter. Both exhibits discuss the greater question regarding the difference between architecture and industrial design in a technologically advanced society.

Dorfles stepped in to bring up an important point that has been discussed in Chapter Four in the idea of Programmed Architecture. The interrelationship between constituent elements happens at all manners of scale. Here Dorfles related this to the ethical responsibility of the architect to be certain to site a building in a sensitive relationship to its site and environment, and the only way that he can justify the autonomous action of an architect:

> In my opinion, what distinguishes industrial design from architecture is that fundamentally architecture must anchor itself on a particular site. In other words, the only way that we can consider architecture as an autonomous entity, artistically or socially and politically, is the

the component elements, but rather than designing these as an outside skin only, the performative aspect was intended to be through the depth of the modular units, something that he was ascribing to the term *membrane*, versus *involuco* which Frateili uses. These are different ideas of the skin.

463 Ibid. See also Emilio Ambasz, ed. *Italy: The New Domestic Landscape* (New York: Museum of Modern Art, 1972) and the XIV Milan Triennial.
fact that in any architectural project whether a single building or the neighborhood, or even
the city-region, there is always an important issue, that is the integration of and
interrelationship between the building and its environment.464

Orefici then continued a discussion about the particulars of architectural construction systems and
used Konrad Wachsmann as an example of a the visual manifestation in his work of an aesthetic
logic that belies the industrialized production of the component elements, but in a cautionary tone
also looked at Wachsmann’s work as only a “parable or an allegory of construction” or later he
called a pure “mental parable.”465 Is that revealed in this following statement by Wachsmann?

The detail, a linear structure, a point in space, a component, a volume, all those increments
under one anticipated law of a geometrical ordering system, will adapt itself to almost any
change in shape and form, condition or function. Alone by its assembly combination, it
sharpens our eye, everything becomes meaningful. Permanence of the unchangeable finished
total product doesn’t exist anymore. As I said, the smallest nucleus of a living unit or an
unlimited urban system, including traffic arteries and supply and return and systems,
vertically or horizontally, now become adaptable, changing, expanding or contracting
phenomena as a realization of primary but not only abstract ideas.466

Perhaps Orefici’s is a fair allegation, as Wachsmann, in Orefici’s analysis, no longer was building for
others. This is something that had plagued Wachsmann from the outset, the primacy of perfecting

464 Gillo Dorfles, “Architettura industrializzata,” 166. “Dico questo per non complicare le
implicazioni semantiche di questo termine e anche per un’altra ragione: secondo me quello che
distingue il disegno industriale dall’architettura è in fondo il suo (dell’arch.) essere ancorata a un
determinato suolo. In altre parole l’unico modo per cui noi possiamo considerare che l’architettura
sia qualcosa di autonomo sia artisticamente sia socialmente sia politicamente, è il fatto che in qualsiasi
progettazione architettonica sia del singolo edificio che del quartiere, che addirittura della città
regine, interviene sempre un quoziente importantissimo, cioè l’integrazione e l’interelazione tra
edificio e suolo.” [Translation mine]
465 Roberto Orefici, “Architettura industrializzata,” 168. “Proprio qui si può innestare la discussione
sul significato di opere come quelle di Wachsmann, che, per ottenere un certo tipo di manifestazione
visiva della logica ‘estetica’ che è raggiungibile attraverso un tipo di procedimento di produzione,
accettano però una riduzione di partenza degli strumenti usabili che fanno sì che il loro esempio può
essere solo una parabola o un’allegraia del costruire del mondo contemporaneo.
466 Konrad Wachsmann, The Art of Joining, audiotape, my transcription of tape consulted at the
Canadian Center for Architecture, Montréal, February, 2009.
Chapter 5: Systems, Modularity, and the Prefabricated Component

the system rather than actually having, for example the Packaged House, ready for construction for an explicit social need. Frateili then commented on Orefici’s penetrating analysis of Wachsmann’s “structural world,” emphasizing the importance of Wachsmann’s innovation in unifying the theoretical theme of the “standard,” and its multiple implications in construction, the most important one of which is the idea of using new materials and technological processes that are applicable to construction of combinable elements.467

Frateili then turned to a discussion of Wachsmann’s project “Mobilar” open truss system that he had used in the hangar structure for the U.S. Army.468 He referred to Giulio Carlo Argan’s discussion of Wachsmann’s work which was published in Casabella, but was first seen as the Introduction to Wachsmann’s book Una svolta nelle costruzioni.469 Argan used the term “tricoter continuo,” a kind of continuous knitted textile. The Italian work tessuto carries this meaning in architecture and urbanism. Throughout this work references are made to the isomorphic transmission of the terms fabric, or tessuto and tissue and how this term was used to denote structure, from the a small scale of an individual work or building to the scale of the city and territory. Just as knitting or crochet builds up a larger surface through a series of knots or loops, so too does “industrialized building,” and the initial knot is a fabricated element with an equal emphasis on the joint that connects the parts. Argan

467 Frateili, “Architettura industrializzata,” 168. To be fair though, the story of “standard” dimensions was in discussion from the end of the 19c, and had many protagonists and important contributions along the way. This will be discussed in the following chapters in terms of architectural building manuals.
468 Note: Wachsmann was working for Finsider in Genoa in the years 1961-63, and may have had interactions with the various authors of this article. Rinaldo Semino has related to me that meeting Wachsmann in Genoa was an important moment in his early career and he claims to have seen the three-dimensional model of the hangar structure in Genoa, something he could never forget.
wrote this in 1960 as the introduction to Wachsmann’s book and he captured the idea of the *standard* and how the serial repetition of a single, simple element, connected through complex and variable joints could knit space, but rather than creating an interiorized space, Argan spoke of their being no differentiation between interior and exterior. This is a lasting problem that is seen in the three-dimensional space frame structure.  

But other questions remain in regard to issues of the near infinite combinatorial possibilities in a structure made up of the combination of regularized singular elements. Rather than emphasizing actual building, the exercise could be, as Dorfles pointed out, utilizing the joint, or the repetitive element as a semantic element, pushing connections to structuralism and the semantic qualities of language that may miss the point in the feasibility of the built project. A missing point is that with this type of modular construction, with the repetition of a standard three-dimensional unit, misses the integration of the enclosing skin which would need to be considered in the system. Perhaps this was not was the most important issue for Wachsmann; rather, it had to do with the more abstract nature of the system: that of the emphasis of the connection of individual elements through highly

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470 Giulio Carlo Argan, “Prefazione a ‘Una svolta nelle costruzioni’ di K. Wachsmann,” in *Casabella-Continuita: rivista internazionale di architettura e di urbanistica* (244 (October 1960), 37. [Emphasis in the original]. “L’industrializzazione edilizia, il cui procedimento tipico è la prefabbricazione, opera generalmente mediante una serie di *standards*, che ovviamente tendono a costruire una vasta tipologia; la composizione per elementi costanti e giunti multipli di Wachsmann tende a superare lo *standard* nella determinazione di elementi più semplici, ma tali da permettere il maggior numero possibile, e teoricamente un numero infinito, di combinazioni. Il modulo di Wachsmann è dunque un oggetto, per esempio una sbarra metallica di una data lunghezza e di un dato diametro: è anzi, l’oggetto costruttivo per eccellenza, nella sua definizione più elementare. Lunghezza, diametro e peso del segmento modulare dipendono da una metodica ricerca sulle sue possibilità operative e combinatorie. Con questo elemento illimitatamente riperibile, Wachsmann riesce a tricoter lo spazio, a tesserlo all’infinito, senza mai porre una distinzione tra lo spazio esterno e l’interno, tra il capiente e l’incluso.”
designed joints, emphasizing the creating of a surface, which in this case is synonymous with its reading or gestalt, that of the technique and expression of “structurality.”

Argan continued to discuss the idea of an infinite architecture, that because of the repetition of the standard element, knits elements in space, it doesn’t create space, but is space. He saw Wachsmann’s project as really the measure of an unlimited expansion, or critically, expressing above all the virtuality of a defined figure in space, the system presents a possibility of construction, but really is an unlimited and continuous possibility of construction: calling Wachsmann’s approach “a possibility of operating according to a rigorous technical approach.” Argan as an art critic was perhaps more comfortable with the level of abstraction and openness that Wachsmann’s system proposed than others who are more grounded in the practical application of technology to building. However, it is a compelling concept when Argan described Wachsmann’s as an “operative” approach. This implies that infinite architecture is a continuous project but Argan presciently understood the problem that would haunt the late 1960s and early 1970s (and is resurrected in the 1990s with the advent of computational architecture) when he stated that the moment in which one finishes the design of a project and begins to construct it, you no longer have a continuous project.

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Wachsmann’s project raises other areas of interest that gripped the imagination of many. The design of a series of building systems actually becomes the material of design. The modular coordination of component parts, rather than being organized hierarchically, are rather seen as a structural relationship between the various elements, something which rings familiar in contemporary practice. In Wachsmann’s life long search for the perfect universal joint in architecture, he had unwittingly perhaps contributed to the resistance to such a detached and autonomous design sensibility when confronted with the very real issues of the day.473

The remaining question at the core of Industrialized Architecture really has to do with its rhetorical content. So many projects of the day were concerned with combining small constituent parts to make up an assemblage of great complexity. There had to be point of meeting between an obsession with the design of the parts and the overall system and the project’s feasability. But the questions are

473 Gillo Dorfles, “Architettura industrializzata,” 170. See also this very strong critique by Roberto Orefici, Roberto Orefici, in Gillo Dorfles, Enzo Frateili, Vittorio Gregotti, Roberto Orefici. “Architettura industrializzata,” 172-3. “Inoltre, nelle strutture di Friedman si può pensare di incasellare come dei piccoli cassetti i singoli alloggi od altre cose del genere. Cioè, sì, bene, benissimo, come tutti questi contributi che singolarmente oggi sono stati dati possono ognuno prendere la propria posizione, invece che puntare ognuno sulla moltiplicazione di se stessi sino a coprire lo spazio per una soluzione unica che non può essere Friedman (sic), né la continua tessitura di Wachsmann. Tra l’altro credo che a Wachsmann si faccia un torto, in questo senso, perché si è finito ormai per prendere come una specie di stemma araldico il suo hangar, mentre questo è uno fra le tante sue esperienze cioè lui si pone come problema un sistema chiuso che è analizzabile e che non abbia altri problemi fuori di sé, ogni volta il sistema chiuso cambia; una volta è il problema dei tralicci, ma di volta in volta è un sistema chiuso diverso dagli altri. Il problema quindi varia e non si può dire che lui voglia fare una specie di tricoter continuo, come dice Argan, e null’altro, in realtà fa solamente una serie di parabole di rigore che volta per volta assumano un tema diverso. Cioè vedo abbastanza nelle propettive future la possibilità che tutte queste esperienze non si perdano in un tipo di ricerca ma si raccolgano ognuna al suo livello di utilizzo.”
important especially in light of the population explosion that was seen in the postwar period, coming to a head in the 1960s. These concerns are key to understanding how to work with industrialized processes necessary for increased production of housing and other structures, but the equally important question about how to evade the equally great pressure of avoiding absolute monotony and repetition. Is there a median way to design with great flexibility and novelty, in tune with the environment, but also economically efficient? That is the question of the next chapter.
Chapter 6: The New Dimension and *Il Grande Numero*

*La Dolce Vita*: the Economic Miracle in Italy 1958-1963

In the early 1960s, many Italian architects genuinely believed that technology could improve the quality of life through housing, infrastructure, and other badly needed public works. Modular, industrially produced building systems were explored in their capacity to allow for the rapid erection of housing for an exponentially increased demand. The idea of “openness” was a way to check the power of urban planners to allow for the input of individual freedom within an organic and dynamic system. In addition to technology, the megastructure, or the *macrostruttura* as the term is often used in Italian, was seen as a solution to providing housing for the greater number.

The techniques of cybernetics, organizational theory, system theory, componenting, and fabrication had a strong influence on specific architectural proposals. These strategies provide operational techniques with which to deal with the complexity of dealing with large numbers. The term *Large numbers* (or Greater Number) in regard to architecture has a specific valence: that of the architectural response to the housing crisis in the postwar period. This problem had extraordinary implications for architecture in terms of the correspondence between idea and technique: prefabrication of dwelling units was a common research theme, and the basic organizing principles between the individual unit or cell and the overall organization of larger structures were paramount. While it may seem that the term “Greater Number” and mass housing would be in direct conflict with a notion of “individual freedom,” the proposal here is that an attention to the smallest unit had the potential to generate complex structures in which the emergence of the larger organism would reflect the individuals situated within.

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474 Used here as if the basic living unit.
Key to this definition is that the smallest unit is not linked to the Modernist notion of the minimum dwelling unit, but could be a manufactured building component: a tectonic unit, programless, structural, and in its combination, a space-making, space-enclosing unit, that may accrete into larger configurations at various scales.\textsuperscript{475} Some of the parallel discourses that help to traverse this territory were discussed in the previous interrelated chapters that have treated the more theoretical aspects of the idea of the “Open work” in philosophy, aesthetics, and industrialized building components. This chapter will look in more detail at the diverse discourses in Italian architectural culture from the late 1950s to the mid-1960s in dealing with this theme in magazines, building construction manuals, and competitions.

“Industrialized Building” and “Industrialized Architecture” as they had been discussed in the last chapter was an area of research and design in which architecture was to be made up of manufactured component parts that would be brought together to make a whole building system. The theme of industrialized building also raises the theoretical question of openness and indeterminacy, not only in the designs themselves, but in the political idea of diminishing the importance of the role of the architect as the sole designer of a project. A building that would use an industrialized building system could be open to the input of the end user rather than a preconceived overall design by the architect. In this kind of design, smaller, industrially produced building elements were studied and overall guidelines for how they were to be assembled to provide efficient solutions to myriad design problems. This was an extension of the discussion regarding seriality in art practices and how it could be applied to the \textit{componibilità} (componenting) of prefabricated building elements.

\textsuperscript{475} This theme is the open work and carries the idea of activating the spectator to complete the work.
The open design impulse can be examined directly in the various illustrated building manuals of both the pre- and postwar period. A systems approach in architecture is seen in modular or prefabricated construction and discussed in terms of open and closed systems, concepts which are borrowed from system theory and the scientific disciplines. As have already been discussed in terms of art practices by Umberto Eco, these concepts will now have a precise meaning in the design of modular construction systems.

**Architectural Building Manuals 1930-1960**

While this chapter is focused on the period of the late 1950s and the early 1960s, it is important to contextualize the period in light of earlier events and precedents. Modularity and prefabrication as had been discussed in Chapter Five was a primary concern in the late 1950s. In order to address the housing crisis as a result of the economic boom in the late 1950s, it is useful to look at the manuals that had been in use in Italy before the war in order to provide a context for the analysis of the postwar manuals. Architectural building manuals are a repository of information regarding the techniques, materials, and typological norms that reveal the specific conditions of a particular time and place. The manuals reveal a split between two tendencies. Some manuals prior to 1945 looked abroad for inspiration for new techniques and materials that are based in the industrialization of fabrication and a concomitant rationalization in building techniques and modularity. Others embraced more traditional techniques and materials. Both approaches reveal the complexity of Italian society and the repercussions in architectural culture. The deep questioning of national identity may be read in the building manuals as a complement to what is observed in projects and built work. This chapter will give an overview of the culture of building manuals prior to 1945 before discussing the postwar building construction manual such as the *Manuale dell’Architetto* (1946) which was produced with United States Information Service assistance and in cooperation with the Consiglio Nazionale della Ricerca and the inserts that were published in *Casabella* from 1948 to 1950.
by Irenio Diotallevi and Franco Marescotti, which are collectively known as *Il Problema Sociale Costruttivo ed Economico dell’Abitazione* (The Problem of Housing: its economic and social construction). The material discussed in this chapter is only the very beginning of what will be a much larger research project.

**Manuals prior to 1945: Donghi, Griffini, Klein, and Neufert**

Among the building construction manuals that were published in Italy was the multivolume set that comprised the *Manuale dell’Architetto* edited by engineer Daniele Donghi in 1930. Donghi’s work was a cross between typological studies and a repository of building construction details. For example, in Volume II, “Architectural composition,” Donghi analysed the theme of “Distribution” and studied modern types such as libraries and archives, sports facilities, public theatrical spaces, and artist’s studios. Donghi wrote in a prose style that reads like an illustrated history of architecture and then situated the newest technologies, for example metal library shelving, within a larger history of important historical examples of the building type.476

476 Daniele Donghi, *Manuale dell’Architetto*, vol. II, Sezione V, (Torino: Unione Tipografica, 1930). I have not been able to find a full set of these manuals, and consulted this single issue from the collection at Yale University.
The prewar manuals of Rationalist architect Enrico A. Griffini reveal that Griffini embraced northern European modernism and modeled his work on German manuals such as the publications of Alexander Klein published between 1927 and 1934. Griffini’s *Dizionario Nuovi Materiali per Edilizia* (Dictionary of New Building Materials) was published in 1934. Its purpose was to collect, organize, and present in an elegant reference manual new materials and methods of construction. Griffini published this work as a response to explosive development in recent years as a result of the advances in modern industry, seen even in Italy. His *Dizionario* addressed the need for new materials and methods of construction that would support new forms of architecture. Divided in chapters according to the material’s application in the building construction phase, Griffini gathered products from diverse countries and sources, such as the U.S., Germany, France, Great Britain, and others. The chapters detailed products for wall construction, prefabricated lightweight concrete block and gesso panels, flooring materials, and prefabricated concrete beams, all indicative of the somewhat backward but contemporary building materials available in Italy. The majority of the chapters however are the showcase for various new industrially-produced products for covering the interior and exterior of buildings: plaster, new chemical additives, paint, and materials such as cold bitumen for sealing joints and in particular for waterproofing the flat roof of the modern building. Griffini had a penchant for rationalist architecture which may be seen in his architectural projects and built

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478 Enrico Griffini, *Dizionario Nuovi Materiali per Edilizia* (Milano: Hoepli, 1934), vii. “Le nuove forme architettoniche determinarono nuovi problemi al cui richiamo l’industria moderna non rimase passiva: una fioritura di studi secondi si raccolse in breve volgere di anni; centinaia e centinaia di nuovi prodotti per le più svariate applicazioni si ebbero a disposizione.” Griffini was a Professor at the R. Istituto Superiore di Ingegneria and at the R. Facoltà di Architettura di Milano.
works from the 1930s to 1950 which exemplify his exploration of rationalist architecture and the materials and methods of its construction.

Figure 131 Enrico Griffini, *Dizionario Nuovi Materiali per Edilizia* (Milano: Hoepli, 1934), cover. Right: a portion of a typical page where he spoke about the use of and make up of “Celotex,” an American product.

Griffini’s collaboration with Piero Bottoni and Eugenio G. Faludi for the V Triennale of Milan in 1933 is notable for their built colony of five vacation homes, with house types for locations in the countryside, seaside, mountain, hills, and lake. More interesting for the current discussion on housing and manuals, was the project for “Elements of popular housing.” This was a speculative project, a model house of which only a portion was built. It had never been intended to be fully completed; rather, it was to be an example of the possible configurations of the of the various elements which would be needed for a house. Importantly, the proposal was to be used for houses that are constructed in series. Through the formal criteria of repeating and varying the individual component parts, new streets and even neighborhoods could grow from the combination of simple elements. This project had the dual intention of being a testing ground to study the applications of
new materials and new applications in popular housing, and coordinating the new materials and methods with already current practices.\textsuperscript{479}

Method of Construction: Foundation in reinforced concrete, stone walls, concrete floors covered with brick. Waterproofing of the terraces with asphalt-impregnated felt protected with a layer of sand and paving stones. The lower walls are faced in Moltrasio stone and the upper walls are sprayed with white Duralbo plaster, the sills are in cement containing stone aggregate, finished with a rough texture. The windows and blinds are in wood. The columns are concrete cast in asbestos cement tubes.\textsuperscript{480}

\textsuperscript{479} Enrico Agostino Griffini (1887-1952) \textit{Progetti e realizzazioni MCMXX-MCML} (Milano: Industrie Grafiche Italiane Stucchi, 1951), 14-17.

\textsuperscript{480} Griffini, \textit{Progetti e realizzazioni}, 11. “Metodo di costruzione: Fondazioni in calcestruzzo di cemento; muratura in pietrame; solai di cemento armato e laterizi. Impermeabilizzazione delle terazze con feltri bitumati protetti da strato di sabbia e pavimento praticabile; rivestimento della parte inferiore delle facciate in pietra di Moltrasio; della parte superiore in intonaco Duralbo bianco dato a spruzzo; copertine e davanzali in cemento granigliato raschiato. Serramenti in legno e persiane avvolgibili. I pilastri isolati sono in cemento armato gettati entro tubi di cemento-amianto.” [Translation mine]
Figure 133 Enrico Agostino Griffini (1887-1952) Progetti e realizzazioni MCMXX-MCM (Milano: Industrie Grafiche Italiane Stucchi, 1951), 17.

What may be seen in this description is a complex web of relations between the Italian reception during the Fascist period of modern architecture complicated further by the Fascist polemic regarding the use of autarchic or local autochthonic materials. Griffini seemed to negotiate these two aspects by nodding to the use of local materials, for example Moltrasio stone of Italian provenance, while the most advanced materials, Duralbo plaster or waterproofing materials are given subordinate, almost invisible roles of covering the traditional stone walls. The reinforced concrete structure permits the almost complete horizontality of the second level and the openness of the ground level, while the wooden windows and doors, traditional sills, and plaster and stone coverings act as a decoy to the rebellious use of non-traditional instead of indigenous or autochthonic materials.

Griffini embraced Mitteleuropean modern architecture and presented this work, filtered through an Italian lens, in his first book, Costruzione Razionale della Casa (Rational House Construction) of 1931. The book exemplified the influence of the theme of the minimum dwelling unit and concern for the social aspects of housing. This had been the focus of the second CIAM meeting in Frankfurt am Main in 1929 on The Minimum Dwelling (Die Wohnung für das Existenzminimum). The work of Alexander Klein was exhibited at this meeting and was an influence on Griffini. The topic of the third CIAM meeting in Brussels in 1930 on Rational Land Development (Rationelle Bebauungseisen) extended the study of the individual, rationally planned home to the larger scale of the neighborhood and urban scale. Rational studies for the requirements for the design of a functional “minimum kitchen” were used to decrease domestic labor outside of work in order to

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481 See below at page 227 in a further discussion on autarchy in Italy in an essay written by Marcello Piacentini.
482 See below at Piacentini.
483 Griffini looked outward in both his interest in Modernism in issues of style and material systems, which was a much wider discussion in Germany and in the manuals after 1929, but then later becomes complicated by the rise of the Third Reich.
increase leisure time. This theme was central to the Charter of Athens which was produced at the fourth CIAM meeting in 1933. In the quadrivirate of the four functions: inhabiting, working, recreation (in leisure time), and circulation, are instructions for the design of housing, neighborhoods and the city. Alexander Klein, the third CIAM meeting, and the work of Ludwig Hilberseimer were specific Mitteleuropean influences seen in the work of Enrico Griffini. Italian historian Giorgio Ciucci pointed out in his essay “Il ‘manuale’ nella cultura europea” (The manual in European culture) a similar influence on the work of Irenio Diotallevi and Franco Marescotti in their Tavole di particolari costruttivi di architettura (Drawing plates of architectural construction details) produced in the late 1930s to early 1940s and published in series in the magazine Casabella-Costruzione.484

The notion of Existenzminimum implied a rational approach in determining what would be the minimum amount of space, air, light, and heating, for a human to develop a vital life. A vital life was considered one that was not hindered by hardship of substandard living. The home should be a refuge from the difficulty of urban life and modern forms of work.485 These concerns were detailed in Alexander Klein’s book Das Einfamilienhaus, in which he developed graphical methods as instruments to analyze the problems of housing. His methodological approach, and his use of matrices as combinatorial devices, provided means to simultaneously understand the individual element and to visualize their combinations. This was a kind of scientific method, an operational process, pointed to a new social reality that could be seen in the rationalist architecture. After the

war, rational modes of designing housing for the Greater Number would necessitate a rational design process be reframed so as not to seem connected to the Fascist regime. This was highly problematic as will be seen.\footnote{Rossari, 38.}

This matrix of housing types and configuration of rooms is a typical illustration from Alexander Klein’s book which focused on issues of the aggregation of elements of housing into larger units and then into neighborhoods.\footnote{Ibid., 34. This is a very complex issue regarding housing in Germany which is beyond the scope of this project, though I hope to begin to make connections here for further research.} Klein’s manual was intended as a guidebook with precise recommendations to adhere to in the design process, connecting a scientific method to a pedagogical approach. \textit{Das Einfamilienhaus-Sürtyp}, (or in Italian \textit{Enciclopedia dell’urbanistica e dell’edilizia residenziale}, translated in the postwar in 1949) was first published in Stuttgart in 1934 and studied the single family house. Its scope was quickly extended beyond the exigencies of the individual home to address the aggregation of individual units into neighborhood planning.\footnote{Ibid., 38.}

Figure 134 Matilde Baffa Rivolta and Angelo Rossari, ed. \textit{Alexander Klein: lo studio delle piante e la progettazione degli spazi negli alloggi minimi. Scritti e progetti dal 1906 al 1957} (Milano: Gabriele Mazzotta, 1975), 90-1.
Another German architect, Ernst Neufert (1900-1986), produced two important and influential manuals that are still in use today and whose reach beyond Germany was extensive. His *Bauentwurfserlehre (Architects’ Data)* of 1936 forged new ground in the rationalization of building processes, new technologies, modern materials, and the systematization of building dimensions all of which greatly affected a new approach to modern building assemblies.\(^{489}\)

![Image of Ernst Neufert's book](image_url)

Figure 135 Ernst Neufert, *Bauentwurfserlehre* (Berlin: Bauwelt-Verlag, 1943, 1936), cover, 22-23.

Neufert’s book began with ergonomic analyses of dimensions of men, women and children, which he then applied this to analyzing spatial requirements for all manner of architectural applications. Design based on human physiognomy was a way to mediate between the essential needs of a person at the scale of the body and to extend this scale to the larger environment. Divided into sections, Neufert’s book began with norms and dimensions of paper sizes, the DIN standards, graphic symbols, drawing standards for architectural practice, sun analyses, lighting analyses and such.\(^{490}\) He


\(^{490}\) See Jean-Louis Cohen, *Architecture in Uniform: Designing and Building for the Second World War* (Montréal: Canadian Centre for Architecture, 2011), 100, 156-77. For a study of Neufert’s related
then discussed the different types of buildings arranged by material properties (wood, metal) and had a large section of detailed construction drawings of building assemblies that acted as norm and as instruction plates to follow in the design process. He made use of table of elements as has been previously noted, including many pages of tables of windows, doors, cross sections through streets, offering multiple variations on a type, a common element that will be seen in Architectural Graphic Standards and in the Manuale dell’Architetto.

Figure 136 Ernst Neufert, Bauentwurfslehre (Berlin: Bauwelt-Verlag, 1943, 1936), 58-9. Window types and details.

Neufert then provided standards to construct complex housing types, from the simple components. In these studies he identified the requirements for individual rooms, the single family house, and large, multi-story apartment complexes. In the next section he detailed public building types such as schools, offices, theaters, and sports facilities. These building types were also used in the Manuale dell’Architetto. It is illuminating to see that while Neufert gave guidelines for factory construction, these were not included in the Manuale dell’Architetto, as the Italian reconstruction effort focused on providing public housing and basic neighborhood services. Neufert’s volume then concluded with identifying the sources for the images, both from architects and from industry catalogues, both national and international sources.

To summarize, there were in effect two themes that emerged from the study of building manuals before the end of World War II in 1945. The first theme emphasized the importance of building types for the minimum housing unit characteristic of the Existenzminimum and extended to the planning of urban neighborhoods for mass housing. The second theme related to the individual

491 This is earlier than we see in Italy, but which will be furthered through a much larger study by Adriano Olivetti and his important work on the factory town and the founding of a new community based on industrialization. This is a much larger issue than can be addressed in this chapter, but will be a source of further research.
building construction elements and the strategies that were used to combine these elements into ever larger housing and building projects. As projects grew in scale from the single family house to multi-family dwellings to the design of neighborhoods, the question grew to include urban and regional planning strategies. This indicated a shift to a rational approach to the design process.

These two themes are seen in the various publishing projects of architects Irenio Diotallevi and Franco Marescotti whose work spanned from the 1930s to 1950, with important contributions in interwar period, publications during the war, and in their larger project in postwar period. Their series of drawings of construction details, the *Particolari Costruttivi di Architettura* (Architectural Construction Details) were developed in the 1930s and 40s and were published in *Casabella-costruzione* by editor Giuseppe Pagano in 1942-1943. These plates were assembled from images of construction details and building plans, sections, and photographs that were borrowed from other sources. While not a traditional manual that was bound as a book for distribution, the plates were published over a several year period and may, when viewed together, be considered a manual. The fact that the pages could be detached from the magazine and compiled in a folder prove this point. The importance of the *Particolari* were that they were dedicated to the technical and architectonic analysis of the various fundamental elements that were used in the construction of modern architecture. The *Particolari* permitted the dissemination of methods of technical expertise and became a model

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492 These categorizations remain valid if World War II is considered to have lasted from 1939-1945. Italy entered the war on June 10, 1940.

493 Such as Giuseppe Pagano, “Variazioni sull’autarchia: II” in *Casabella-Costruzione* 130 (1938): 2-3; or “Tavole di particolari costruttivi di architettura,” in *Casabella-Costruzione* 172 (1942), are references. For further information about pre-WWII manuals, see Carlo Guenzi, ed. *L’arte di edificare Manuali in Italia 1750-1950* (Milano: BE-MA editrice, 1981). Most importantly though the interrelation between the manuals and professional magazines is seen in the publication of the different plates from *Particolari Costruttivi di Architettura* in *Casabella-Costruzione* in the years 1942-1943. (See Casciato, *Particolari*, 19-20). A precedent cited is Alfred Roth *La Nouvelle Architecture* (Zurich, Editions H. Girsberger, 1940). The indebitness is also noted in the arrangement of buildings with their construction details as noted in Roth’s text, but also that as a kind of dedication, twenty examples of Roth’s building are used in the *Particolari*.

for a rational method for construction. This was achieved in the drawings which focused on the particular elements of construction: details of wood and metal houses, window and door assemblies, moveable walls, and stairs. New materials such as glass, resin cement, and steel were discussed. These are the materials that could be used in the fabrication of modular manufactured panels. Diotallevi and Marescotti were excited about the possibility for ease of assembly and of disassembly and reuse of the parts that prefabrication provided. The authors outlined the dimensions for the design of bathrooms and detailed the location and spacing of bathroom fixtures. In line with their rational approach, after discussing the various materials, they gave guidelines as to how to assemble the materials into larger and more complex assemblies. These assemblies were conceived of as portions of building enclosures, and they illustrated examples of vertical and horizontal enclosure assemblies and then their use in multi-story construction. These details were then shown on the same plate with multiple photographs of the case study building for which the assembly drawings were originally drawn. These case studies, all examples of modern architecture, were drawn from projects within Italy as well as Switzerland, Sweden, Germany, Great Britain, France, Czech Republic, and the United States. The case studies range across modern building typologies with public buildings such as schools, and offices shown in addition to single family homes, multi-family dwellings, and notably in public housing.\footnote{Casciato, \textit{Particolari}, See the Index of locations and architects, reprinted on pages 20-22.}

Marescotti, who had contributed articles relating to building technique and materials to \textit{Casabella} as early as 1936, was instrumental in Pagano appending the subtitle \textit{Rivista mensile di architettura e tecnica} (Monthly magazine of architecture and technology) to the title \textit{Casabella}. Pagano then changed the magazine’s name to \textit{Casabella-Costruzioni} in 1938. In a larger discussion that cannot be elaborated in this context, Paganobroke with the regime’s rules on the use of autarchic materials and brought rationalist architects and young engineers together to collaborate on studies regarding modern
materials and modern expression in architecture and sought to reinforce the connection with industry and building products.\textsuperscript{496}

Figure 138 Maristella Casiato and Giorgio Ciucci. Irenio Diotallevi and Franco Marescotti, \textit{Il Problema Sociale Costruttivo ed Economico dell’Abitazione con Particolari Costruttivi di Architettura}, Maristella Casiato, ed. with texts by Franco Marescotti, Giorgio Ciucci, and Maristella Casiato (Roma: Officina Edizioni, 1984), 27.

This was a direct response to the end of the association between Pagano and Marcello Piacentini. Piacentini had in the same year launched a polemic about autarchy in respect to building and housing in particular and called for the strict use of local, hence Mediterranean, building materials and methods of assembly.\textsuperscript{497} The term Autarchy refers to the period of isolation and economic autonomy of fascist Italy. This was partly in response to United Nations’ economic sanctions against Italy after the 1935 invasion of Ethiopia. Italy had inadequate material resources and energy sources within its borders and the raw materials and especially iron and other metals needed for the war effort were prohibited for use in building after this period even though these material were central to

\textsuperscript{496} Ibid., “Nota introduttiva,” 19.
\textsuperscript{497} Ibid., 19.
the production of modernist architecture that had been central to the program of Rationalist architecture. Looking inward, local and autochthonic materials were favored and the use of modern materials became viewed as a willful antinational stance.

In his essay “Variazioni sull’autarchia II,” Pagano boldly countered Piacentini’s missive, turning his argument around to defend the progressive engineering feats of engineers Gaetano Ciocca and Pier Luigi Nervi. According to Pagano, autarchy defended itself only by linking an artistic approach to that of the economy, and that from his point of view, (and radically in respect to Piacentini’s models of indigenous materials) were seen only in the work of Ciocca and Nervi, that “create excellent architecture, but not that of the academy” which were seen as morally, economically, and technically sound.⁴⁹⁸ Pagano advanced his point further. Even though the use of metals in architecture were prohibited, Pagano pointed out the connection between the Associazione Nationale Fascista (Fascist National Association) and the Industriali Metallurgici Italiani (Italian Metallurgic Industries), and began a new series on the use of iron and steel in building.⁴⁹⁹ He added that while there was a tacit understanding on the part of architects to obey the guidelines of autarchic materials and to restrict the use of metals to only the most essential applications, the same purists (he termed propagandists) were presenting inconsistent arguments to the public, something that should be further examined.⁵₀₀

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⁴⁹⁹ In issue 124 of *Casabella-Costruzione* of 1938.

Overall the *Particolari* represented a limited but important “manual” that united technology and architecture and used the manual as a vehicle of transmission of this information to a new kind of architect-engineer. These *Particolari* are connected to representative prewar manuals of both Griffini and Neufert, in terms of collecting and disseminating technical information that could be used for the postwar reconstruction. In a similar approach as the to Griffini, the *Particolari* showcased new techniques of standardization, industrial procedures, and unified building components. The last of the *Particolari* were printed in *Costruizioni-Casabella*, no. 187 in 1943, but the authors began a new series, also printed on perforated sheets that could be detached and accumulated as a larger published work.  

This new series, *Edifici tipici della moderna architettura* (Building types of modern

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501 Ibid. “Terminata con il n. 187 del 1943 di *Costruzione-Casabella* la pubblicazione dei *Particolari* ha inizio, con il numero successivo, la presentazione di una nuova serie di tavole, anche esse su pagine provviste di dentellatura e quindi, eventualmente, staccabili.” [Translation mine]
architecture) was edited by Diotallevi and Marescotti, but it had a short life, published in *Costruzioni-Casabella* numbers 188 and 189 in August and September of 1943. This was due to the arrest of Pagano in November of that year and the end of his collaboration with Diotallevi and Marescotti.\(^{502}\) While short-lived, these detachable sheets in *Costruzioni-Casabella* represented a new technical model for modern architecture and revealed their authors’ interest in introducing building typologies that would be appropriate for modern architecture and the eventual postwar construction. This project would be the basis of their investigation for their series of plates collectively referred to as *Il Problema sociale costruttivo ed economico dell’abitazione* (The social construction and economic aspects of housing) of 1948 – 1950. This collective work focused on public housing, and reflected larger social issues that were associated with the crisis of housing in the postwar period.\(^{503}\) However, the contested reception of modern architecture after the war presented problems for an approach that was technologically centered and which biased a formal connection with modern architecture.

The *Particolari Costruttivi di Architettura* and the later *Il Problema sociale costruttivo ed economico dell’abitazione*, which were published in *Costruzioni-Casabella* from 1948 to 1950, are emblematic of the polarity of the types of manuals in circulation: those that focused on modern materials, methods,

\(^{502}\) Pagano was deported and died shortly after this time.

\(^{503}\) These separate series of plates that were found published within the pages of *Casabella-costruzione* were assembled together in a box set of the plates in 1984 by Maristella Casiato and Giorgio Ciucci. Irenio Diotallevi and Franco Marescotti, *Il Problema Sociale Costruttivo ed Economico dell’Abitazione con Particolari Costruttivi di Architettura*, Maristella Casiato, ed. with texts by Franco Marescotti, Giorgio Ciucci, and Maristella Casiato (Roma: Officina Edizioni, 1984). The *Particolari Costruttivi di Architettura* and introductory essays are printed and bound as a document, while the *Il Problema Sociale Costruttivo ed Economico dell’Abitazione con Particolari Costruttivi di Architettura* are all reprinted as individual double-sided plates topped with color-coded titles at the top of each plate, organized in ascending order.
and assemblies and those which studied the minimum dwelling unit needed for the construction of dwellings that would foster a healthy society.\footnote{504}

**The divide in postwar manuals: Diotallevi & Marescotti’s series *Il Problema Sociale Costruttivo ed Economico dell’Abitazione* and the *Manuale dell’Architetto***

The various projects of Irenio Diotallevi and Franco Marescotti, from the *Tavole di particolari costruttivi di architettura* plates produced in the late 1930s to early 1940s and published in *Costruzioni-Casabella* in 1942 and 1943,\footnote{505} their *Ordine e destino della casa popolare,*\footnote{506} and their later *Il Problema Sociale Costruttivo ed Economico dell’Abitazione*, all were, in various ways, concerned with the social, material, economic, and architectonic issues of rebuilding low-cost housing rapidly with the goal of providing a home for all...


\footnote{506} Casciato, *Particolari*, 16, fn. 12
who were in need.\textsuperscript{507} In particular, Diotallevi and Marescotti’s \textit{Il Problema Sociale Costruttivo ed Economico dell’Abitazione} represented a different approach, one ended up having less traction than the 1946 \textit{Manuale dell’Architetto}\textsuperscript{508} because of the Left losing ground in the elections of 1948. These two “manuals,” both published shortly after the end of the war, present different approaches to architectural design, the relationship to technology, and relation to state apparatuses. This could be due to the fact that Diotallevi and Marescotti, whose work spanned the interwar to the postwar period, provided in their \textit{Particolari} a bias toward modern architecture and modern materials which would be dismissed by the architects of the \textit{Manuale dell’Architetto}. It might also be attributable to the fact that the plates of \textit{Il Problema Sociale Costruttivo ed Economico dell’Abitazione} were self-published by the authors several years after the end of the war and well into the reconstruction process. This was in a climate in which the urgency of the immediate postwar was being tempered by increased prosperity and the development of a new consumer taste for something more than the bare essentials. The \textit{Manuale dell’Architetto} instead had been a state-sponsored project and the authors were tasked to develop the manual for immediate use in the postwar period. Utilizing building materials which were readily available and not dependent on industrialized processes was important to its


\textsuperscript{508} Casciato, “Quando Francoforte era sul Naviglio,” 13. She discusses the 1950 conference by the union CGIL in Rome on the “Piano del Lavoro,” which was to propose the nationalization of electrical service, promote agriculture, and a national agency for public housing and public works. “Il Piano compiva un ultimo tentativo per sottrarre, almeno in parte, il processo di ricostruzione del paese alla prassi del completo neoliberalismo che lo connotava; ma la debolezza del sindacato per le scissioni recenti e l’inequivocabilità del messaggio che era venuto dalle elezioni del ’48, il ritardo con cui giungeva la proposta e i suoi limiti tecnici, furono tutte ragioni del disinteresse che per il Piano mostrò il governo De Gasperi. Fu proprio nell’ambito di questo Piano che Irenio Diotallevi e Franco Marescotti ebbero la loro ultima grande occasione pubblica per ribadire quell’ideologia della ‘casa per tutti’ a cui avevano dedicato più di un decennio della loro attività…. ” The issue of public housing, rather than being a fully national organization then split into smaller agencies, companies without an overall vision and in fact, rather than looking towards more advanced modes of modern construction and standardization, what resulted was a movement in the opposite direction, an \textit{arretratezza}, or a backwardness in the field of housing that was more focused on guaranteeing as many jobs as possible, something that the fields of industry and agriculture succeeded in securing. [Translation and emphasis mine]
implementation by incorporating a realistic approach to available skilled and unskilled laborers. In addition, the architectural climate witnessed a swing toward the reinvention of traditional forms of housing types at the most representative of the new Italian democracy.

Diotallevi and Marescotti’s plates that made up *Il Problema Sociale Costruttivo ed Economico dell’Abitazione* were geared toward a continuity with the prewar CIAM social and political agenda in housing, and took their proposal further for a hypothesis for a new political system.509 Advocating for a more centralized social and political organization for minimum housing, it was later thought to be too far left for the more conservative Christian Democrat party which came to majority power in the 1948 election. In addition, the formal adoption of architecture in the modernist idiom was often seen as having an ambivalent tie to the prewar regime. The social and political aspect of their work was eclipsed by the continued influence of the *Manuale dell’Architetto* which had a very different agenda.

Giorgio Ciucci was concise in the range of concerns and approaches that may be seen in the role and rhetoric of the building manual.510 Ciucci used *Il Problema Sociale Costruttivo* as an unusual example in the legacy of architectural books that take the form of a treatise, a manual of building typologies, construction materials, and techniques. In the case of Diotallevi and Marescotti, the *Problema Sociale Costruttivo* composed of a series of loose plates, each a composition of examples borrowed from various published sources and organized and formatted around the theme of housing, building types in relation to the urban “organism,” and construction methods set within a larger context of social and economic problems. The plates were then organized into different categories such as Dimensions, Hygiene and Social Problems, The Value of Developable Land, Orientation, Analysis of the Component Elements of Housing, Connections between Housing units, The Cell/Unit Type,

and The Expandable House. Another aspect that is perhaps unique to the Problema Sociale Costruttivo is that by not being bound it is presented more as a collection, an open-ended work, provisional, indefinite and able to constantly grow.

While the Manuale dell’Architetto on the other hand was bound, it gave direction to the architect and other practitioners of how to organize the related loose papers and brochures that were accumulated in an office. These papers and brochures were to be collected in a series of binders, an open collector/un raccogliatore aperto organized according to various classification sections used in the Manuale. In addition to giving guidelines for construction details, the Manuale was geared toward larger questions of organization in the field and was given as the example for architects to follow in order to create their own general building catalogue for their office. After setting up a box folder for each section, architects were prompted to organize other books and materials according to the same classification system.\footnote{This is shown in the illustration, and bears great similarities to the U.S. Sweets Catalog that was developed initially as a bound set of tomes that organized manufacturers materials within a classification system of 16 sections, with appropriate subsections. Related to the larger project of the Construction Specifications Institute and the CSI Master Format, it was integrally tied into the professional office, development of construction drawings and building specifications. See Andrew M. Shanken, “From the Gospel of Efficiency to Modernism: A History of Sweet’s Catalogue, 1906-1947,” in Design Issues vol. 21, no. 2 (Spring 2005): 28-47. This is an excellent discussion of the relationship of technological development. “The industrial revolution gave rise to a revolution in communication that, in turn, enabled the new scale of consumption….Where industry went, advertising followed. The nationalization of advertising closely paralleled the rise of the Dodge Reports. Both grew out of the nationalization of industry and the need for manufacturers to communicate their services or products to a far-flung public.” (p. 30). Shanken also discusses the possible connection of Mr. Sweet’s catalogue to Frederick Winslow Taylor’s theories of Scientific Management outlined in his book Principles of Scientific Management of 1911, five years after the Catalogue was founded. Shanken also details the influence in the 1930s (p. 38-9) by the designer Knud Lönberg-Holm in the graphic design for Sweets and Architectural Record highly influenced by the work of Otto Neurath and the use of the graphic symbols or Isotype that Neurath had developed after World War I, “transforming a dull, text-based format into a startling fresh iconic page, sublimating the text itself to the overall effect.” [p. 39, emphasis in the original]. The headings within the Manuale dell’Architetto are also integrally linked to the organization of the Architectural Graphic Standards manual, as there are references such as “detailed in Sweets,” in early editions of Graphic Standards.}
Figure 140 The *Manuale dell’Architetto*. Classification system for the management of office materials based on the chapter organization of the *Manuale*.

Figure 141 Diverse plates from the various sections of *Il Problema Sociale Costruttivo ed Economico dell’Abitazione*.

(C.N.R. National Commission for Research) led by architect Mario Ridolfi, with the collaboration of Bruno Zevi and engineers Bruno Buongioannini and Pier Luigi Nervi.\textsuperscript{512} The young architects (and friends of Zevi) Cino Calcaprina, Aldo Cardelli and Mario Fiorentino also contributed. The \textit{Manuale}, as had \textit{Architectural Graphic Standards} (and most manuals already discussed), drew from an extensive array of sources, including patented prefabrication systems, trade brochures, and tables, all redrawn for direct and immediate access for the design professionals.

![Figure 142](image.png)

Italy was in immediate need of housing and other structures in the postwar Reconstruction but did not have the unified approach to building as the United States had. In contrast, Italy’s domestic building techniques were generally in situ, traditional methods of construction and predominantly on site construction. A notion of modularity, if any existed, referred only to the brick, concrete block, or gypsum panels used, but there was nothing of any sophistication in terms of prefabrication of

\textsuperscript{512} Consiglio Nazionale delle Ricerche. \textit{Manuale dell’Architetto}. Roma: CNR-USIS, 1946. Preliminary research on the \textit{Manuale dell’Architetto} was presented in a paper presented and published in the conference proceedings for the ACSA Northeast Regional meeting on Oct. 10, 2012 at Temple University with the title: “Modularity, Prefabrication, and Building Manuals in Postwar Italy: Scenes from America.”
building components off site or intelligence about systems of modular construction. The use of metal was limited to fasteners, fencing and gates, grills and the like, but was not indicated as a building material.

One of its chief authors was Bruno Zevi, who after his graduation from Harvard University was employed as an architect in the Design and Engineering Section of the Office of the Chief Engineer in the United States Army. In July of 1944, he was reassigned to a post in England and awaited his return to his native city of Rome, which did not happen until the end of the war in 1945. Zevi, with his combined experience in the United States and working for the U.S. Army in Britain, was exposed to cutting edge modular construction used for temporary and emergency housing, for hangars, and other prefabricated military buildings. He was also most certainly exposed to a scientific approach to the design process through *Architectural Graphic Standards* (first published in the U.S. in 1932) and other building manuals, which offered a modular and systematized approach to the design and production of buildings through drawings and specifications. Because the *Manuale dell’Architetto* came into being at the crossroads of political change in Italy, it is another lens that may reveal the problem of the relationship between political theory, and building design and method.


514 Zevi was employed by the U.S. Government if various capacities starting in 1944. Inventario dell’archivio Bruno Zevi, a cura di Vincenzo De Meo, coordinamento scientifico Elisabetta Reale. Prepared for the Ministero per i Beni e le Attività Culturali Soprintendenza Archivistica per il Lazio (MiBAC). Prepared for the Fondazione Bruno Zevi - Roma 2006 04.01/02 United States Information Service (USIS)
29 giugno 1944 - 1 agosto 1947 (con documentazione dal 1937)
Il fascicolo contiene documentazione relativa al periodo di servizio di Zevi presso lo United States Information Service (USIS), all’indomani della liberazione; attestato dell’Headquarters European Theater of operations United States Army che attesta l’impiego di Zevi presso la Design and
Rome after the war, Zevi brought this American know-how of modular construction to his position working for the Rome-based American Government outreach service, the United States Information Service (U.S.I.S.). He was stationed as Chief of the Technical Bulletin Section with the Office of International Information and Cultural Affairs in March 1946. Under this umbrella organization, Zevi as the youngest member was valuable because of his experience in the U.S. worked with Buongioannini, Nervi, and Ridolfi. One may surmise that the full range of these U.S. publications were accessed by Zevi and the other members of the team producing the *Manuale dell’Architetto*. The group was tasked to develop the *Manuale* which was to be completed in a rapid six month period.

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This paper presents early research on this theme. Future research will include a study of the U.S. Technical manuals especially the U.S. Army Field Manuals in the late war and immediate postwar period. A list and index of War Department publications may be found at the U.S. Govt. site: http://www.loc.gov/rr/scitech/SciRefGuides/technicalmanuals.html#inventory (Accessed Nov. 4, 2012). Also to be consulted are the Field Manuals in *Series 5: Corps of Engineers* which cover such topics as Carpentry, Construction and Surveying, the Universal Grid System, Grid and Grid References, Construction in the Theater of Operation, General and Construction Drafting (in the 1970s only), and especially a 1946 publication #5-609 and #5-610 *Buildings and Structure, Grounds, Roads and Pavements, Railroads*. War Dept, Sept. 1946, LC #U408.3.A13 TM 5-610 Sep. 1946 or #5-744 *Structural Steelwork*. Dept. of the Army, June 1944, LC #U408.3.A13 TM 5-744, June 1944.
The *Manuale* was distributed free of charge by the U.S.I.S. to 25,000 architects, engineers, builders, and technicians throughout Italy. It was written with the intention of instructing Italian professionals in a systematic approach toward building, in order to address the urgent need for housing and other civic structures, through the implementation of modular dimensional systems and prefabricated elements. The *Manuale* was developed in a moment in which modern, and modular, building techniques were proposed in a period of tension between totalitarian and democratic society. Because modernism had first flourished in Germany, and systematized design had been used in such horrific ways, for example in the building of extermination camps, the Italian reception of such techniques was uncertain. This was compounded with an ambivalent reception of rationalist architecture after the war because of its association with the overthrown domestic regime. Yet it was hoped that the American influence would encourage a new association of modular design with democratic, egalitarian governance. This was not to be the case, or at least immediately.

In the introduction to the *Manuale*, Mario Ridolfi clarified the necessity for Italian architects to have an easy-to-consult modern building construction manual which would outline practical criteria for construction. This kind of manual, he asserted, was missing in the technical manuals available in Italy at the time. Citing other manuals that were currently in use, such as those by Donghi or Briemann which were too voluminous and antiquated to be of use in the current crisis, Ridolfi recommended that guidelines be established for modern construction. While there existed general publications of a scientific and technical character, he believed that a volume like the *Manuale* to be of value. Of the existing technical manuals in use, some were cursory articles which offered little information, while others were published in various languages which limited their usefulness. In 

addition, lacking one affordable source, it was prohibitively costly for the majority of architects to have access to these publications.516

While Diotellivi and Marescotti were concerned with surveying typological aspects of housing for adoption by the field, the authors of the Manuale were less concerned with rationalization in building standards than for a more pragmatic approach to the project of reconstruction. This approach took into consideration the real limits of materials and methods in the immediate postwar with a particular emphasis on keeping the underemployed employing. This aspect has been criticized as promoting an arretratezza, or backwardness in the building sector.517 It has also been speculated that the leader of the group, Mario Ridolfi, a communist, tended to think of the newly born democracy as a kind of expression of a unanimous voice, a chorus of voices which sounded the “participation of the people.” The emphasis on the collective citizenry was a very specific cultural problem of the reconstruction.518 It had been the dream of the planners of the ERP to develop industry, agricultural production, produce energy, and provide a model for an efficient method of standardization of building materials and components. It was the hope that standardized materials would be utilized

516 The Introduction by Ridolfi was reprinted in Metron 8 (1946), 35-41.
517 See note 539. See also Sergio Poretti, “Le tecniche edilizie: modelli per la ricostruzione,” in La Grande Ricostruzione, Il piano Ina-Casa e l’Italia degli anni cinquanta,” Paola Di Biagi, ed. (Roma: Donzelli editore, 2001), 121-5. Poretti, questions the well-accepted canon of the backwardness of technological innovation in the building sector in areas such as prefabrication, new businesses, levels of industrialization in respect to other fields. He then states that it was only in the 1960s that Italy finally was able to develop prefabricated building systems, after other countries had already adopted or were phasing out these systems. (p. 121). See his “La costruzione,” in Storia dell’architettura italiana. Il secondo novecento, Francesco Dal Co, ed. (Milano: Electa, 1997), 268-73. See also Maristella Casciato, “L’invenzione della realtà: realismo e neo-realismo nell’Italia degli anni cinquanta,” in La Grande Ricostruzione, Il piano Ina-Casa e l’Italia degli anni cinquanta,” Paola Di Biagi, ed. (Roma: Donzelli editore, 2001), 205-222.

This arretratezza could also be attributed to the fact that much of the Manuale was based on the very standards developed within Italy during its period of isolation, a constraining factor in light of the the limited access to materials and the lack of industrial methods of production and the predisposition to use local materials and techniques.\footnote{This backwardness was notably more pronounced than before the war.} Between 1940 and 1942, Mario Ridolfi published a series of articles in Architettura magazine accompanied by architectural drawings which detailed the standardization of technical drawings and established guidelines for normative
construction. Following the crackdown on the use of metals and other modernist materials during the fascist period, Ridolfi’s drawings detailed wooden doors and windows and built-in closets. His idea was not meant to be nostalgic, but what he thought of as reale, the reality of limits in material workmanship merged with the rational approach needed for rapid and efficient construction. He assiduously developed visual charts of types and models of details for these door and windows. These drawings were an integral part of the Manuale and are seen in the background in the photograph of the men working on the Manuale. Ridolfi’s later work blossomed into a merging of the rational with a more poetic program of representing the realtà of the traditional housing type that would exalt a connection with the nation’s rural past. These seemingly mutually exclusive approaches are factors that contributed to the reading of Ridolfi’s work as deeply ambiguous and complex vis-à-vis modern architecture. It is Ridolfi’s presence as the head of the Manuale dell’Architetto team which might have skewed the manual toward the traditional detailing and material uses, emphasizing locally made, though modular construction, versus pre-manufactured and prefabricated building systems, rather than looking out beyond Italy’s borders as had been goal of the U.S.I.S. and the C.N.R.


522 Muratore, “L’Esperienza del Manuale,” 82. Again on a topic that is parallel to this discussion which is focused on the Manuale, see the following works which extend Muratore’s use of realtà to the idea of neorealismo. Another way to approach this is that these themes are already so deeply engrained in Fascist period, with anti-urban stance and desire to keep the populace dispersed across the landscape in an agrarian based culture supported by the State. See also the Rurale Building exhibition of the VI Triennale of Milan in 1936 which surveyed various rural housing typologies, materials and methods. This is in contrast to other sections on the “Programma dell’abitazione moderna.” This is beyond the scope of this dissertation, but will be brought into my further research. The International exhibit looked at the “Sezione Internazionale di Architettura, Architettura Rurale nel Bacino del Mediterraneo and Architettural Attuale e la Tradizione Italiana.”
Figure 143 Giorgio Muratore, “L’Esperienza del Manuale,” in *Controspazio* 1 (1974): 85. On the left, from *Architettura* (May, 1940 or in Fascist year, XVIII). On the top left are various details for built-in cabinets (*fissi*) and below for wood operable windows (*infissi*). On the right are pages from the *Manuale dell’Architetto* for which the earlier details were models. Top right: Nomencature for the different parts of wooden doors. Bottom right: Wooden windows, with joint details. [Translation mine]

In this light, one can see other sources of inspiration that countered this backward approach in the *Manuale*. Zevi, charged with producing the *Bollettini Tecnici dell’U.S.I.S.* (The Technical Bulletins of the U.S.I.S.) in Rome beginning in 1946, brought with him knowledge of wartime prefabricated housing with which he was familiar from his experiences working for the U.S. Government in the U.S. and Britain.\(^{523}\) This interest was echoed in the numerous articles published in *Metron* beginning with

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\(^{523}\) In a letter dated March 11, 1946 from the Department of State-OIC, United States of America (the letterhead which is crossed out showed the Office of War Information), 224 West 57th Street, New York, 19, N.Y. Addressed to Mr. Bruno Zevi, Department of State – OIC, 230 W. 57 Street, New York, N.Y. “Dear Mr. Zevi: This will confirm your appointment as Chief, Technical Bulletin Section with the Office of International Information and Cultural Affairs to be stationed at Rome,
essays by Bruno Zevi and Eugenio Gentili on prefabrication in the first issue. Prefabrication and modular housing components and systems were a recurring subject published across the range of Italian architectural magazines in the first years after the end of the conflict. Paradoxically, the dissemination of modular systems and the use of prefabrication was not an explicit mission for reconstruction developed in the Manuale, although it had been the focus of Zevi’s energy. At the First National Congress for Reconstruction held in December of 1945 in Milan, Zevi spoke about U.S. examples for prefabricated housing as had been recommended by Regional Planning Association of America, seen in the two-part prefabricated houses that were developed by the Tennessee Valley Authority. These examples, Zevi urged, could be immensely useful in the postwar reconstruction effort. He also reiterated the importance of national plans and programs both for regional and national planning and for the coordination of industrially-produced building components in order to efficiently produce the enormous quantity of housing units needed in Italy. He compared the need for housing in postwar Italy as comparable to the need in the U.S. for

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524 Eugenio Gentili, “La prefabbricazione in America,” in Metron 1 (August, 1945): 24-32 and Bruno Zevi, “La ricostruzione in Inghilterra,” in Metron 1 (August, 1945): 33-40. Metron began publication in the immediate postwar with first issue in August 1945. It was the initiative of Eugenio Gentili, Luigi Piccinato, Enrico Tedeschi, Cino Calcaprina, Silvio Radiconcini, and Bruno Zevi (Cited here in Zevi su Zevi, p. 48. Part of its mission was to introduce the Italian architectural community to what was happening outside of Italy as a result of the isolation during fascism and the war. Zevi was involved in the editorial board after issue 25 in 1948).
housing during the war for the massive number of civilians relocated to work in wartime industries.\textsuperscript{525}

Figure 144 Eugenio Gentili, “La prefabbricazione in America,” in \textit{Metron} 1 (August, 1945): 30-1. Left: Wachsmann-Gropius, panel system. All of the parts needed are shipped, thus packaged. The panels are of equal dimensions in seven different types needed for floors, ceilings, walls, and incorporated doors and windows. Right: Tennessee Valley Authority. “This plan is made up of two units and includes service blocks. Windows and doors, fixtures, pipes, conduit, etc. are already incorporated into the system, and during installation only a few connections need to be made.” [Translation mine]

Figure 145 *Manuale dell’Architetto*, House of manufactured wooden elements with rigid metal connectors. “These types of houses are made with prefabricated elements and were produced by Swedish industry in this project by Erik Friberger. The fundamental principal is that many kinds of compositions are possible and may grow according to use. A house once constructed could be taken apart and reconstructed without any loss of materials. The factory furnishes four kinds of external walls, a roof system, and diverse elements for flooring and balconies. The roof is covered with two layers of bituminous paper which assures its watertightness.” [Translation mine]
The use of preformed wooden “T” shaped wooden elements that close the structure. The simplicity is in the joining of the prefabricated parts which are interlocked and held in place with a simple nail. It is notable here that this very simple, much earlier system of Wachsmann’s is used rather than the Packaged House which had required a specially outfitted factory (also designed by Wachsmann) to produce the various panels and connectors in that system. See Konrad Wachsmann, *Building the wooden house: technique and design* (Basel, Birkhäuser, 1995). Originally *Holzhausbau* (1930).

With factories destroyed, agriculture decimated, and cities bombed, there was a real and true need for rebuilding. The mission of the *Manuale dell’Architetto* was to be realistic, to give architects methods to utilize locally found materials and to provide a manual that would streamline the construction trades, within the context of material shortages. But the larger aspiration was for it to

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526 One can see the pull in the different directions in the *Manuale*, some, like Neufert, or seen in *Architectural Building Standards* a systematic set of dimensions and norms for building materials, efficient kitchen and bath layouts, and the like. There are also numerous examples of prefabricated housing, although these tend to be wooden houses such as Wachsmann’s house and a project for a
be a catalyst for a new future economy, as had been the intent in the initiative for prefabricated houses that were integral to the projects of the Tennessee Valley Authority. Zevi stated, “Italians can find a direct, practical, and immediate utility from the study of wartime American housing.”

The Manuale dell’Architetto was part of this agenda. The work of the U.S.I.S. signaled an ethical necessity to deal with urgent political-organizational problems, specifically in instilling the idea that it was necessary for the rebuilding to have standards and guidelines in construction and design, but also that this effort must take a cue from American models of administrative cooperation and centralization such as evidenced in the T.V.A., which is arguably the larger issue. Beyond the application of new construction systems, and in particular that of prefabrication in building construction, in some ways it was a utopic ideal in a country that was struggling to get on its feet. But Zevi felt it was necessary to understand the American experience as a democratic model for change.

The overriding sense in the Manuale is its proposition for a realistic set of approaches and methodologies with which to tackle the enormous problem of building in the reconstruction period. Different than Diotallevi and Marescotti’s project, which they hoped to relate to the larger issue of state-sponsored public housing projects and unfortunately remained only an abstraction, the wooden prefabricated house by Eric Friberger. But the most daring materials are glass block, or elastopolymers used for expansion joints.


529 Roberto Dulio, Introduzione a Bruno Zevi (Roma: Laterza, 2008), 46-47.

530 However this is not entirely the case as there are many sections in the Manuale that surveys methods of construction that are not realistic in Italy such as wooden prefabrication. If so, this would be possible in the northern sub-Alpine areas where wood is plentiful.
Manuale found a consonance with the times, of the existing political and social systems and was thought of as a practical aid. Ridolfi had an agenda that would add a different kind of social agenda to the equation that of the “popular” character of architecture would be seen in the exaltation of the production of the tradesperson, the handmade, the details, which he had considered the essence of architecture.

According to Ciucci, the American reference materials that were studied in the very short period of preparation of the Manuale were initially developed in the 1930s in response to the Great Depression. These were less oriented to industrial development and standardization than had been seen in the German manuals of the same time. The U.S. manuals developed for the Housing Division program of the Public Works Administration (introduced in 1933 as part of the New Deal) were proposed without the agenda of developing a rational ideology, nor did these manual fetishize modular dimensions. They were a simple series of optimal standards and guidelines to follow in order to produce relief housing. Housing was seen in light of a larger regional plan of development which also included industry, commercial centers, parks, and schools. These manuals did not emphasize the house as a rational, industrially produced ensemble, and the program did not spur the revitalization of industry. While not an appropriate model for Italy in the 1930s, in a period identified with rational architecture, in the late 1940s and early 1950s it was an ideal model for a country whose isolation and backwardness were exacerbated by wartime destruction and the return to the reliance on very basic building materials and labor.531

With the influx of funds from United Nations and the U.S. government via the European Recovery Program, the territory of rebuilding was no longer a neutral topic. For the U.S., the idea of a minimum dwelling for all seemed to be to close to a socialist agenda to U.S. officials who viewed the

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ERP was seen as an aid program that would deter the spread of communism. So, the *Manuale dell’Architetto* sought to give guidelines for building which would be inspired by more advanced building techniques imported from the U.S. It also came with the realization that in the current state of Italian development, advanced building techniques and material assemblies could not be dependent upon a highly industrialized process of assembly. The ERP motto, “helping people help themselves,” spoke less to the role of central government and more to individual initiative, local materials, and labor.

**Manuals, changing concerns in the economic boom**

Again, the *Manuale dell’Architetto* represented an important moment in the development of postwar Italy on all fronts, practical, economic, social, and above all political, and was still in use at the crucial moment of the postwar economic boom of 1958-63. At that time it became an important reference for the increasingly industrialized building trades and prefabrication and modularity of component building parts. Design is never neutral; as the political stakes grow higher, so do the implications of building. The *Manuale* combined the model of American building manuals with a distinctly Italian postwar predisposition against aspects of modernism. It retreats to traditional forms and methods and a what has been called an intentional backwardness. Implicit, however, in Ridolfi’s detail drawings for doors and windows was the systematic way in which the possible configurations were presented in a table. These matrices are inherently analogue computational devices, which are used to work through multiple configurations of very simple elements, in order to produce rapid solutions for diverse sites and situations. Conceptually, though still working with simple materials and artisanal craftsmanship, the idea conveyed in the manual, despite all postwar restrictions, was a manual for construction at a very large scale. This aspect was magnified by the period of economic prosperity in the late 1950s. So although the *Manuale* was introduced in a period of hardship and lack of industrial base, this was to change.
The charts of door and window types that are shown in *Manuale dell’Architetto* are known in Italian as an *abaco* or *abacchi*. Like an *abacus*, these tables become computational devices, offering a way to visualize multiple combinations of simple elements. It is this combinatorial aspect of the manual that makes a connection with the sciences and scientific method that were the subject of study at the HfG Ulm in the late 1950s. Building on the format of previous manuals, new manuals were developed that took industrialized building as their subject, and used concepts such as system theory and cybernetics to describe the interrelationship between the component parts of a building.\(^{532}\) Italy saw a late development of this approach, achieving its peak in the mid-1960s, at which point prefabricated systems that had been prevalent in other countries since the end of the war were finally feasible in Italy, just as other countries were moving steadily away from such systems.\(^{533}\)

At the end of the last chapter, I discussed Konrad Wachsmann’s work from the early 1950s, including his American Air Force commission to design large-span aircraft hangers and in the drawings for an Experimental Structural Web. These examples are indicative of international experimentation in structures that developed advanced structural techniques. Projects such as there were perceived to be in the domain of engineering rather than architecture. In the Italian context, it is interesting to examine the role of Pier Luigi Nervi in his design of public structures over a time period which spanned the years of the fascist regime until the the 1970s. Nervi’s work was expressive of the modernist idiom, but because his projects were not seen as being in the domain of

\(^{532}\) This theme is then the point that I come back to look at Rinaldo Semino’s working process, his *organic* process of working with combinatorials, driven by combinatorial *abacchi* as method.

\(^{533}\) See note 539. See also Sergio Poretti, “Le tecniche edilizie: modelli per la ricostruzione,” in *La Grande Ricostruzione*, 121-5. Poretti questions the well-accepted canon of the backwardness of technological innovation in the building sector in areas such as prefabrication, new businesses, levels of industrialization in respect to other fields. He then states that it was only in the 1960s that Italy finally was able to develop prefabricated building systems, after other countries had already adopted or were phasing out these systems. (p. 121). See his “La costruzione,” in *Storia dell’architettura italiana. Il secondo novecento*, Francesco Dal Co, ed. (Milano: Electa, 1997), 268-73. The numerous construction manuals by Giuseppe Ciribini will be discussed shortly.
architecture, experimentation in modern methods of construction occurred which not seen in the design of civic buildings or housing. Nervi’s role in the Manuale is recorded by Ridolfi in its introduction. Nervi was responsible for editing the section of the manual dedicated to structural design and the guidelines and tables for the calculations of static forces in construction. This seems to be a missed opportunity, for Nervi might have contributed to a robust idea of standardization and rationalization of construction methods. He had already experimented with standardization in construction techniques that were not tied to the idea of fabrication of building components in a factory setting that would subsequently be delivered to and assembled at the building site. Nervi used on-site labor to produce the component parts. An example is in the construction of the Palazzetto dello Sport at the site of the Olympic Village in the Flaminia district of Rome which was designed for the 1960 Olympic summer games. Nervi utilized a series of molds of diminishing proportion that workers used to assemble the myriad coffered roof components on site. Nervi’s interest in prefabrication was well adapted to the paucity of industries that could produce standardized parts, as he invented an on-site method to obtain thin-shell concrete structures by using layers of mesh, rather than reinforcing steel bars to produce ultrathin and ultralight component structures. Much of the systematized aspect of Nervi’s work has been overlooked, as the elements were constructed on-site. Rather than a formal articulation of the individual elements, the elements were joined to create larger arches and roof structures, and ultimately the exterior was fully covered with thin layers of concrete, giving the sense that the overall structure is monolithic, a monocoque shell, rather than a hybrid entity.

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534 Ridolfi, Manuale dell’Architetto, 41. (see also Ridolfi’s article in Metron)
535 See recent scholarship by Marzia Marandola, Sergio Poretti, etc. See Rassegna di Architettura e Urbanistica year XLI, no. 121/122 “Ingegneria italiana.” Tullia Iori and Sergio Poretti, ed. Pubblicazione quadrimestrale dell’Università degli Studi di Roma “La Sapienza” (Roma: Edizioni Kappa, srl., (Jan.-Aug, 2007). This is an area that I would like to expand and see in light of Nervi’s
The overlap between engineering and architecture may be one of the reasons for the increased attention to the design of component systems that emerged in the late 1950s. Another factor as has been discussed was the influence of the HfG Ulm in the Industrialized Architecture course. Another factor is likely the influence of architects associated with Team 10, including Italian Giancarlo de Carlo, who created housing from an assemblage of individual elements. The standardization of industrially-produced building components was part of early postwar incentives for growth from the ERP, and an increased awareness of Europe emerging as an economically connected group of individual countries. It was also tied into the development in northern Italy of factories geared towards the production of consumer goods, the rise of industrial design and of course the need for housing for an rapidly growing and increasingly migratory Italian population. In all, it was a complex matrix of events that contributed to the rise of a systems thinking that began to dominate the field of building construction during the economic boom.

As already noted, Giulio Carlo Argan used the term “tricot continuo” to describe Konrad Wachsmann’s space frame structures as a kind of continuous knitted structure. This term was meant to describe a new spatial concept that he saw developing in new advances in prefabrication. By repeating simple elements, Wachsmann designed space structures of great complexity at an enormous scale. It is as if these structures were speculations on the repetition of elements in a seemingly infinite arrangement. This aspect of modular design has an affinity with the idea of the open work. This can be seen in a parallel way in the various illustrated building manuals already discussed, but will take a decisive turn toward explicit references to system and information theory in the 1960s. A systems approach in architecture as seen in modular or prefabricated construction can be understood in terms of open and closed systems. These concepts are borrowed from system progression of techniques regarding prefabrication of parts, both in factory and on site both before and after the war.
theory and the scientific disciplines, which ascribe a specific precise meaning to modular construction systems.536

These early manuals were important models for the development of modular construction systems in rapidly developing and industrializing Italy. Among these are manuals by Giuseppe Ciribini, G. Mario Oliveri, Piero Spadolini, and others who furthered the rapid spread of modular construction in Italy from the late 1950s through the late 1970s. These later works emphasized the issue of prefabrication at a theoretical level as a “system,” a logical combination of constituent building components.537 Again, the rise of interest in systems, new materials, new construction manuals, and advances in prefabrication and experimentation with these new systems in the many projects and competitions were seen in the pages of the journals and magazines of the time.538

536 Pierluigi Spadolini’s writings on industrial design and componenting were an important contributions in this period, as well as seminal texts by Giovanni Klaus Koenig on the correlation between architecture and information theory. Also for example, Tomás Maldonado, “New development in the industries and the education of product designers,” in ulm 2 (1958): 25; Gui Bonsiepe, “Systems and Variable Systems,” in ulm 6 (Oct. 1962): 30. This opens up an idea of improving the environment through the use of technology, seeing that it is possible to improve the environment through the use of a system and provide variety within a unified overall system, such as would be seen in natural systems. The crucial idea is that elements would be coordinated to be able to adapt to any new site or circumstance. As has been discussed at various points in this dissertation, this idea of the programmed work, the open work, the was the key to an idea of a new aesthetic: one that seemed to be a new kind of what I will call a rationalized organic, or a technological organic, emulating biological processes. Cybernetics, system theory and similar scientific approaches were thought to be a way to extend to the idea of humanity as a living system, a necessary step when seen in light of a world view of population explosion and as a way to deal with the idea of large numbers in a socially, humanely, and engaged way.

537 This emphasis on system provides an interesting context in which to examine contemporary research and the proliferation of parametric modeling and BIM systems of integration and fabrication that is current today.

538 These manuals will be discussed briefly in Chapter 7.
The new dimension and the Greater Number

Le plus grand Nombre, The Greatest Number, Il Grande Numero

The initial discussion of Rinaldo Semino’s work in Chapter 1 served as an entry to a larger discussion of the economic, political, and social implications that industrialization had on architecture and planning in postwar Italy. Semino’s projects were designed in response to national and international competition briefs. Competitions played an important role in architectural invention and were timely indicators of the immense changes that occurred due to increased industrialization and the emergence of a predominantly urban consumer society.

Rampant industrial development in the Italian northern cities of Genoa, Milan, and Torino raised important changes of scale in urban development and is something that affected all aspects of Italian society. Migration in the 1950s and 1960s was characterized by movement from the agricultural countryside and small regional towns and villages to the major cities such as Naples, Rome, Milan, and Turin. The division between the north and the south was attributed to the disproportionate allocation of postwar subsidies such as ERP/Marshall Plan funds, which were largely channeled toward the northern cities. The agricultural and industrially undeveloped Southern regions, the mezzogiorno, suffered from damage and occupation during the war and from the eroding of the social structure and economic base of the region as large waves of workers emigrated to cities in search of work. The crisis in finding adequate solutions to house the new population in the cities was exacerbated by the fact that there were no overall guidelines for development, and housing solutions did not consider the design of civic spaces or public services, and most egregiously did not include the development of transportation and infrastructural systems. This created the need for a

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comprehensive planning program in order to cope with the uncontrolled building explosion and need for utilities and infrastructure at an unprecedented scale.

Major design studies and competitions were launched after 1959 to address changes that postwar prosperity was beginning to have upon cities and territory. These changes in society and urbanism as a result of the postwar miracolo economico (Economic Miracle) in Italy in the years 1958-1963 were profound and raised the question of large numbers, or what was known at the “Greater Number” (Il Grande Numero, Le Plus Grand Nombre). The idea of the Greater Number held traction in a decade marked by explosive worldwide birthrates and changing demographics. The Greater Number was a key concept that was first discussed in the international architectural community at the 9th CIAM conference of 1953, held in Aix-en-Provence, but had already been under discussion as an incentive of the United Nations to address the dire need for low cost mass housing after the war. In the

540 In 1952, the United Nations was considering forming a Working Group on Low Cost Mass Housing (Habitation pur le plus grand Nombre), at the suggestion of two CIAM members, Swiss engineer Jean Jacques Honegger and Russian born French engineer Vladimer Bodiansky. It was a continuation of sorts of their work with the CIAM Commission IV: Industrialized Building as well as their work with the firm ATBAT-Afrique and Michel Ecochard in Morocco, in the search to rehouse residents of the bidonville or shanty towns. As recounted in Ellen Shoshkes, Jaqueline Tyrwhitt: A Transnational Life in Urban Planning (Farnham, Surrey, England: Ashgate Publishing, Ltd., 2013). Tyrwhitt was secretary to the council and close to Sert and Giedion and was involved with the UN and Habitat pour le plus grand Nombre project. It is interesting that Shoshkes discusses the difficulty of translating the french habitat into English, having “accept that it meant something larger than ‘housing’ and smaller than ‘neighborhood’—in other words, the setting of daily life.” In discussing the theme of the CIAM 9 meeting, on the Charte de l’Habitat that the changing role of housing and the implications on daily life was changing. Tyrwhitt related to a doubtful Sert that Le Corbusier, in maintaining the theme was not being dogmatic. “He announced that he no longer was ‘confident about the way men should live in this changing world….The ‘Habitat’ is clearly an element of living space…but how it should be organized with other elements is less and less clear.” (note 16) See also Francis Strauven, Aldo van Eyck: The Shape of Relativity (Architectura & Natura, 1998), 253-5. In the section on George Candilis: l’habitat pour le grand nombre’ with van Eyck also taking up the question of building for large numbers. See also Jean-Louis Violeau, “Les Architectes et le Mythe de Mai 68,” in Les années 68: le temps de la contestation Geneviève Dreyfus-Armand and Antoine de Baecque, eds. (Bruxelles: Éditions Complex; Paris: Institut d’histoire du temps présent, 2000), 248-49. Violeau details the relationship between the longtime collaboration between Le Corbusier and Michel Ecochard on the “loger le plus grand nombre,” and would bring up Candilis’s topic at the CIAM X meeting in Dubrovnik in 1956. The newly formed younger generation
early postwar period, housing posed a critical problem that was addressed by architects. The practice of Candilis-Josic-Woods in France studied housing in relation to the larger social context of the population explosion and proposed a task for modern architecture, to provide housing for what would be called the *Habitat pour le plus grand nombre*, or housing for the Greatest Number.541


vast serial production, repetition of elements, and similarities between finished products” that would need to be used to address the housing crisis. To mitigate the anxiety of such rapid increase in population and to employ technocratic means to be able to house people, Candilis-Josic-Woods sought for a way to reinvest daily life and dwelling with new meaning, a changed sense of place.

In North Africa in particular, the French colonies became the laboratory for investigating modernization coupled with the idea of the Greatest Number. Michel Écochard, leader of the Service de l’Urbanism in the French colonial protectorate between 1947 and 1952, viewed the colonies as a laboratory, and analyzed the shantytowns. He also spoke of “American big-city slums, South African compounds and our European big-city hovels,” as comparable sites in which one could analyze in situ a condition to extract a set of rules. These guidelines could then be abstracted and used to plan at the scale of the person first, working then to common spaces such as the courtyard and the neighborhood, always understanding the relationship of the smallest part, the individual living unit and its assemblage within larger configurations, both physical and social. Thus a more humanist approach to a technocratic approach was proposed. The study of the bidonvilles (or slums) was connected to demographic changes with people moving from inland areas to the Atlantic coast, what was termed by a critic in 1955, writing in the French architectural magazine L’Architecture d’Aujourd’hui, as a “sudden rural exodus…generating amongst other things, shantytowns.”

While the setting in French North Africa is not identical to the Italian situation, many parallels were drawn to propose an approach to low-density aggregate housing typologies. In fact these studies were influential in Italy, as seen in the well-known project by Adalberto Libera for the INA-Casa

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542 Candilis is quoted in Avermaete, Another Modern, 122.
543 Avermaete, Another Modern, 122.
544 Ibid., 135. Avermaete quotes Écochard here in fn 73. Fn. 74, again double check He is quoting a critic in a 1955 article in the journal L’Architecture d’Aujourd’hui.
housing project in Tuscolana, Rome of 1950-54.\textsuperscript{545} Italy too looked for models to rapidly house the displaced population and to resist the overly technological. The 1950s in Italy saw a return to traditional techniques and a longing for previous times, a connection with the land, and a sense of place. Often critiqued as a neorealist approach in contrast with the rapidly changing lifestyle of the Italian citizen in part due to mobility and changing employment, the impulse was often counter to the incredible changes in mass culture and the evolution of a mass consumer society. All fundamental ways of life were changing in the new urbanized individual, and there was tension as the individual and the family began to undergo a changing identity. Often uprooted from a village or rural, provincial life that had gone unchanged for centuries, the move to the city and the change in the quality of life is a dramatic moment in the social and cultural life of Italy, as the sense of identity connected to place is lost or radically altered.\textsuperscript{546} These changes are the subject of numerous books and films.

The stimulus for reconstruction at a national scale came from the intervention of international agencies in the immediate postwar years. Direct assistance to Italy was provided in particular through the European Recovery Program (ERP), also known as the Marshall Plan, which offered aid and technical assistance to promote European reconstruction after the war. The program ran for four years beginning in June 1947.

\textsuperscript{545} This may also be seen in other INA Casa projects of the time. See Mario Ridolfi’s plans for typological housing studies.

\textsuperscript{546} This is a much larger issue of study and may be seen in some of the major texts by Maristella Casciato,
In a campaign poster for the ERP, an American flag wrapped around a box, symbolic of American aid, is held by ropes that seem to be dropping this aid package on the map of Italy below.\textsuperscript{547} The slogan \textit{Gli aiuti d’America—Grano, Carbone, Viveri, Medicinali—Ci aiutano ad Aiutarcì da Noi} is clear: “American aid --grain, coal, food, medicine --the USA helps us to help ourselves.”\textsuperscript{548}

A parallel and very real concern of the Marshall Plan was to prevent the spread of communism in the volatile postwar period. The challenge in Italy from the U.S. point of view by the Marshall Plan planners was to develop a consumer society in a country of predominantly working class agricultural workers known for their frugality, who had become accustomed to making what little they had go a

\textsuperscript{547} I find this image disturbing in that there is a level of detachment represented in dropping aid as such.

\textsuperscript{548} Seen in special Issue of \textit{Rassegna} XV, 54/2 The Reconstruction in Europe after World War II (1993): Illustration #13, with credit: Rossetti, Cremonesi, Bottoli, poster, “The USA help those who help themselves”, 1945. From G. Rumi, A. C. Buratti, A. Cova, ed. \textit{Milano ricostruisce 1945-1954} (Milano: Cariplo, 1990). This may have to do with \textit{a fai da te} mentality, do-it-yourself, to set the balance of new methods, techniques, contributing to a new mindset. [Translation mine]
long way after years of war, occupation, and severe shortages of the basic necessities of life.549 Part of the motive of the Marshall Plan was to introduce a desire for consumer products, changing a subsistence way of living into one that would come into line with other developed nations. It was also, in no small measure, directed to suppress the appeal of communism.550 While not the sole reason for the success of the recovery and the development of an industrial base (especially in the north), the Marshall Plan did spur growth and contributed to what was evident by the late 1950s the effect of an economic boom, or as it is known as the economic miracle.551

The last years of the 1950s and the first years of the 1960s can be characterized by the emergence of new approaches for housing and cities in light of the population explosion and changing migration patterns in Italy. This prompted the emergence of theories of the new dimension (la nuova dimensione), the city-region (la città regione), and the city-territory (la città-territorio). It also spurred the proposal of new hybrid urban entities such as the central business districts (i centri direzionali) proposed at an enormous scale that would lie between, and tie together, the historic city center with

550 David W. Ellwood, “The Marshall Plan,” in Rassegna XV, 54/2 The Reconstruction in Europe after World War II (1993): 84-89. This is a much larger political discussion that I will be treating in new research on the United Nations Rehabilitation and Relief Act in the immediate (or first) postwar period.
551 This is a very complex time period and cannot be covered adequately in this dissertation. I focus on a particular aspect of the development of technology from the steel industry and how this affected housing and urban life. What I am aware of, but am not discussing is the complexity of the political situation in postwar Italy, in transition from Fascist rule to a nascent democracy. It is not until 1948 that the country is broken into 20 regions, broken into provinces (except for Aosta) who have autonomous powers defined in the Constitution. The Democrazia Cristiana DC (Christian Democracy party) dominated Italy for 50 years from 1944-1994. Beginning with Alcide De Gasperi (Dec. 1946), the effect on housing and urbanism was greatly felt under Amintore Fanfani whose name is associated with the national housing program the Piano Fanfani also known as INA-Casa (L’Istituto Nazionale delle Assicurazione) founded in 1949, became the party leader in 1958. This program proposed the construction of over 300,000 units of public housing (edilizia residenziale popolari). The program was partly sponsored by Marshall Plan funds. See forthcoming Stephanie Zeier Pilat, Reconstructing Italy: The INA-Casa Neighborhoods of the Postwar Era (Burlington, VT: Ashgate Studies in Architecture, 2014).
its rapidly and haphazardly developing periphery. These various theories were proposed by architects and urban planners to address the explosively growing cities with a view to their integration within the overall scale of the territory and countryside. But these concepts did not just remain theory. Architects were involved in studying the theories through design projects, and competitions were launched that sought projects that would investigate actual proposals. In addition to the formal issues that emerged of a dramatic juxtaposition of the scale of the city and its expansion into the hinterlands, the studies also proposed new forms of decision-making and recommendations for policies and urban plans that would have a great impact on the character of housing types and neighborhoods in addition to the overall urban fabric. Cities were not thought of in isolation, but were as a network of urban centers (known as the concept of conurbation), linked by improved rail service and by the new connection by high-speed highways or autostrade. The concept of the city was extended and was physically made manifest at the territorial scale.\footnote{552} The growth of industrial sectors, especially heavy industry and steel production, directly affected the housing industry, architecture, and urban design, as well as railways, highways, and the diffusion of the family automobile.\footnote{553}

**Industrialization, energy resources, and new materials**

Many of the economic and political changes in postwar Italy were tied to the influence of Marshall Plan and other sources of foreign aid. The effect of this funding on the development of the steel industry in Italy was substantial. Another aspect that may be overlooked, but was critical for any development at all, was the search for sources of energy for coal-poor Italy. In the late 1950s,

\footnote{552} It is striking to note here, that this concept was developed in 1962, only 16 years after the establishment of the various “regions” in postwar Italian unification.  
exploratory drilling for oil in the Po Valley and the seabed of the Adriatic Sea came up dry, but sources of natural gas were found in the Adriatic. Large scale national consortia were founded, such as ENI to regulate the exploration, drilling, processing, and distribution of gas.\textsuperscript{554}

Other extra-Italian forces were at play as well. The development of the steel industry was made possible after the end of the Marshall Plan because of the newly formed European High Commission of Coal and Steel in 1954 (CECA, also known as the \textit{Piano Berman}), which provided for the supply of raw and finished materials and source of power to move between the consortium countries France, Italy, Germany, England and the Benelux countries.\textsuperscript{555} New industrial materials, especially steel, when coupled with the concept of industrialized building (again, a term that was used at the HfG Ulm), led to new developments in building. This is especially true for high-density urban housing, which called for a new approach to building, taking into account advanced technological capacities to prefabricate building parts, a drastic change to the then low-tech manual labor that was the norm.

The technical aspects of prefabrication presented a problem. How could designers and builders use a series of repetitive manufactured building elements to provide enormous quantities of housing units, while retaining a sense of cultural identity, home, and common public spaces? The illustrated building manual was a significant way that information and techniques were disseminated to architects, engineers, surveyors, and builders to assist in this shift to mass housing projects. This was not limited to the postwar period in which the most prominent example, the \textit{Manuale dell’Architetto}, was created and distributed in Italy, but had its roots in the interwar period and flourished in the


\textsuperscript{555} A short history of the CECA accord, also known as the \textit{Piano Berman} is discussed in Chapter 7.
1960s, post-boom period in order to develop industrialized building techniques to address the need for housing for the Greater Number.

In the immediate postwar period the issue of reconstruction of housing and infrastructure destroyed in the war was a common and recurring theme in architectural magazines such as *Casabella-Costruzione* edited by Giuseppe Pagano and Edoardo Persico and *Domus* co-edited by Gio Ponti and Ernesto Nathan Rogers. During Rogers tenure from 1946-7, *Domus* added the subtitle, *la casa dell’uomo* (the house of man) and addressed the needs of postwar conditions. Other magazines that began publishing between 1944 and 1946 also included *La Città* of Giuseppe De Finetti, *La nuova città* of Giovanni Michelucci, and *A* directed by Lina Bò, Carlo Pagani, and Bruno Zevi. In order to address the speed and economy with which housing needed to be built, the magazines published accounts of examples of prefabrication and modular housing outside of Italy. This is also clear in the first issue of *Metron* in 1946, which featured articles by Eugenio Gentili and Bruno Zevi on prefabrication in the United States and in use in the reconstruction efforts in Britain. In general, the magazines published articles which focused on housing and proposals for the reconstruction of historic centers. Debates arose regarding what would be the correct approach. Some architects favored a return to traditional values with an emphasis on regional tradition and resources, while others saw the reconstruction as a possibility for new ideas and a new understanding of post-regime society and culture.

We may compare, for example, the point of view of two editors, Ernesto Nathan Rogers of *Casabella-continuità* and Bruno Zevi of *Architettura. Croniche e storia* (founded in 1955). Their approach is quite different. It has been thought that both Rogers and Zevi shared a belief in the poetic vision

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557 This is clear when scanning the early issues of these magazines. It is also discussed by Paolo Scrivano, “Italy after the war,” in *2G* (2009).
of the individual architect, and published many articles which focused on the works of individual
architects. Zevi’s inability to define organic architecture except through examples made this
approach very ambiguous.\footnote{Luca Molinari, “Between Continuity and Crisis: History and project in the Italian Architecture Culture of the Postwar Period,” in 2G (2000): 9.} Rogers was influenced by the work of , and collaborated with, the
philosopher Enzo Paci and affirmed the phenomenological aspect of architecture as experience.
Rogers viewed the role of the contemporary architect to be in discourse with the work of the
masters of the modern movement, seeing history as a kind of continuity from the Renaissance on.
His approach as editor was to publish numerous monographic issues, supporting his interest in the
historiographic reading of the recent past, and urging the modern movement to find its own
tradition. His approach is completely different from that of Zevi, who was less concerned with these
traditions, and as has been discussed, who was at odds with Giedion and the seemingly unified
nature of modern architecture represented by CIAM. Zevi believed that by studying a range of
heterogeneous projects, one could expand the definition of modernism, breaking the insistence of a
direct line of evolutionary progress. His eclecticism was already evident in his Verso un’architettura
organica of 1945 and was only further developed in the next two decades.\footnote{Molinari, general discussion and he sets up the comparison between Rogers and Zevi. P. 9 See especially Vittorio Savi, “Costruzioni’ nell’ideologia della ricostruzione,” 47-62. Also Francesco Tentori, “Casabella-continuità e le riviste italiane di architettura,” 63-72.}

Other magazines were also deeply invested in the discussion regarding the reconstruction and the
rapid evolution of culture and the emergence of a consumer society.\footnote{Silvia Micheli, “Le riviste italiane di architettura. Il luogo logico del dibattito architettonico,” in Italia 60/70, una stagione dell’architettura, Marco Biraghi, Gabriella Lo Ricco, Silvia Micheli, and Mario Viganò, eds. (Padova: Il poligrafo, 2010), 125.} Magazines that were founded
by Adriano Olivetti, such as Comunità, Zodiac, and Urbanistica had an underlying basis in comunitarian
ideals.\footnote{This is an area of research that I will further develop about the role of industrialist Adriano Olivetti and others.} The magazine Urbanistica was the official publication of the INU (Istituto Nazionale
Urbanistica), directed by Giovanni Astengo with important contributions by Luigi Piccinato, Giancarlo De Carlo, Giuseppe Samonà and Ludovico Quaroni with important studies of both domestic and international aspects of the emerging discipline of urbanism. Edilizia Popolare, published by the Associazione Nazionale fra gli Istituti Autonomi per le Case Popolari, a national association representative of the multiple agencies responsible for public housing, published articles which examined various types of construction for public housing which were being developed at the periphery of the larger cities. In a different light, editor Gio Ponti geared the content of Domus toward the development of a collective “taste” (gusto) for the new Italian middle class.\footnote{Micheli, 125-6. She refers to the following texts, E.N. Rogers, “Continuità o crisi? Casabella-continuità 215 (1957), 3-4; A. Mendini, “Rogers e noi,” Casabella 343 (1969), 4-5; Chiara Baglione, Casabella 1928-2008 (Milano: Electa, 2008); Gio Ponti, “Ai nuovi lettori di Domus,” Domus 433 (1965).}

In December 1953, Rogers wrote in his first editorial for Casabella-continuità that:

> the consciousness needed for history, the essence of tradition lies in the precise acceptance of a tendency that for Pagano and for Persico is the eternal variety of the spirit, adverse to every past and present formalism…not mannerism, nor dogma, but the free, unprejudiced search with the consistency of method.\footnote{Also Francesco Tentori, “Casabella-continuità e le riviste italiane di architettura,” 65. [Translation mine] Emphasis in the original.}

Rogers looked to tradition to provide a continuity of modern architecture. He was quick to state that this was not based on formal aspects, but on the political responsibility of the practitioner to design in a responsible and methodical manner.\footnote{Micheli, 127. Micheli’s account follows Tentori’s very closely, but in some ways is a clearer discussion.} Initially Rogers had brought in three editors, Giancarlo De Carlo, Vittorio Gregotti, and Marco Zanuso. Zanuso was interested in what had been a central and fundamental interest in the discussion in Metron, having to do with building technologies (tecnica
edilizia) and with industrial components. Gregotti had been a writer for Casabella from 1953-1955, from 1955-1963 for Casabella-continuità, editor of Edilizia Moderna from 1963-1965 as well as being responsible for the architectural section of Il Verri.

**Giuseppe Samonà and the city-region**

As has been discussed, an enduring problem in the postwar period was the need to develop housing and infrastructure for a transient population during and after the period of the economic boom. These enormous changes in population are clearly seen in the movement from Italy being primarily an agrarian society to an urban one. With these massive movements, cities were growing explosively and important contributions were made by architects and planners regarding rethinking the city and territory, prompting the notion of the *città-territorio* so crucial to planning at the time. As discussed, the theme of the Greater Number or the *Il Grande Numero* expanded on studies on Le Plus Grande Nombre developed in the early 1950s by the CIAM, which looked to theorize and find a kind of method for guiding urban growth, and was crucial in establishing the idea of natural growth as a model. It is precisely here that this work stakes a claim for and a reconsideration of the *organic* in relation to Italian architecture.

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565 Tentori, 67.
566 Samonà’s *L’urbanistica e l’avvenire della città negli stati europei* examined large cities which had developed in the 19th and 20th centuries, looking for the “progressive elements of the work and linked to sociological concerns for a ‘communitarian’ communities studied by Mumford and Gutkind—which were postwar examples. Samonà’s work laid out a theme regarding the city which influenced studies and projects. For example this led to the section in the 1960 XII Triennale of Milan on the studies of the Italian periphery and blossomed into the development of a center for this research at the Istituto Universitario di Architettura di Venezia (IUAV) in 1964-65. During the period 1960-64, the discussion on the city was also influenced by North American culture in the *Journal of AID* where articles on the ‘new dimension,’ and ideas of the city-territory and the city-region were published—including the role of traffic and circulation in relation to developments of office districts (*centri direzionali*), shopping centers and the emergence of the new discipline of planning. Architecture as language, as a formal theme loses at the new dimensional scale, containers become megastructures. Expanded from CIAM directives. See Casabella 440/441 “Casabella cinquant’anni 1928-1978,” (Oct.-Nov. 1978): 76, 83.
An early text which forms the basis for urban studies in postwar Europe is Giuseppe Samonà’s *L’urbanistica e l’avvenire della città negli stati europei* (Urban Planning and the Future of European Cities) of 1959. In this book, Samonà examined the transformation of European cities beginning in the nineteenth century, with a special focus on mass housing that radically transformed urban planning at the beginning of the twentieth-century. He then discussed the emphasis in the interwar period on rationalist approaches to architecture and spoke of postwar reconstruction with a lens on British planning. Layin a discussion of political programs and the relationship to urban planning in other European nations, he then focused his attention in the final two chapters on the situation in Italian planning prior to 1955 and then subsequent to 1955. The period after 1955 coincided, as Samonà pointed out, with the period of the economic boom which had a tendency towards individual building developments without an overall sense of planning for the structures themselves nor for infrastructure. In addition, rather than concentrated building contiguous with existing urban centers, there was a tendency for developments to spread themselves across larger areas of territory. The boom in building was not coordinated.\(^{567}\)

Samonà also pointed out that there was in general a scepticism toward the overaching power of planning to regulate development, especially if this interfered with development of private interests to negative ends. There was neither a coherent local plan, nor one that would address a regional plan surrounding the largest industrial cities of Milan and Torino or regional capitols like Bologna. Samonà posited that this situation presents a favorable climate in which to think of larger regional planning and pointed to the movement to develop intercity (*intercomunali*) plans, creating a “city-territory” (*città-territorio*), seeing that the individual cities were not able to successfully produce a

zoning plan. In 1959, Samonà also coined the term la nuova dimensione (the new dimension) to describe the complex and dynamic interrelationship of the city and its hinterlands, seen through the lens of the complex social, economic, and political aspects.

Samonà discussed the intercity plan of Milan developed by Giancarlo de Carlo, who he claimed “more than any others sought to develop a scientific method to adopt for the study of a larger metropolitan region of the city. For the first time the idea of the city-region and the city-territory became prominent even if it was lurking at the fringes of urbanistic thinking over the past few years.”

The salient point that Samonà then discussed was to point out that the city-region is dynamic, that the structure needs to be flexible, an expressive language of social life: it can address the more formal as well as the more ephemeral aspects of modern civic life. What is interesting in Samonà’s language is that he used biological terminology to describe the growth and responsiveness of modern city-territories, as if they are a living entity with internal pressures and external pressures. The city reaches a state of homeostasis with exogenous and endogenous growth.

**Postwar urban theories and the tessuto urbano**

The organic metaphor could also be extended to the urban organization. Often referred to as the urban tissue or fabric, the tessuto urbano is a concept that is striking in a country such as Italy with historical city centers that display in their organization a variation within the pattern, accommodating to an overall idea of its shape that is continuously changing by its growth over time. Rather than

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570 Giuseppe Samonà, L’urbanistica e l’avvenire della, 215. “A questo punto bisogna sottolineare che il piano intercomunale di Milano, per opera soprattutto dell’architetto De Carlo, è quello che più di tutti ha cercato di dare un’impostazione scientifica allo studio del territorio metropolitan della città. Per la prima volta l’idea di città-regione o di città-territorio, che aveva già da alcuni anni serpeggiato marginalmente alla cultura urbanistica, trova la sua chiara impostazione scientifica; che lo stesso De Carlo aveva fornito a conclusion del convegno di Stresa.” This could be expanded to summarize the Piacentini/ Pagano debate.
seeing this as nostalgia for the past, or a rejection of the modern or the autarchic restrictions of the fascist period, the organic metaphor signaled a new approach that could use modulation and a variation in the urban pattern to bridge between the modern and the organic. The metaphor could be applied to the design of large urban quarters of densely populated housing. By using natural models of growth as inspiration, the environment would not be static but organic, due to an endless repetition of self-similar building elements, organically mimicking the formal intricacies of historical urban centers. This might then facilitate a community that engages the creation of their environment. This was at least the dream. Examples of this vision have been noted in the earlier postwar interesting examples of housing for the INA-Casa by Mario Ridolfi and Ludovico Quaroni or Adalberto Libera in the Tuscolano district in Rome, and in proposals by Mario de Renzi and Saverio Muratori, in which the use of the repetitive element is used with slight variations to produce rhythm and modulation.572

Figure 148 Adalberto Libera, Housing in Tuscolana quarter, Rome

571 In contrast with Mario Ridolfi and use (see Colquhoun, Modern Architecture, 218 how van Eyck in relation to Team 10 attacked the Italian ‘contextualists’ p. 187. Rogers 1955 “Pre-existing Conditions and Issues of Contemporary Building Practice” explicitly modern in its techniques respond to historical and spatial context ‘existential not idealized’ reality. See English translation, Ockman, Architecture Culture,” 200. These techniques are against Fascism, autarchia in material systems, vs. Moretti’s hiding of concrete structure at the Fencing Academy, etc.

572 See Gyorgy Kepes work on series and modularity (1953) and intersections with science.
Saverio Muratori was also known for his studies on the city of Venice and Rome.\textsuperscript{573} His project *Studi per una operante storia urbana di Venezia* (Studies for an Operative Urban History of Venice) was published in Rome in 1959 and looked at the *tessuti nel quartiere* or the spatial texture of the city neighborhood and studied it in hierarchically nested spatial units: canals, calli (streets) and corti (courtyards). The project for a new neighborhood fluidly uses these elements to create a “double warp” modulated by the individual elements; while repetitive, it is quite fluid.\textsuperscript{574}

![Figure 149 Saverio Muratori, competition entry for for the CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60. In *Rassegna* vol 17, 61. Issue: “Architecture Competitions After 1945. History, Methods, Procedures,” ed. Marco De Michelis with Dario Matteoni. (Bologna: C.I.P.I.A., 1995), 13.](image)

Muratori had also led a study on the city of Rome (1956-1962) in which he led his students in the 1960-61 academic year to design new infill housing to respond to the existing historic fabric.\textsuperscript{575} He makes overt references to biological modes of growth and growth, presented as a positive factor.\textsuperscript{576}


\textsuperscript{574} This is also based on Muratori’s studies from 1950.

\textsuperscript{575} Cataldi, 104. Also in S. Muratori, R. Bollati, S. Bollati, G. Marinucci. *Studi per una operante storia urbana di Roma*, (Roma: 1963). These studies span a period of mass speculative housing projects in Rome, and coincide with the new 1962 Rome PRG. Cataldi also shows examples of student designs for Muratori in 1960-61 in Tor di Nona and Portico di Ottavia, neighborhoods within the historical fabric of Rome. He speaks of this new work being in a positive dialogue with the existing elements.

\textsuperscript{576} A key idea that is questioned in this work is the positivistic notion of progress of the technological society. So much of the early part of the period is characterized by a faith in technology to make positive contributions in society. This is echoed in *Casabella’s* self-definition at the period of 1965-70 as “L’ideologia della tecnica.” (reference).
No longer is it possible, as had been done in the past and until recently in architecture of the period of crisis, to juxtapose new organisms on preexisting organisms, or, in dealing with urban planning which includes older neighborhoods to superimpose the new ideas on the present conditions in one fell swoop. It is advisable to proceed with development already underway, inserting new elements of the character of the existing fabric and with organisms that are already existing in the plan.\footnote{Cataldi, 105. “Si tratta non più di giustapporre, come faceva e fa tuttora l’architettura della crisi, organismi nuovi agli organismi preesistenti o, se si tratta di piani urbanistici comprendenti i vecchi quartieri, di sovrapporre le nuove concezioni sulla situazione presente presa in blocco. Si tratta di proseguire lo sviluppo in atto, inserendovi gli elementi nuovi nel carattere di tessuto e di organismi dell’impianto esistente.” 

Add a concluding thought here on urban fabric, the organic ideas of continuity seen here…how can it be modernized via Muratori, versus the more conservative approach of Cataldi.}

The idea of a “Plan” (or Planning) was a polarizing thought, tautological, totalitarian for some. The question became how to have individual freedom, yet provide equitable access to resources and infrastructure, and avoid speculation, greed, and the destruction of the landscape. It was necessary to find an organic approach to design in the fabric of the city and maintain a healthy connection with the periphery and the hinterland beyond.

The early 1960s

In the first few years of the 1960s, many magazines were still concerned with issues regarding the postwar reconstruction effort, although change was perceptible in their focus.\footnote{Micheli, “Le riviste italiane,” 125, fn 1. In this footnote, Micheli recommends the following texts which examine the activity of Italian magazines published between 1960 and 1980: M. Mulazzani, Il dibattito architettonico in Italia 1945-1975 (Roma: Bulzoni, 1977), 408-551; Francesco Dal Co, ed. “Le riviste di architettura. Costruire con le parole,” in Storia dell’architettura italiana. Il secondo novecento (Milano: Electa, 1997), 430-443; Francesco Tentori, L’Architettura contemporanea in dieci lezioni (dividendo per undici): zibaldone e bibliografia sull’architettura, l’arte italiana e le riviste del Novecento (Roma: Gangemi, 1999), 113-144.} For example, Rogers, still director of Casabella-continuità and some of his contributing writers, Giancarlo De Carlo, Vittorio Gregotti, and Guido Canella, Giorgio Grassi, and Aldo Rossi, recent graduates from the Polytechnic of Milan, authored articles that were central to the architectural debate around the idea
of Large Numbers. Some of these articles such as Rossi’s “Nuovi problemi,” or Manfredo Tafuri’s “I centri direzionali italiani” are central texts in the historiography of the period.\footnote{Aldo Rossi, “Nuovi problemi,” and Manfredo Tafuri, “I centri direzionali italiani,” and “Studi ed ipotesi di lavoro per il sistema direzionale a Roma,” in Casabella-continuità 264 (June 1962). Giorgio Piccinato, Vieri Quilici, and Manfredo Tafuri, “La Città Territorio verso una nuova dimensione,” in Casabella 270 (Dec., 1962): 16-22.} Roger’s Casabella-continuità in this period also published important articles by Carlo Aymonino, Paolo Ceccarelli, and Manfredo Tafuri. Importantly, the magazine published the activity of the Study Center of Casabella-continuità which was formed by Aldo Rossi, Luciano Semerani, Francesco Tentori, Silvano Tentori, and Aurelio Cortesi.\footnote{See also Micheli, “Le riviste italiane,” 127.}

In January of 1962, De Carlo organized an interdisciplinary seminar to discuss the New Dimension and the City Region (la nuova dimensione and la città-regione) at the Lombard Institute for Economic and Social Studies (ILSES). De Carlo brought together a group of experts to investigate the city as a “self-organizing system.” He also conceived of the city as an “open structure,” open to change, responsive to its inhabitants and the surrounding territory. Ultimately this was not merely a formal gesture for De Carlo, but one that pointed the way to more equitable forms of representation and a more just society, and is representative of the discussion of the time.\footnote{Giancarlo De Carlo organized a conference on the city which was published as Relazioni Conclusiva al convegno dell’ILSES sulla. La nuova dimensione della città—La città-regione (Milano, Italy: ILSES, February 1962). In addition, the well-known experimental design studio led by young architects organized at the University of Roma in 1962 on the città-territorio. Starting from a decisively left position, the study interrogated the imbalance between the inhabitants in the center versus the periphery (with studies for Centocelle, a working class district to the east of Rome) and for a new business district (centro direzionale) at the periphery of Rome. This conference is documented with texts by De Carlo and Piccinato, Quilici, and Tafuri, in “Il IX Congresso I.N.U. a Milano: Programmi di sviluppo economico e pianificazione urbanistic,” in Casabella-continuità 270 (Dec., 1962): 10-22. See also Ludovico Quaroni, “Introduzione alla relazione, ‘Dinamica e forma della nuova città,’” Relazioni Conclusiva al convegno dell’ILSES sulla. La nuova dimensione della città—La città-regione (Milano, Italy: ILSES, February 1962), 131. See a lucid discussion of the role of urbanism in Manfredo Tafuri, History of Italian Architecture 1944-1985, (Cambridge, MA: MIT Press, 1989), 72-83. For recent scholarship on aspects of this conference see Mary Louise Lobsinger, “The New Urban Scale in Italy: On Aldo Rossi’s L’architettura della città,” in Journal of Architectural Education (2006): 31-2.} Rogers had always been
concerned with the political responsibility of the architect and how the architect might bring a
quality of life to citizens which would be more than just fulfilling the absolute bare necessities of life.
This is an important stance in the face of increasing pressures to accommodate the rapidly exploding
population humanely and not just capitulate to mass housing. Because of the scale of growth and the
concerns for thinking of an organic relationship between city centers, the theme of territory became
all important as well, introducing the notion of overall national planning. This group tackled the
problem of the città-territorio, the centri direzionale, the nuova dimensione, and il grande numero with
optimism, rigor, and commitment.

As a concrete example of this, a proposal for a bridge to Sicily, was developed by the urban design
group “Gruppo Urbanisti Siciliani,” headed by Giuseppe Samonà, and others including his brother
Alberto Samonà. The project, “Un ponte per la Sicilia,” was published in 1962 in Casabella-
continuità.582 It was commissioned by the provincial administration in the Sicilian city of Messina and
was based on the PRG guidelines. The team concluded that a bridge would be necessary to connect
to the mainland and continue the rail and new highways across the north coast of Sicily to connect

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Lobsiger gives a comprehensive explanation about the evolving discussion about the nuova
dimensione and other aspect of the changing scale of the city, highlighting Rossi’s move toward
historical models of the city in the 1965 The Architecture of the City. This is an enormous area of
research which I only begin to touch on here. Future work that I will pursue is to see these studies in
relationship the planning in the late 1950s for the 1960 Olympic Games. Initially venues were
planned for the anarchically developed and poor east side of the periphery, including a desperately
needed road connection, that would link Olympic venues at EUR to the south with the existing
Foro Italico at the Flaminio in the north of the city. Lobbying by wealthy citizens, residing in the
northwest affluent areas of Prati were successful in diverting the road from the east side to a
piecemeal set of roadways moving through existing residential neighborhoods on the West. The city
still suffers from these choices and still does not function. This was covered in a series of articles in
Urbanistica. This was the subject of a paper that I had delivered in “Hosting Celebrity/Housing
Cittadini/Città dell’Arte: The Olympic Village, Rome 1960-2010,” in October 2010 at conference at
the American Academy in Rome on the occasion of the fiftieth anniversary of the 1960 Olympic
Games.

582 Gruppo Urbanisti Siciliani, Giuseppe Samonà with Antonio Bonafede, Roberto Calandra,
Napoleone Cutrufelli, Giuseppe De Cola, and Alberto Samonà, “Un ponte per la Sicilia,” in
to the major city of Palermo. This is an embodiment of the principles of the *città-territorio*. Conceived of as a coordinated structure at the regional and territorial scale, it reflected the relatively recent organization of autonomous regionsthat were somewhere in between the state and the town. These autonomous regions would allow for regional distribution of territorial goods. They reiterated the program of investment in new infrastructure, and the effort to plan and coordinate, eliminate contradictions and redundancies, and overcome sectorialization and fragmentation.\(^{583}\)

Taking the earlier study further, Alberto Samonà’s article “Un’esperienza di pianificazione: La Città-Regione dello Stretto,” (An experience in planning: the City-Region of the Strait [of Messina]) developed ideas from Giuseppe Samonà and from the *City-territory* of Tafuri, Piccinato, and Quilici.\(^{584}\) Samonà built upon their idea that in a territorial structure, cities would “develop along continuous lines of development, localized in traffic nuclei, and would be expressive of the multiplicity of urban function…against the anticipatory pedagogy of language.”\(^{585}\) By imagining these new lines of communication and by concentrating the industrial centers, “the conditions of nature are found again.” Samonà looked for a planning methodology that would consider larger territorial concerns and in this case, viewed the gap at the Strait of Messina that separates Sicily from the mainland Italian region of Calabria as one region. It was only connected by ferry (which to this day carries all automobile, truck, and rail traffic). Samonà imagined what would eventually be the competition brief in 1969 for a bridge to span the Strait. Set in 1963, one year after the implementation of the national PRG (piano regolatore generale), many local municipalities called for competitions to address urban development.

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The authors of “La Città-Territorio verso una nuova dimensione” were wise to have questioned the idea of continual progress as a purely positive movement. Progress displays contradictory aspects of the neo-capitalist development of the modern metropolis, heightening dramatic inequalities in the physical and social lives of its citizens and a greater impact on a larger territorial organization than that which had been anticipated in modern urbanism:

But we cannot a priori know if the city-territory will assume a form of an evolution that is socially positive or its opposite.586

They knew, however, that the development and the spread of industry and administrative centers to the periphery of the city was well under way. Their project sought to find innovative solutions for the rapidly changing urban/territorial changes that had not been predicted by the early modern architects and urban designers. This change occurred at the national scale in terms of an overall new Urban Planning Guidelines (Legge Urbanistica) in 1962. Subsequent planning at the regional scale took into account both geographic and environmental issues in terms of development at the scale of territory. The idea of territorial or provincial planning thus provided an intermediate level of planning between the national regulations and that of individual town or municipality. The individual town for the first time coordinated local planning directives with those planned at the regional scale.587

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586 Piccinato, Quilici, and Tafuri, “La Città Territorio verso una nuova dimensione,” 17. “Se lo sviluppo storico della città, che si è andato configurando dalla prima fase industriale a oggi, non è, di per sé, né da accettare, né da rifiutare in blocco, perché contiene, al suo interno, elementi contraddittori, si può oggi riconoscere che lo stesso sviluppo neo-capitalistico della metropoli contemporanea, anche se a costo di gravi scompensi sociali, si muove verso forme più evolute di organizzazione territoriale che non sono, in fondo, molto lontane da certe anticipazioni e profezie dell’urbanistica moderna ma, nello stesso tempo, non possiamo a priori sapere se la città territorio assumerà forme di evoluzione socialmente positive, o il loro contrario.” [Translation mine]

These concerns were seen in other magazines as well, though through a different lens. In a move to focus more on the actual buildings that would make up the form of territory, Vittorio Gregotti left *Casabella-continuità* in 1963 to form *Edilizia Modern* (Modern Building) with Gianfranco Isalberti as director. Other technical magazines which featured prefabricated building systems surfaced in the mid-1960s in a slightly delayed response to the economic boom such as *Le Prefabbricazione* and *Prefabbricare* (after 1971, *Prefabbricare: edilizia in evoluzione*). Magazines such as *Marcatré*, founded by Eugenio Battisti of the Gruppo ’63, registered the changing face of architectural culture. In *Marcatré*, broader investigations of cultural themes were discussed, looking for a resonance of ideas across the various arts of theater, dance, poetry, visual arts, architecture and other intersections of art and technology. *Op. Cit.*, founded by Renato De Fusco in 1964 as a “selection of contemporary art criticism,” addressed a wide range of the arts from a semiotic point of view.588 In all, the radical changes that had occurred in Italian society because of the economic boom was investigated in a series of design competitions that are extraordinary records of the architectural responses of the time.

588 Micheli, “Le riviste italiane,” 125-9. (Here 128) She discusses an overview of the magazines.
Concept of città-territorio in the competitions

Beginning in 1959, numerous competitions were launched that investigated the evolving concept of urbanism. The theme of the polyfunctional building, the macrostructure, the business district, and the call for the design of entire residential neighborhoods represent the scope of the problem of a new concept of territory. These competitions then are a repository of the theories made manifest. Manfredo Tafuri discussed the importance of the interconnection between government policy, “convulsive urbanization,” and the changes in society as a result of mass communication and population growth. He saw 1959 as a turning point, not only in connection with the publication of Samonà’s book on European cities, but what he regarded as a pivotal moment in the entire notion of urban planning. He pinpointed a critical moment when at a 1959 INU Convention round table, participants Giancarlo De Carlo, Piero Moroni, Eduardo Vittoria, and Ludovico Quaroni claimed the exhaustion of the term “urbanistica” (urban planning). Henceforth, urban issues should be subsumed under the term “architecture,” setting the timbre of the discussion of the new dimension and the connection between individual buildings, neighborhoods, districts, the city and the territory previously discussed.

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590 L’edificio polifunzionale, il macrostruttura, i centri direzionali and quartiere edilizie, case popolari.

It was only in the period of 1964-65 that these various experimental threads were brought to fruition, recognizing the positive contribution of the built urban environment which could be tied to architectural design. In 1965 L. Semerani, A. Rossi, G. U. Polesello and E. Mattioni, and Aldo Rossi and Carlo Aymonino, who were teaching in Venice and Milan, introduced research on urban analysis and the architecture of the city into the academic setting. These studies reached a greater audience as they were published in *Casabella*.\(^{592}\)

With the jump in scale to the new dimension, or the greater number, the question of the scale of architecture radically changed. The new types such as the macrostructure, the *centro direzionale* (the business district), polyfunctional urban areas or buildings, and of course the megastructure were all new types of architectural responses that were already built into the competition briefs especially in the period from 1959-1970, but continued well into the 1980s. Several articles and chapters document a wide range of the competitions and winning project entries such as an article in a special issue of *Rassegna* in 1995, or in Maria Dolores Morelli’s book on Italian architecture in the 1960s, which discussed the competitions, manifestos, words, and documents of the period. In this context, several competitions will be discussed that contribute to the overall focus of the dissertation. The first is a pivotal competition for the CEP Barene di San Giuliano a Mestre of 1959-60 among a few others.\(^{593}\)

A major national competition was commissioned by the Comitato di Coordinamento dell'Edilizia Popolare (Agency for the coordination of public housing) in 1959-1960, for the CEP low rent

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Neighborhood at the San Giuliano Sandbanks in Mestre, at the mainland of the Venetian lagoon. This competition was emblematic of many others and is a much cited example of the network of conceptual relations and practical issues that were at stake in competitions. The competition provided a venue to explore an experimental problem that would generate new methods and new architectural form with an attendant development of a new theoretical point of view(s). Most competitions were organized around large scale architectural projects or designs for neighborhoods, or regional infrastructure which problematized the urban organism, in formal, social, theoretical, and political terms.

The CEP Neighborhood at the San Giuliano in Mestre (also known as the Barene di San Giuliano quarter in Mestre) was important because it situated the problem of affordable housing in the larger context of the neighborhood as a district of the city. The overall guidelines for the project were set by the Venice Planning Scheme and asked the competitors to integrate large-scale municipal facilities within the overall housing plan and to consider the design of the new neighborhood in light of its relationship with the historic center of Venice. From the 56 schemes that were submitted, the first prize was awarded to the group headed by Saverio Muratori, who used three different types of housing blocks which emulated the morphology of the existing city fabric. The first scheme used irregularly placed but identical housing blocks scattered on the small islands, the second a radial plan alternating between long streets and canals running through the depth of the fan-shaped neighborhood, and the third, the best known of the schemes, used rectilinear perimeter blocks to replicate the calle (streets) that are seen in the existing structures of Venice but these are then radiated to reflect the change of the shape of the adjacent canal.
Figure 150 Saverio Muratori group, first prize for the CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60. In *Rassegna* vol 17, 61. Issue: “Architecture Competitions After 1945. History, Methods, Procedures,” ed. Marco De Michelis with Dario Matteoni. (Bologna: C.I.P.I.A., 1995), 12-3. “The winning project, by the Muratori group, resolved the problem of the relationship with the old city by reproducing the different types of Venetian building fabric in the three solutions presented, and shaping the project for a neighborhood that was ‘homogeneous and not complementary’ to the urban fabric of the historic center. The solution presented rejected a functional relationship with the territory, providing the residential area with facilities that were of a size only appropriate to the scale of the neighborhood itself.” (S. Muratori, R. Bollati, S. Bollati, G. Figus, P. Maretto, G. Marinuzzi, G. Mazzocca).

Among several groups selected as runners-up, the project by the group led by Giuseppe Samonà and another by Ludovico Quaroni are notable. Samonà’s project elaborated a series of various housing blocks ranging in scale from low-rise to medium rise. These were set back from the edge of the water and were arranged leaving the ground clear for recreational use, similar to the plans for the Olympic Village by Luigi Moretti and Adalberto Libera in 1960 or Moretti’s plan for the INCIS neighborhood south of EUR. The stadium and other public buildings were set along the waterfront, the overall project a formal exercise in composition of individual elements.

Figure 151 Giuseppe Samonà group, project for the CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60. In *Rassegna* vol 17, 61. Issue: “Architecture Competitions

Perhaps the best-known of the projects was by the group led by Ludovico Quaroni. This group arranged the low-density housing units informally within a verdant landscape. All of the public services, administrative and commercial, were clustered in hemicyclical plazas at the water’s edge.\(^{594}\)

It has been noted that the study of the housing by which the units are divided into smaller parts were the result of Quaroni’s study of natural forms by Gyorgy Kepes and makes the informal character, or the organic character of the project more than solely a visual analogy.\(^{595}\)

![Figure 152. Ludovico Quaroni, sketch for the CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60.](http://www.fondazionemaxxi.it/2011/12/01/ludovico-quaroni-disegni-e-schizzi-per-le-barene-di-san-giuliano-a-mestre/?lang=en)

This project was characterized by Manfredo Tafuri as following an aleatory approach, and that the diverse images and various functions that were to be accommodated in the new network was a “plan-in-process,” an “open work” at the urban scale, as if it were a territorial organism.\(^{596}\)

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\(^{595}\) See project description at: http://www.fondazionemaxxi.it/2011/12/01/ludovico-quaroni-disegni-e-schizzi-per-le-barene-di-san-giuliano-a-mestre/?lang=en

Continuing with the textile and biological references, Tafuri, commenting on Quaroni’s process stated:

Quaroni sketched out many typological inventions for the configuration of fabrics, but they were not binding. The urban design freed the architectural configurations, giving them full autonomy within a system of pure relations.597

Tafuri continued to state the importance of this project which he asserted set the stage for a new approach toward design in the 1960s, as one can see in his clear discussion of the autonomy of architecture within a structuralist framework. This is the pivotal moment when he claimed Italian intellectuals were just beginning to perceive the new reality of late capitalist production:

It appeared, in fact, at a moment in which Italian intellectuals were becoming aware of a new reality: convulsive urbanization and the diffusion of mass communication had effected profound transformations in society and individual behavior. These changes, along with rapid economic growth, encouraged the formation of interpretive models that quickly replaced those of the preceding decade. Neorealist myths were replaced by technological ones, though consideration was given to the legacy of the avant-garde.598

597 Ibid., 73-4. “In this project, Quaroni concentrated the positive results of his incessant criticism, the intuition of untried planning methods suited to large-scale design, a disinterested reading of the historical morphology of the Venetian lagoon, and an attention to visual communication aimed at a densely stratified mass public. The shapeless, aleatory quality of the zoning and the formal rigidity of architectural articulation were rejected in favor of a ‘town design’ that set its principal components within a weft of relations, but did not define the forms of individual parts. This aesthetic of the undefined was, however, deliberate. The big semicircular edifices facing the lagoon linked to form an enormous belt opening out to the urban fabric and then radiating inland. The project alluded to the urban lesson of Venice’s historical fabric: an allusion perceptible on a structural, rather than a visual level. The intense stratification of the city, the intersections of its multivalent images and the eclecticism informing it were organized by Quaroni into a large-scale network of signs animated by a vitality that also influence the design method. The discovery of the immense communicative richness of the aleatory approach was translated into a ‘plan-in-process,’ an ‘open work’ of urban scale. Quaroni sketched out many typological inventions for the configuration of fabrics, but they were not binding. The urban design freed the architectural configurations, giving them full autonomy within a system of pure relations.”

598 Ibid., 14-15. Tafuri continues this paragraph: “It was not, then, a question of implementing the technique that Pier Luigi Nervi had triumphantly celebrated in his Palazzo and Palazzetto dello Sport in Rome and his Palazzo del Lavoro in Turin, nor was it a matter of simply assuming the new
Quaroni envisioned the new quarter as a satellite city, connected to its context through infrastructure. The central traffic spline would split the “city” in two parts, and each side would be subdivided in three or four units, which would be then divided into smaller parts. The main green spaces and principle public elements would comprise 30% of the area. Quaroni described the theory behind the project:

Urban design, architecture, and housing should not appear like completely different entities, each “should” exist together with the others—the semantic distinction would confuse rather than precisely define the idea behind the project.599

Figure 153 Ludovico Quaroni, sketch for the CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60. In Morelli, *Architettura Italia Anni '60*, 55.
Quaroni explicitly wanted to keep the project an open work, leaving the design of individual buildings or a housing complex to the architect, hoping for a more spontaneous sense of the development of a new neighborhood rather than a “city created in a single moment from the singular system of one brain.” He believed that they were overturning the existing system of urban design, and gesturing towards future development. This project serves as a lens for the potential for industrially-produced, standardized housing to be an open system, inviting permutations in the serial element to produce diversity. Each of the housing units was designed to be incomplete. The different modules would lock together in ways to form visually and spatially complex spaces, both in the positive built form and in the empty spaces between.

Figure 154 Ludovico Quaroni, Top: sketch for the modulation of the base apartment configurations. (shown sideways). Center: sketch for the modulation of the base apartment configurations into

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600 Ibid.
blocks. Bottom: Plan of the intersecting units and their configuration in various clusters. The black shapes are the roads, access to the units and the open space between would be by foot. The section shows the structure (“la piastra” that the units would fit into, much like the contemporaneous projects of Yona Friedman. CEP Neighborhood at the San Giuliano Sandbanks in Mestre (Venice), 1959-60. In Morelli, *Architettura Italia Anni ’60*, 56.

The idea of the new dimension is clearly shown in Quaroni’s project. This project embodies a stance that is critical of the early modern project of *existenzminimum*. No longer were identical units to be organized in efficient larger structures. By using modularly coordinated, industrially produced building elements, the project was able to critique and also engage industrialization.

Following this important competition there were numerous urban scale competitions for *centri direzionali* (business and administrative centers) proposed for Padua (1959), Bologna (1961), Turin (1962), Rome at EUR (1962), and for Milan. The project for Padua was planned along an axis that ran in the direction of Vicenza-Venice-Bologna and was organized around the idea of developing administrative and other public functions in high-density blocks along the proposed high-speed road and railway.  

Notably, this approach along an axis of development was developed by the INU in 1955 as an *asse attrezzato*, an outfitted or well-equipped axis. Other competitions were significant such as the two-part competition for the Tronchetto area of Venice of 1963-4. The Tronchetto is a small island that is adjacent to the road and railway causeway at the entry point into the city from the mainland. The first stage was exclusively for public functions, such as the enormous automobile parking structure, a seaport, hotels, storage areas, electrical plants, and fuel storage. The second stage was more open-ended, seeking a density that would reflect the urban fabric of Venice, but leaving the building typologies up to each competitor. The competition struck a chord: many were critical of such a hypocritical move, to propose such prosaic programs at the entrance to this exquisite historic

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601 Maria Dolores Morelli, *Architettura Italiana anni ’60*, 41-43.
city.\textsuperscript{602} Inherent in each competition was the debate about the new and the historic city and the regional scale.

Before coming back to focus in detail on the 1965 CECA Steel housing competition in the Epilogue, the 1967 Genoa Container Port competition, and the 1969 competition for a bridge to span the Strait of Messina, it is informative to look at a few projects for architecture that was conceived of at the scale of territory, which was brought to light in a series of competitions for universities in the early 1970s. The project for the remodeling of the University of Florence outside of the city center is drawn at the scale of the high speed road that it straddles, and is as large as the scale of the cloverleaf traffic exchange at the exit. The enormous scale of the proposed university was directly related to university reforms that had initially been sparked by protest in the period of 1963-64, but which came to a head with the student occupation of universities in 1967-68. Universities in Italy had usually been housed in a number of departments in different buildings within the city fabric, or as at the University of Rome in the Fascist period, was designed as a district with individual buildings designed by prominent architects. At this juncture of reform, the university was seen as an opportunity to design a large scale sector of the city. Because the reform was still under way, and new guidelines for university organization had not been released, the competitors were asked to speculate on the university's organization. These ideas would be reified in abstract form. Until this time, the university was organized around the various schools, and many of the schemes in this period parceled off each of these as separate and often homogeneous forms that would be linked by a superstructure at a territorial scale. A striking example was the megastructural scaled scheme proposed by Vittorio Gregotti for the University of Calabria in 1973-74. The site was not predetermined and it asked the competitors to propose a site and an arrangement. Most projects proposed a linear scheme at an enormous scale outside of the city. The project by Vittorio Gregotti

\textsuperscript{602} Morelli, 74.
was the first place winner, with a scheme that organized all of the departments in sequence around a central one-kilometer-long central pedestrian street. Housing in repetitive blocks were developed perpendicular to the main “street” at three different locations.


The excessiveness of scale seen in his university design had been taken a degree further, and to the breaking point in Gregotti’s winning scheme for the ZEN housing plan for the Sicilian city of Palermo. Designed in 1970-71, the plan concentrated densely and regularly spaced four-story apartment buildings set off from other parts of the city, surrounded by green space, but cut off from the city by high-speed roadways.
Other projects of note are competitions for singular buildings that begin to take on the scale of territory as seen in the Competition for the Teatro Comunale in Cagliari in 1965, with the winning scheme by Maurizio Sacripanti, and the Competition for the San Cataldo Cemetery in Modena by Aldo Rossi in 1971-74.

In a project like the Zen housing project, the limits of the excessiveness of the ways that the Greater Number had been interpreted was counter to the initial desire to provide human based responses to prefabrication and large-scale development. This project is the symptom of what was the potential of the Greater Number: the initial focus on the organic growth of cities. How could an “organic” model, as seen in the tessuto or existing urban fabric that evolved over centuries, be modeled in rapidly built new housing quarter designs tied into industrialized modes of fabrication and construction so as to avoid the inevitable alienation in the creation of housing projects through the repetition of identical modules? In what ways could historic cities become a lesson regarding variation in the greater number? This period could also be characterized as the moment of the emergence of consumer society euphoric with the possibilities that development and technology promised. This uncritical (yet planned) reception of the fruits of technology began to change at the end of the decade of the 1960s replete with social, economic, and political crises in planning strategies documented in the magazines, in building manuals, in the competitions, and in particular with one exhibit that may be viewed as a critical moment of the shift from the faith in progress to address the hardships and necessities of a rapidly industrializing nation to one in which the failures of technology and the embrace of a positivist attitude towards progress are called into question, and

603 The architects from Morocco and Algeria who presented the detailed studies of daily living conditions in the North African bidonville brought a focus on the importance of public spaces. The change in the notion of the term “habitat” is important in that it was no longer seen in a similar functionalist aspect of the minimum dwelling unit, but seen as a complexity that was a result of the informal growth of spontaneous dwelling, offering organic analogies of growth that may be seen as akin to biological growth. Importantly, form and function were inextricably linked with social practices that may be seen in a different way in Zevi’s definition of “organic”. A direct influence on this work may be seen in Adalberto Libera’s project for housing in the INA-Casa complex in Tiburtina, Rome (1950-54). Other variations may be seen in Libera’s housing for the Olympic Village in the Flaminio district of Rome (1957-60). There are also direct parallels in the work of Giancarlo de Carlo.
one may even say, fail. The XIV Milan Triennial of Design with the theme, “The Greater Number” (Il Grande Numero), was not only an exhibit, but an episode from its planning from 1966 on to the occupation of the exhibit on the day of its opening that embodied the crises of the period.
Chapter 7: Post 1965, The “Metaprogetto yes and no”604

The “metaproject”

The first twenty years after the end of World War II were initially marked by the urgent need to provide adequate housing for the rapidly growing and relocating population. Prevalent was an optimism about architecture’s capacity to address the needs of explosive population growth, and was a period in which urban planning and housing projects were pursued in earnest. Architects held the conviction that architecture did, in fact, matter and that applied expertise could make a difference in the lives of “the people.” But many of the architects were so focused on doing good that they were unaware of their unwitting complicity in the capitalist project from which architecture is inseparable. This blind spot towards the dangers of capitalism is rightfully called into question later in the 1960s in intellectual critiques, including Manfredo Tafuri’s “Per una critica dell’ideologia architettonica,” essay in Contropiano 1 of 1968, which later became the basis for his 1973 book, Progetto e utopia (Architecture and Utopia, 1976), as well as in political acts such as students’ and workers’ protests. This increasing unrest and the changing role of architecture was especially signaled in the occupation of the Milan Triennial in June 1968, among other events. The shift in focus was also signaled in changes in the magazine Casabella in the years 1965-70, when Gian Antonio Bernasconi was the editor. Building on Ernesto Nathan Rogers’s focus on housing and the changing status of architecture, the city-territory became a central topic under Bernasconi. The focus then shifted to the parallel concern of the necessity to industrialize building processes in order to meet such a large demand, and is indicated in Alessandro Mendini’s discussion of the “metaproject.” The

604 Alessandro Mendini, “Metaprogetto sì e no,” Casabella 333 (Feb. 1969): 4-15. The first page of this essay is a summary in English. The English translation of the title “The problem of building metadesign,” does not do justice to the title in Italian with more accurately reflects the positive and negative aspects of metadesign. A better title would be “Metadesign, yes and no,” which will be discussed.
“metaprogetto” was an idea based on the coordination of industrially-produced building components for housing, and was theorized in a series of articles in Casabella that were published from 1965-67. These became the basis for a much larger study by G. Mario Oliveri in his 1968 book, Prefabbricazione o metaprogetto edilizio (Prefabrication or the building (housing) metaproject) of.\textsuperscript{605} As Mendini summarized the “metaproject”:

The metaproject may be understood as a kind of logical analysis of architecture, for which the true and correct building language is prefaced by a sort of metalanguage…separating the metaproject from the architectural project and thinking of the metaproject as a principle of latent relationships and as a generative strategy that operates through such vehicles as modular coordination.

The building metaproject may be understood as a kind of overall framework in which industrialized building develops in time and space and an openness to possible programs that may develop in the process of their formation.

Without overly intellectualizing the discussion, a fundamental question regarding housing is this: how can one design a product-dwelling that is high quality but produced in extremely large number?\textsuperscript{606}

\textsuperscript{605} G. Mario Oliveri, Prefabbricazione o metaprogetto edilizio (Milano: Etas Kompass, 1968). This work built upon earlier studies by Giuseppe Ciribini, who wrote the Preface for Oliveri’s book but already had produced as series of books such as Giuseppe Ciribini, Architettura e industria, lineamenti di tecnica della produzione edilizia (Milano: Libreria Editrice Politecnica Tamburini, 1958) and Giuseppe Ciribini, Industrializzazione dell’edilizia (Bari: Dedalo, 1965) for example. For a political contextualization of the issue of the industrialization of housing after 1962 see Paolo Viola, “Il metaprogetto edilizio come politica di programmazione,” in G. Mario Oliveri, Prefabbricazione o metaprogetto edilizio (Milano: Etas Kompass, 1968), 169-72, and Alessandro Mendini, “Dallo stile al metaprogetto,” in G. Mario Oliveri, Prefabbricazione o metaprogetto edilizio (Milano: Etas Kompass, 1968): 173-5 in which he discussed open fabrication and the change from speaking about architectural style to the idea of “metadesign,” or the “metaproject.”

\textsuperscript{606} Alessandro Mendini, “Possibilità per il metaprogetto edilizia,” as an introduction to the essay “Possibilità per la fabbricazione aperta,” Casabella no. 325 (June, 1968): 38. “Il metaprogetto può essere inteso come una specie di analisi logica dell’architettura, per la quale il linguaggio edilizio vero e proprio viene preceduto da una sorta di metalinguaggio—indipendente dal primo e tuttavia con esso collegato a circuito—che ne codifica gli ambiti di validità. S’intravede la utilità e la possibilità di concepire e di staccare due modi di essere del progetto—‘metaprogetto’ e ‘progetto’—per raggiungere con il primo un vero e proprio principio di relazione organizzata; che da taluni è idicata
The idea of the building metaproject further linked the concept of the industrialized building to that of a system, invoking a language that directly confronted the concept of mass housing, providing both a theoretical, as well as a focused idea of its implementation. Rules were established, as is seen in the constant references to language and metalanguage. Norms were established for the modular building components, as were rules for their combinations. Tables (abbachi) of component parts would permit the parts to be combined in various ways, thus generating (norme di germinazione) form and producing singular buildings, which Mendini called the unicum. The most radical aspect of the idea of the metaproject is that of “componenting” as the generative principle. That is, the industrially produced component part is, in fact, the generative force, a part-to-whole relationship that destabilizes the idea of monumental architecture. Beyond that, the most interesting aspect is for the designer; establishing the generative rules (based on component elements) allows the “building

negli strumenti offerti dalla coordinazione modulare, da altri in più complesse relazioni di vincoli e di libertà. Si potrebbe dunque definire come ‘metaprogetto edilizio’ quella intelaiatura entro iconfini della quale l’edilizia industrializzata dipone, nel tempo e nello spazio, di possibilità programmate nel proprio formalizzarsi. Parlare di metaprogetto significa probabilmente riproporre nella sua primitiva sostanza—libero da sovrastrutture intellettualeistiche—il problema dell’edilizia, rispondendo alla seguente fondamentale domanda: come si progetta un prodotto-alloggio di alta qualità e di grandissima serie? Perseguire senza mezzi termini questi obiettivi vuol dire trasferire i ragionamenti dall’ambiguità del mito stilistico alla globale concretezza dell’oggetto-alloggio, ovvero da una architettura intesa come ‘a priori’ monumentale (con criterio prevalentemente motivazionale), ad una architettura intesa come risoluzione di problemi (con criterio prevalentemente operazionale); vuol dire in definitiva portare in modo lindo il tema ‘casa’ al centro di se stesso, dopo avere sedimentato le troppe incostazioni che provocano labirintiche deviazioni ed involuzioni degli obiettivi stessi. Per l’edilizia, la risoluzione ‘industriale’ coincide con quella dei problemi più pressanti dell’umanità; il metaprogetto potrebbe porsi, appunto in quanto struttura riproduttiva, quale proposta veramente operazionale di risoluzione diretta di uno fra i più urgenti bisogni del prossimo futuro.” [Translation mine]

organism” to have an organized growth, but one that is open and relatively free. Mendini acknowledged that these relatively conceptual avenues opened up the possibility of architecture cultivating new approaches that seem familiar in terms of contemporary architectural discourse. In Mendini’s words, the:

moment that one thinks beyond only designing and constructing the individual house, the metaproject undoubtedly provokes an evolutionary break and a complexity in the genetics of housing.

Paralleling ideas in computer programming, the metaproject was ironically first and foremost a “written project”—a virtual project—before becoming “many” designed projects. This way of thinking echoes the interest in serial art and programmed architecture that has been discussed in Chapter Four. Using the Nizzoli Associati project for the CECA competition as the key project in the discussing in the article “Metaprogetto sì e no” and “Possibilità per la fabbricazione aperta” ties together these figures with both their studio practice and their larger impact in architecture culture in the two book publications, and especially in Casabella.

Oliveri was a partner in the firm Nizzoli-Oliveri with Marcello Nizzoli from 1948-1963, collaborating on many projects for Olivetti in Ivrea. Between 1965 and 1971, Alessandro Mendini and Paolo Viola, among others, joined forces with Nizzoli and Oliveri as the Nizzoli Associati.

608 Ibid. “Una chiave per la traslazione in termini europei di questi precedenti crediamo possa trovarsi proprio più che nella concezione di ‘componenting’ (che è un effetto) in quella di ‘metaprogetto’ (che del componente è il principio generatore); ovvero in quella sorta di analisi logica dell’architettura industrializzata che da qualche tempo più o meno esplicitamente va delineandosi.”

609 Ibid. “Problema più interessante, più profondo e radicale, è allora per il progettista quello di definire ‘norme di germinazione’ che consentano agli organismi edilizi una cresciuta organizzata, ma aperta e relativamente libera (dal progettista che fa i prodotti si passa al progettista che escogita i metodi per fari i prodotti). Queste le intenzioni concettuali, che fra l’altro introducono nell’architettura l’interessante novità per la quale—dal momento che si supera la elaborazione di progetti singoli per ogni casa da costruire—il metaprogetto provoca indubbiamente uno scatto evolutivo e di complessità nella genetica edilizia.” [Translation mine].

Chapter 7: Post 1965, The “Metaprogetto yes and no”
During 1966-1967, the studio focused on the design of industrially produced component building parts in response to the CECA/Finsider competition’s call for steel housing. Notably, many figures who published articles in *Casabella* on prefabrication, new materials, and industrialized building systems were collaborators in this competition including the artists Davide Boriani, Gianni Colombo, Paolo Scheggi, Angelo Fronzoni, and the architects Enzo Frateili, and Mario Scheichenbauer. The centrality of this competition in terms of driving theoretical research into industrialized building systems is notable, with, for example, both of Oliveri’s books documenting this research and using their competition entries as case studies, in Mendini’s article “Metaprogetto sì e no,” and in the Enrico D. Bona’s article, “Possibilità per la fabbricazione aperta” (Possibility for open building) with an introduction by Mendini, in which Mendini ties the idea of open building or fabrication (with the industrialization of modularly coordinating component building parts) with the idea of the *metaprogetto edilizio* (building metaproject), as had been theorized by Oliveri.

The need for, and ambivalence towards technology and the industrialization of architecture and the building industry is indicated in the idea of the metaproject, yes and no. It was necessary to adopt advanced industrial techniques to be able to produce the required housing, but there was danger in embracing a technological and bureaucratic model uncritically. Again, the evolving debate in the architectural field may be followed within the pages of the magazines of the time. This is particularly evident in *Casabella*, under Gian Antonio Bernasconi’s editorship from 1965-1970, a period which has been termed in the special fiftieth anniversary issue of *Casabella* as having been governed by the “Idea of technique.”610 This points to the idea of the importance of technology and new modes of construction that received special focus in this time period.

Enormous changes were made to the editorial control of *Casabella-continuità* in the critical juncture of the mid-1960s. Ernesto Nathan Rogers, who had been the director of the magazine since 1953 was asked to step down in 1964 as a result of a serious disagreement with the editorial board. In his final editorial, entitled “Discontinuità o continuità,” Rogers spoke emotionally about what he felt the magazine had accomplished in its more than 100 issues that had been produced under his editorial leadership. His stance remained that, rather than dwelling in abstractions, the critical examination of real projects revealed the theoretical aspect of the work and the time in which it was made.  

This approach would soon change.

After several months during which the magazine suspended publication, Gian Antonio Bernasconi was appointed as the new director, as of issue 296 in August 1965. Bernasconi brought together an “operative” group that was already in place to work with him on *Casabella*. Marcello Nizzoli, with his associates G. Mario Oliveri and Alessandro Mendini developed a research group on “total design,” in 1964. This group also included graphic designer Angelo Fronzoni, artist Paolo Scheggi (whose work bears some similarity to Arte Programmata, and in particular to the work of Dadamaino, and who was an editor of *Marcatré* as of 1965), and art critic Germano Celant. The minimalist graphic style of Fronzoni was influenced by the magazine *ulm* of the Hochschule für Gestaltung, as well as Programmed art. In this way, architecture was aligned with the visual arts, and a new aesthetic was embraced, evident in the magazine’s content as well as in Fronzoni’s striking cover designs. This new team proposed to bring to the new *Casabella* a focus on industrialized building processes, something they thought was of current interest. This new team also understood, and enacted the

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value of “an organic work group.” Recent graduates from the Polytechnic of Milan, Carlo Guenzi, Franco Alberti, and Enrico Bona began work on the magazine in a more informal role.\textsuperscript{614}

The period of Bernasconi’s tenure as director has been maligned as a low point in the magazine, reflecting for some a less critical stance toward architecture, urbanism, and culture. It is often dismissed in favor of speaking about Roger’s \textit{Casabella-continuità}, the \textit{Casabella} of Mendini, and of the rise of Radical architecture after 1970.\textsuperscript{615} However, this understudied period is precisely what this dissertation is most invested in interrogating, bringing a critical lens to a period troubled by accusations of technophilia and of not being sufficiently critical.

An underlying critique was \textit{already} present in this phase of the magazine. Two principle areas of focus were undertaken in the five years under Bernasconi’s direction—one, clearly the role and advances in industrialized building; the other, the publication of industrialized building and urban design competitions, with theoretical articles on various topics and a survey of exhibits, conferences, books, and a review of current topics in other magazines. In addition, the discussion of various aspects of architectural pedagogy and events at schools of architecture were of interest, and included articles about university reform, didactic methodology, and even student work. After 1968, many articles documented the occupation of the schools of architecture and the debates that were occurring around crises in university policies.

By the mid-1960s, two areas of research dominated Italian architectural culture. One could trace its origin to Rogers and Samonà, and after this period, ushered in a renewed interest and focus on the historical reading (\textit{lettura storica}) of a project or intervention. Thus, a building was seen less in isolation, and more as a part of the historic fabric of the city. A second focus was on the processes

\textsuperscript{615} Micheli, “Le riviste italiane,” 127.
of construction, and looking at prefabrication as an instrument of rationalization and a means to contain costs. This was taken up in many articles in Casabella, and was extended to include discussions about the new dimension. References to the role of design as part of larger economic cycles were made, and pedagogical models like the Bauhaus and the HfG Ulm were applauded. But often, coverage of the technical aspects of construction were very dated, reductive, and overly simplistic due to lack of information. This situates Enzo Frateili’s rhapsodic discussion about the Ulm library in context. Faith in technology, and even in the expression of the building form focused on assembly procedures even in examples of buildings in which prefabrication and modularity was in fact very rudimentary on the ground in Italy. While there was an inherent contradiction in that many of the buildings published in Casabella were not produced with the advanced technological systems of construction possible, the fact that the magazine consistently looked to examples outside of Italy helped to bring Italy up to date technologically. That the country was delayed in respect to other European countries in becoming industrialized may have partly contributed to the critical discussion of movement toward industrialization and its negative effects on society, a discussion which came to the fore later in the decade.616

The Casabella of Bernasconi may be characterized by the affirmation that a project is always a rational one, tied to economic cycles and operative models of capitalist production, all echoes of the recent economic boom. The magazine looked outside of Italy, to Mitteleuropean, British, and American models of development, and especially to the work of the late 1950s in the British and Scandanavian contexts. Of note is the work and writings of Giovanni Klaus Koenig, who was the editor of the Casabella from 1965-1970 and the coverage of key “manuals” on prefabrication by Giuseppe Ciribini, G. Mario Oliveri, Enzo Frateili, and others. Many of the articles in Casabella examined intersections in philosophy, architecture, and art regarding arte programmata, seriality, and

the open work, as expressed in the architecture and design. The use of serially produced components and prefabrication pointed to complexity of the role of industrial design in relation to the artisan-made design in postwar Italy. The magazine also regularly featured projects that embodied an “applied rationalism” that had been the model at Ulm.

These inconsistencies have not gone unobserved. Giorgio Muratore critiqued the direction that the magazine had taken as representing “a neo-Keynsian positivism” which, in the final accounting, “was too sophisticated, mythic, and inexpressive and fell between the neo-avant garde position and new planning issues of the day.” For Muratore, this signaled what he termed a “new cultural dimension” in which technology had a significant impact on culture, both within, and beyond the physical design of the environment.

Overall, one can see in this period in Casabella the problem that was hiding in plain sight—that of conceiving the building process as a fully rationalized one that was yet flexible enough to adapt to various situations. Was this really possible? New materials and prefabrication are the focus of many essays, such as “Prefabbricazione aperta” (Open Prefabrication) and “Metaprogetto sì e no?”—which I will examine in detail—and the “Metadesign.” Andries van Onck, a designer associated with the HfG Ulm described “metadesign” as the study of the movement of elements within a system, or more precisely, an approach which establishes the rules by which the elements or components move in relationship to each other. Further, it is this that determines the various geometries of a work.

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The interest in modularity and complex form is also seen in various projects shown in *Casabella*, such as the Plastic pavilion and shell structures for the XIV Milan Triennale by Angelo Mangiarotti, the prefabricated systems designed by Renzo Piano, and other technological systems that triggered the shift to the urban dimension and building on the scale of the megastructure. This was also seen in *Casabella* in this period in the work of Nizzoli Associati, Bruno Morasutti, Leonardo Ricci, and Leonardo Savioli. Multiple articles by Mario Scheichenbauer detailed the new material of plastic for use in architecture, and ultimately shifted to the scale of the componentable interior and the microenvironment of Joe Colombo. Other articles published in *Casabella* in this period included those of Z.S. Makowski on three-dimensional space frame structures composed of simple elements and Piero Sartogo on university planning and urban planning as inspired by systems theory. These themes were developed in relation to a systems approach related to the issue of the Greater Number, with strategies developed in order to deal with the large population, the necessary housing, the complex space frame structures, and building systems: emphasizing *fabbricazione aperta*, the

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621 Ibid.
metaprogetto, and systems theory. The overall focus on the organization of large numbers of combinations of building elements and housing units was part of a larger technological development that was the beginning of the discussion of the emergence of computation for urban and building analysis and design. It was Alessandro Mendini who was the most concerned with these themes, even discussing system theory in the work of Christopher Alexander, or contributing an essay, “Dal progetto al metaprogetto” to a conference organized by Casabella in October 1968 on the theme of fabbricazione aperta and environmental design. In all, Mendini brought a focus on what was necessary in the process of making an architectural or urban work rather than on evaluating only the final result, thus also linking this focus to the idea of the open work or the interest in indeterminacy.

With the series of articles by G. Mario Oliveri between 1965 and 1967, examples of prefabrication systems that were current in various countries was developed. In another series of articles, Mario Scheichenbauer described in detail the use of plastic in building design. Angelo Mangiarotti and Renzo Piano’s work in prefabrication was highlighted, as well as were articles on R. Buckminster Fuller, Félix Candela, and Frei Otto (in connection with interest in Zodiac at a similar time period). The connection with the HfG Ulm was revealed by a didactic approach and research current at the German school, including in articles by Tómas Maldonado on environmental design, Herbert Ohl on industrialized building, and Abraham Moles on communication theory. There was also the

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622 Ibid. See also Alessandro Mendini, “Dal progetto al metaprogetto,” Casabella 330 (October, 1968).
623 Ibid., 331.
625 See for example Carlo Guenzi and Abraham A. Moles, “Invenzione nella macchina,” in Casabella no. 323 (Feb., 1968): 4-11. This essay was written on the occasion of the “Nuova tendenza 3” exhibit in Zagreb in 1965, ties together a discussion of arte programmatica, high volume serial production, the difference between a “complicated” and a “complex” structure, the irrationality of consumerism with a discussion of the use of code to produce a new aesthetic-artistic approach, hoping to link ideas of quantitative analysis, “rational” development has the capacity to bring
direct participation of Roberto Pane, Franco Borsi, and Giovanni Klaus Koenig who, as of July
1967, was vice director to Bernasconi, with Mendini becoming chief editor. The upheavals in 1968
in the general society, and in particular the student occupations of the various universities, the
closing of the HfG Ulm, and the occupation of the XIV Triennial of Milan were instrumental in the
changes in the magazine and the movement toward the Casabella that would be characteristic of
Mendini’s direction after 1970, but the themes and questions were already underway.626

The implicit philosophy or hypothetical construct of Mendini et al. was that technological advances
could be seen as operating as a dynamic system, one that could improve the environment if
understood as being in a holistic relationship with the natural environment and augmenting natural
systems. This could be accomplished by conceiving of the fabricated elements that constitute
architecture and infrastructure as being coordinated to be able to adapt to any new site or
circumstance. As I have discussed at various points, this idea of the programmed work or the open
work was the key to a flexible and responsive construction and, by extension, contributed to a new
aesthetic, one that I will term a “rationalized organic” or a “technological organic” approach in
which technologically constructed elements and environments emulated biological processes.
Cybernetics, system theory, and similar scientific approaches were extended to be able to view as
humanity nested within a living system. This lens was useful and necessary when seen in light of a

heterogeneous elements together to produce a new aesthetic theory to supplant theories of
traditional art. The article is illustrated with the Bruno Morassutto and Enzo Mari project for
“Programmed Architecture,” and other examples of arte programmata.

626 Baglione, Casabella 1928-2008, 330. While not the subject of this dissertation, future work will
include tracing Mendini’s transitional role from 1965-1970 and the underlying themes in his
directorship of Casabella from 1970-1979. See Muratore, “Tra ipotesi tecnologica e crisi della
progettazione,” 94. “L’imagination au pouvoir,’ nel corpo vivo della produzione, accentua una serie
di ambiguità formale e di contentuto.”
world view of population explosion, and as a way to deal with the idea of large numbers of people in a socially responsible, humane, and engaged manner.627

This way of thinking in the 1960s was related to what had become topics of intense interest, such as system theory, industrialization of component parts, componenting, kit-of-parts, and the possibility of recombining finite parts in nearly (or rather perceptibly) infinite variations. The issues of occupant-driven design, growth and change, and the industrialization of building components were part of the leitmotif of postwar prosperity. The crisis in housing (triggered by an exponentially growing population), framed by the idea of the open work and facilitated by new techniques of fabrication were explored in earnest, but there was a decisive turn away from this toward the end of the decade, and toward a new mistrust of systems of control. By the late 1960s, issues of ineffective housing and urban planning came to a head, and changed Italy irrevocably. As late as 1969, Mendini was calling for the necessity of industrialized processes of production for housing and other building, but he was already critical of an overly technocratic approach. Mendini repositioned Casabella to frame a critique of neo-positivism that was inherent in these logical and rational models of production and planning, and supported the avant garde, and the reframing of the project and expression in new artistic practices. Mendini is the figure who bridged this change as he became the director of Casabella in 1970, inaugurating a period that is better known as Casabella became a primary outlet for the work and words of the different young avant garde individuals and groups collectively known as the Italian radicals.

Mendini’s approach echoes many aspects already seen in the work of Yona Friedman (whose Scientific Autobiography was published in Casabella), and more pointedly, from a theoretical point of view and connection with a movement against centralized planning, as was seen in the critical

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627 On the other hand, seen as an obsession with technique.
writing of Tafuri and others in *Contropiano*, in other articles in *Angelus Novus, Op. Cit.*, or the more radically oriented magazines such as *Quaderni Rossi*. The intersection between architecture and politics was especially strong in the wake of the students’ and workers’ movements and occupations of 1968, which signaled a break with existing political and social structures and, as such, triggered a turbulent and fecund rupture in architecture culture that cannot be discussed at length here, but has been of great interest in scholarship over the past decade. The Bernasconi years, however much maligned, provide an important point of view on the implicit theoretical stance of the editors and works contained in the publication that provide an important critical lens to look at contemporary architecture. In turn, through the use of computation and computer-numerically-controlled fabrication this lens begs for another one with which to discuss work and praxis in a similarly technologically-oriented later period, a topic which will be discussed further in the “Conclusion.” It is important to note that Casabella, in particular, brought together the debate regarding technology, industrialization, and approaches to design at the territorial scale, harnessing technology for what was perceived at the time to be the only humane solution to very real national, international and global problems. In this light, citing a report by the Rome-based F.A.O. (Food and Agriculture Organization of the United Nations) which presented quantitative data of exploding populations around the world, contributing editor Alessandro Mendini signaled this shift in his essay of February 1969, “Metaprogetto sì e no” (“Metadesign yes and no”) by questioning the implications of the industrialization and modernization of the Italian peninsula from the point of view of housing and infrastructure, something that had already been of concern for some time.\(^{628}\) To take on this

\(^{628}\) Mendini does not cite the report that he had consulted, but in an Extract from the *United Nations Juridical Yearbook* of 1969 (http://legal.un.org/UNJuridicalYearbook/pdfs/english/ByVolume/1969/chpIII.pdf) one sees mention in Article 10 for the “provision for all, particularly persons in low-income groups and large families, of adequate housing and community services,” and in Article 18, “The adoption of measures to introduce, with the participation of the Government, low-cost housing programmes in both rural and urban areas. Some of the discussion of the time may be seen in a report of a few years
enormous task, Mendini asserted that architects must be prepared to investigate construction on an industrial scale. Drawing on images from various sources, Mendini argued that the metaprogetto (or metadesign) would permit housing to be manufactured through components because “freely joining the components in time and space guarantees the basic possibilities for a completely open construction system: distributional, productive, and expressive freedom.”

Mendini’s writing is significant to this dissertation because he discussed the approach—an organic approach—of building housing and other structures through accumulation of smaller units or component parts or cells, an approach which is prevalent in this period. For Mendini, the city was organic, as it grew from smaller parts into a complex organism. This seemed to bridge the perceived lack of a critical stance with regard to technology with the affirmation of the necessity of technological advances and industrialized architecture as the only way to solve the critical problems of housing, infrastructure, and urbanism. Most importantly, a project was no longer conceived of as an unicum, a singular building, but as a kind of growing organism that would develop in a responsive and responsible relationship with the environment. He also thought that the metaproject was a generative concept, that the structure could germinate, in an indirect manner and create infinite morphological solutions that would be diverse, while still being homogeneous. This article is also important as he is questioning the role of the technocrat and of the architect’s freedom to be able to use planning as a tool to resolve critical questions about inhabitation, something he would continue to develop in subsequent years as editor.


629 Mendini, 4. [Translation mine]
630 Ibid., 13. “Disporre di un metaprogetto significa strutturare norme capaci di germinare, in linea indiretta, infinite soluzioni morfologiche diverse ma omogenee.” [Translation mine]
The term “organic” is used frequently to denote growth in cities and other fabrications. The term “lo sviluppo organico,” or “organic development” is a crucial concept which points to the notion of organicity in the built environment, denoting the spatio-temporal evolution of form. An important concern at this time is the concept of the “metaprogetto” or the macrostructure, implying a dynamic order—what Mendini termed a principio germinativo. Thus, urban growth and the buildings within were seen as a continuum, a continuous fabric blurring the distinction between the building and the urban fabric itself. In this essay, he described the building/urban continuum as a “complex case,” and that “the ‘growing’ organism must respond to resolve interagent problems, render the growth in different parts homogeneously, and is tied together by the idea of the metaprogetto.” The idea of organic growth and the city as a continuously growing organism of built structures is a concept that challenges static ideas of the city, and has an overtly biological aspect. Mendini went further, and claimed that this kind of growth was an step in the “complexity of building genetics,” another concept that holds significant traction in contemporary architectural discourse.

Other important theoretical/practical works appear after 1965. Some are individual essays in Casabella, such as Enzo Frateili’s “Dibattito sul componenting,” and some are books compiled from a series of articles published in Casabella, such as G.M. Oliveri’s Prefabbricazione o metaprogetto edilizio (with a preface by Giuseppe Ciribini), which systematized building components and discussed and criticized an international roster of prefabricated systems. Giuseppe Ciribini, who had been assistant to Enrico Griffini, took the lead in decades-long investigations into modularity and

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631 Ibid., 8. [Translation mine]
632 Ibid., 12. [Translation mine]
633 G. Mario Oliveri was partner with Marcello Nizzoli from 1948-1963. Then from 1965-1971 become Nizzoli associati with Alessandro Mendini, Paolo Viola and others.
standards in building component systems.\textsuperscript{634} Ciribini had a long and prolific career, and published many important volumes and manuals regarding industrialized building and component systems. His *Metodi e strumenti logici per la progettazione architettonica* (Logical methods and techniques for architectural design) set up a series of logical notations to diagram the complex interplay of the various components and players in the design and execution of a building on a local, and a global scale, all set within a cybernetic understanding of regulation and control and feedback mechanisms in information theory.\textsuperscript{635} His *Organizzazione tecnica, impianto e meccanismi dei cantieri per l’edilizia*, (Technical organization, building systems and techniques for the building site) was more straightforward, and regarding job sites and methods, while *Introduzione alla Tecnologia del Design: Metodi e strumenti logici per la progettazione dell’ambiente costruito* (Introduction to the Technology of Design: Logical methods and techniques for the built environment) used information theory to discuss a systems approach to the design of an architecture of complexity and advocated for the use of cybernetics in the design of non-determinative, or open systems and communication and information in architectonic systems, privileging the dynamic over static systems. *Architettura e industria: lineamenti di tecnica della produzione edilizia* (Architecture and Industry: technical fundamentals for building production) was published in 1958; in this work, an early interest in system theory and building efficiencies is evident, and in it he highlighted the work of R. Buckminster Fuller work and, again, that of Konrad Wachsmann.

Continuing to present an interest in system and information theory is the important work on architecture and communication, *Architettura e Comunicazione* by Giovanni Klaus Koenig. There are also numerous texts by Pierluigi Spadolini that investigate prefabrication, especially in light of the enduring artisanal culture of design and fabrication, though he Spadolini is more sceptical than


\textsuperscript{635} Giuseppe Ciribini, “Metodi e strumenti logici per la progettazione architettonica” 92.
Mendini, who had an optimistic assessment of the metaproject.\textsuperscript{636} In addition, complementing the early work by Umberto Eco in writing about \textit{Arte Programmata}, the text \textit{La Sfida Elettronica} exhaustively examines the then most current advances in computation and design.\textsuperscript{637} In the article “Fabbricazione Aperta” that discussed the CECA competition (which is described in the next

\textsuperscript{636} Enzo Frateili, “Dibattito sul componenting,” in \textit{Casabella} 342 (Nov. 1969), 46. “Le relazione di Spadolini rispecchia invece un pensiero scettico—in dialettico contrast con le tesi di Mendini—riguardo soprattutto alla possibilità effettiva dei processi industrializzati di esaudire nell’intera loro gamma di complessità le esigenze postulate dall’architettura, soprattutto come richiesta di continua variazione dei modelli, che alla grande scala andrebbe poi adeguata alle esigenze della dinamica territoriale. Mentre la insufficienza in questo senso della prefabbricazione chiusa è abbastanza evidente, meno si può convenire sulle riserve mosse alla prefabbricazione aperta, nella quale la ‘fissità’ dei componenti per una certa durata, come condizione per la loro producibilità in serie non è fra l’altro contemporanea per tutti, ma segue la rotazione con cui avviene il ricambio (redesign) nel repertorio. Soprattutto ci si domanda se esiste e fino a qual punto la asserita azione condizionante su tale variabilità da parte dei tre parametri regolatori la industrializzazione per componenti, dal momento che la coordinazione modulare e la normalizzazione dei giunti, destinate ambedue alla generalità dei sistemi (e non condizionate ai singoli), vengono concepite secondo criteri di sufficiente flessibilità, onde assicurare ai componenti la massima componibilità ed intercambiabilità rispettivamente sul piano dimensionale e nella soluzione delle connessioni. Quanto poi alle tolleranze, la loro normativa, regolamentando l’esattezza di fabbricazione e di posizionamento degli elementi, non dovrebbe comunque impegnarne il design.”

\textsuperscript{637} Notable of Spadolini’s work is Pierlugi Spadolini, \textit{Componentabilità come composizione} (Firenze: Libreria Editrice Fiorentina, 1968), 54-55. He discusses the idea of an artisanally produced series of elements at the industrial design scale that are worked by hand or by machine with very limited variations, starting with a prototype before thinking of industrial production. He then discusses the limits of series, how few, or how many would be made, seeing that at the macroscopic scale, a factory would need to be tooled to produce that object. However, when the object is produced in massive numbers, its value diminishes, although the cost is lower and accessible to more individuals. “In relazione alla sua economicità è produzione di serie anche quella riferita ad un numero modesto di pezzi tutti uguali tra loro purché ne sia stato preventivamente studiato il limite di serie attivo. Concludendo il modello, la serie di studio ed i limiti di una serie sono stati così esaminati nelle loro definizioni e saranno usati in tutte le ricerche, gli esperimenti e le produzioni più tardi singolarmente descritte.” He continues on pp. 56-7 with an interesting discussion about the rapport between componentabilità and prefabrication of parts and the construction of these elements on site and discusses the incompatibility between completely closed systems of component parts which are easily brought together and those of industrially produced elements which are then introduced into artisanally made structures which utilize traditional modes of construction as masonry block and plaster which is traditional in the Italian context. He then on p. 58-9 discusses the idea of componibilità as an “abstract model,” that is useful for the composition of designs and has an application in the building field. “Si può così concludere attraverso tutti questi passaggi che la componibilità è direttamente collegata alla prefabbricazione e che tutte le esperienze di componibilità condotte in campi diversi possono servire da modello astratto e da studio per la utilizzazione e per la composizione degli elementi tale da dare risultati possibili anche nel campo edilizio.” [Emphasis in the original]
section) the discussion pointed to some of the research being undertaken at the HfG Ulm, where “a sufficiently small module would permit the connection (collegamento) between parts without a continuous solution.”\textsuperscript{638} This approach was especially exciting to architects of the time in that it pointed to an anti-hierarchical approach to design which would be a fitting solution to the politics of the time. In addition to the more theoretical aspect, the smaller module, with various rules as to its connections to make larger structures is highly adaptable in producing various solutions for disparate sites and for different types of structures. In a more critical light, Enzo Frateili questioned the larger implications of open fabrication (fabbricazione aperta) on the scale of territory, raising questions about labor and industry. This posed two alternatives and two different technical aspects of construction: that which is found in the factory shop, and the techniques on the construction site. The first implies a regional scale of production and distribution; the second, one that is necessarily more localized.\textsuperscript{639} The reality of the situation was more in line with what Spadolini had suggested—that there was a continued interface between the theory of the fully industrialized building as the notion


\textsuperscript{639} Enzo Frateili, “Dibattito sul componenting,” in \textit{Casabella} 342 (Nov. 1969,) 46. “Il discorso sulle fabbricazione aperta estesa alla scala territoriale implica anche la alternative fondamentale fra due tecniche di industrializzazione: quella di officina e quella di cantiere (la prima più congeniale con programmi di intervento continui e distribuiti sul territorio, e la seconda con programmi localizzati e in misura della loro entità). Ma ancora al di là di tale distinzione resta sempre la preferenza alla sede propria dell’industria come ottimale nei metodi e nel potenziale produttivi. In questo senso la soluzione del cantiere-industria caldeggiata da Spadolini, anche se in nome di una maggior libertà creativa per l’architetto, risulta evidentemente meno congeniale all’impiego della metodologia industriale: e con questo sempre meno compatibile nella misura in cui si voglia lasciare al progettista anche la sperimentazione di procedimenti prefabbricati o industrializzati che è più d’opera magari reinventati per ogni singolo episodio quasi strumenti introdotti con forma che sono destinati a produrre.” This article concludes with interesting comments by Frateili in regard to Spadolini who in general wrote about the industrially produced consumer object/product, wherein the end user would be in direct contact with the object, whereas in building, the individual component becomes subsumed and only part of the larger ensemble (un tutto), the building of which it is an integral part. This is an interesting way to analyze some of the contradictions at the XIV Triennale on the Greater Number in which serially produced consumer objects were presented alongside architecturally scaled projects somewhat indiscriminantly and probably provoking the large scale protest to the event.
of fabbricazione aperta and the local crafts tradition, something that had been part of Italy’s complex relationship with industrialization and architecture.

The immediate postwar period was marked by an extreme need for housing, and for efficient and economic methods of building. In order to address the immediate crisis following 1945, the United Nations Rehabilitation and Reconstruction Act (UNRRA) was developed to address a wide range of needs in Europe. In Italy, a branch was formed to address emergency housing for the displaced or the homeless. Named the UNRRA-Casas, this international agency was established to coordinate aid funds to build emergency housing units for homeless citizens throughout Italy, though it was supplanted in 1954 by other state-sponsored housing programs, such as the Istituti Autonomi per le case popolari (IACP) (founded in the 1930s) and by insurance agencies such as the INA-Casas program (1947-54). On the European scale, the U.S. sponsored Marshall Plan or the European Reconstruction Program (ERP) was instrumental in the initial rebuilding of Italy, both in terms of incentives for industrial development, and in the provision of housing programs after the immediate crisis starting in 1948. Marshall Plan funds and the transfer of technological methods, management methods, and business strategies were critical to the development and expansion of the steel industry in Italy. Finsider, the state-owned steel industry developed as a result of the direct transfer of funds and knowledge facilitated through the Marshall Plan. The steel plant that was built in the 1950s at Cornigliano, near Genoa was the direct result of these incentives, and many other public and private sectors were also inspired by a “neo-capitalist” ideology.640

Central to the postwar recovery and future building programs were other inter-European programs such as the Shuman Plan, a treaty ratified in 1951 which coordinated the steel and coal industries in

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the European member nations. It was proposed by French foreign minister, Robert Schuman that a single authority/member control and monitor the production of steel and the coordination of coal and other raw materials needed for the production of steel, which were seen as critical materials in postwar development. This plan, otherwise known as the CECA (Comunità Europea del Carbone e dell’Acciaio), or the ECSE in English (the European Coal and Steel Community) was formed as an alliance of European industrialized countries, notably bringing ex-combatant Germany into an alliance with Italy, France, England and the Benelux countries. Coal and other energy sources were monitored by a centralized agency. This was essential to allow for the distribution of energy sources to the member countries—which would enable reconstruction projects and the development of an European industrial base—and was also intended to form a cooperative alliance between former enemies. On March 25, 1957 two other important pan-European agreements were signed: the European Economic Community (Comunità Economica Europea) and the European Community on Atomic Energy (Euratom).

Such extra-Italian agencies spurred the industrial development of the peninsula and encouraged the proliferation of large scale competitions calls which seemed to be similar to the complex combination of concepts and industrially-produced architecture that was represented by the “metaprogetto.” One could assert that agencies with sponsored competitions at the national and international levels, which had, until recently, operated at the regional levels were fueled by a kind of “meta-level” of funding. The “metaprogetto” had a logic which was tied to larger systems of exchange and investment, and the need for mass housing was, in fact, tied to the massive industrial

projects. Competitions for housing, infrastructure, and industrial facilities were the logical extensions of this complex interplay of economics and production.

Three competitions in which Rinaldo Semino participated were key competitions that revealed the importance of the “metaprogetto” at work. The first, the CECA (European Coal and Steel Community) competition for housing constructed at the industrial scale of 1966-67 called for a variety of housing typologies to be developed from industrially produced building components. This competition, like some of those in the previous chapter, considered the development at the neighborhood scale. Unlike earlier competitions, the housing was not to be seen in situ, but as a system first and foremost, emphasizing the idea of the interchangeability of the parts, and how seemingly infinite variations on the housing type might be produced from a singular system. The second was the 1967 Finsider-sponsored competition for a container port complex in Genoa’s harbor. This competition was tied directly into the larger economic questions of steel production, international shipping and distribution within Europe, and connection to nearby Cornigliano. It is also, not coincidentally, a singular project on an industrial scale which began to operate truly on the scale of territory, or even on a geological scale.

The third, and final case study is the 1969 ideas project sponsored by the State railway system (the Ferrovia dello Stato) and the national highway authority (ANAS, formerly an acronym for the Azienda Nationale Autonoma delle Strade, or the National Autonomous Roads Agency). This project called for a bridge to provide a permanent link over the Strait of Messina and rail and road connections between mainland Italy and the island of Sicily. This project, especially as designed by Semino is truly an example of the “metaprogetto” as it was intended, in this case, to be constructed of industrially-produced modular elements which would act together as a whole and operate as a macrostructure on the scale of territory. Semino picked up on the ideas that had been converging at
this particular moment in time. His project, by using scalar changes in the prefabricated steel and concrete elements, resisted the homogeneity that is inherent in modular construction. Described by him as “operated as sea ice,” the project also looks as if it were the patterning of scales on a snake or reptile, an evocative organic form that would, in fact, be constructed of industrially made elements: an alternate organic.

**CECA (European Coal and Steel Community) competition for housing constructed at the industrial scale, 1966-67**

In 1965, CECA (the European Coal and Steel Community/Alta Autorità della Comunità Europea del Carbone e dell’Acciaio) sponsored an international competition that asked European designers to consider the use of industrially produced steel in a prototypical housing scheme for a family unit of five people, specifically two parents, two children and another adult. The guidelines were quite open, with the requirement that minimally, the structure, the ceiling, and the windows and doors must be designed in steel. The site was open as well, but competitors were to clarify their design as appropriate to the climate in a specific location in one of the European member countries of the
CECA. The competitors were required to design a light structure made of prefabricated elements for different typologies. All were asked to begin with a certain number of fixed base elements to arrive at an apartment unit that, when combined with variations of certain elements such as roofs of different shapes, balconies, and loggias, led to the following housing types: a free-standing single family house, single family rowhouses, a two-story building for four families, and a building for multiple families, configured in multiple stories. The competitors were required to design a standard prefabricated kitchen and bathroom as well as the stairs and the foundation system, and were also asked to design the light (meaning steel) elements such as trusses, balconies and the like. All parts of the building were to be factory made, and consideration had to be given to transportation to the site. The brief also stipulated that the serial production would be for at least 10,000 units annually, to be done by using the same base elements in each configuration. All the elements used were required to be fabricated in a large series. The goal was to satisfy the requirements by combining the various base elements and the accessory elements to be able to offer the housing on the commercial market.

This is no longer a state-sponsored housing program as had been seen in the immediate postwar period. CECA goes so far as to say that all the materials for construction needed to be produced in large factories, explicitly forbidding the use of any singular artisan-made elements. Using the idea of combinations of the base pieces, the design solutions were required to demonstrate maximum flexibility and variety possible using the standardized elements. Finally, architects were required to collaborate with engineers and an industry partner in the development and final presentation of their project. In his article in Casabella, “Possibilità per la fabbricazione aperta” (for which Alessandro Mendini wrote the introduction) discussing the “metaprogetto edilizia,” Enrico D. Bona detailed the

643 Competition brief pamphlet for the Concorso Internazionale organizzato dall’Alta Autorità della Comunità Europea del Carbone e dell’Acciaio, Per un Progetto di una unità d’abitazione fabbricata su scala industriale, (Regolamento del Concorso pubblicato sulla Gazzetta Ufficiale delle Comunità Europee, n. 163 (4 ottobre 1965), 1.

644 Ibid., 2.
requirements of the competition, recounting the specificities of the competition brief. In addition, he
discussed some of the theoretical aspects that were inherent in the competition—including that of
producing industrial building products that would be interchangeable between the European
countries. The fact that the competitors were required to ensure that the housing elements should be
developed so that various sizes and scales of housing could be constructed is also in line with the
concept of the “metaproject.” Another inherent aspect of the idea of an interchangeable, open set of
construction elements (the open fabrication or fabbricazione aperta) is that the relationship of the
component elements permits them to be assembled in increasingly large, macrostructural projects.
This is, in Nizzoli Associati’s assessment of the project, an example of the practical application of
theory. Associati goes so far as to say that this project is key to address the unrelenting need for
housing in the immediate future:

        Without a doubt this is the road that needs to be taken in the immediate future, invaded by
diverse categories of the “greater number,” to find open solutions that are integrated with
the various essential aspects of reality, but evading the equivocal tecnocratic abyss in which
the jury had fallen. The jury, had for all intents and purposes
selected projects which only
approximately proposed the real possibilities of steel in the European common market.645

Tellingly, the Nizzoli Associati project was not selected as one of the ten projects selected to move
on to the second phase of the competition. De Bona dutifully (and as a point of comparison)
published the winning schemes, but also included seven projects that were not selected but, in his
estimation, had engaged the competition brief fully. As such, the Nizzoli Associati project was
deemed to be an exemplary study of open fabrication, and an example of the political possibilities of
the “metaprogetto.”

645 Enrico D. Bona, “Possibilità per la fabbricazione aperta: Le indicazioni che si possono trarre dai
Figure 160 Nizzoli Associati project for the CECA competition in Enrico D. Bona, “Possibilità per la fabbricazione aperta: Le indicazioni che si possono trarre dai risultati del concorso indetto dalla Ceca,” in *Casabella* no. 325 (1968): 46-7.

Rinaldo Semino also did not place in the competition (his project was certainly not as developed as the Nizzoli Associati project); nor was he successful in addressing the requirements of the competition. However, Semino’s project offers a challenge to the legibility of the systems used in some of the winning schemes. His project was highly abstract, and while not yet approaching a resolved building scheme, raised questions of how one would determine a boundary condition in an aggregative system that is composed of multiple self-similar elements: both a practical and a theoretical question of importance. In the following drawings, the plan does not indicate the interior configuration of the apartments, but is a study in the hexagonal arrangement of the smaller cup-shaped deep-drawn steel elements that are connected top to bottom to create a lightweight floor “slab,” with the edge at the open side of the unit. Glass is held in place in a groove in the steel; presumably, this would be sealed with some kind of elastic membrane.

The habitable space is created by two very large inverted cup-shaped elements (the fabrication of which from a single sheet of steel Semino had, and has still not resolved).

Figure 162 Left: Rinaldo Semino, IN/Arch Finsider competition in *Zodiac* 22, (1973): 154-5. Right: Photo of model by Rinaldo Semino by author, 2008.
Semino proposed using his base tetrahedral image to provide overall structure. He arranged the units into larger hexagonal groups which would allow for vertical strength and the potential to occupy the flat top of the unit. In this cluster of images we see a plan view and its correlation to the section, and two details of the construction in section. Courtesy of Rinaldo Semino.

We can see in the second set of drawings that he did, in fact, anticipate this problem and in the section in the upper right, has shown that the larger curved surfaces would be made up of smaller units, distended and of varying shapes to conform to the overall, larger surface.
Figure 165 Rinaldo Semino In/Arch competition test model, c. 1965. Scale model of the accretion of the individual tetrahedral units. The test was conducted in the mid1960s at the University of Genoa. The experiment was to test the strength of the composite structure. Scan of original photograph. Original model destroyed. Courtesy of Rinaldo Semino.

While his entry to the competition fell woefully short of the very rigorous program requirements, it is an important project in that he began to study the base unit for which he received third place in the 1965 In/Arch steel component competition, and began to think of the individual unit—that which Mendini had thought central to the idea of the “metaprogetto”—as part of a larger system, able to be adopted on various scales and to conform to various shapes rather than when the boundary of the triangular elements would be irregular, as in shown in his scale model above.

The Steel Industry in Postwar Italy: Italsider and Konrad Wachsmann’s plan for the Port of Genoa

As has been discussed, the European Recovery Plan (also commonly known as the United States Marshall Plan) was a conscious political vehicle of “cultural economy” which changed the face of industry and society in postwar Europe. The Marshall Plan was particular in relation to Italy, and required a mass program of outreach to reach the average Italian, using “every method possible […]"
to reach Giuseppe in the factory and Giovanni in the fields. As part of economic development in postwar Italy, enormous steel manufacturing plants were established in Savona and other Ligurian port cities, and in other locations in central and northern Italy such as at Terni in Umbria, or at Senigallia, on the Adriatic coast.

Finsider, the state agency for steel production in Italy, was founded in 1933 to take over the direction of many of the ailing privately-held plants, and by 1937, held more than 50% of the industry. Finsider applied for, and received an ERP loan in 1951 and remodeled itself on the American model of corporate organization and production. This included direct, hands-on training of Italian managers in plants in the U.S. regarding technological aspects of techniques for milling, and extensive reorganization of management culture, industrial relations, business strategies and organization. In 1961, Finsider created Ital sider in order to bring all of the steel plants together in one company that would then be a part of the state-owned Finsider. Additional plants were

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647 Ruggero Ranieri, “Learning from America,” The remodeling of Italy’s public-sector steel industry in the 1950s and 1960s,” in Matthias Kipping and Ove Bjarnar (eds.) The Americanisation of European business: the Marshall Plan and the transfer of US management models (London; New York: Routledge, 1998) 212. See also Paride Rugafiori, “I gruppi dirigenti della siderurgia ‘pubblica’ tra gli anni Trenta e gli anni Sessanta,” in Franco Bonelli, ed. Acciaio per L’Industrializzazione: Contributi allo studio del problema siderurgico italiano (Torino: Giulio Einaudi, editore s.p.a., 1982), 346-348, 359-365. Margherita Balconi, La siderurgia italiana (1945-1990). Tra controllo pubblico ed incentivi del mercato (Bologna: Il Mulino, 1991). Gian Lupo Osti conversazioni con Ruggero Ranieri, L’industria di Stato dall’assesta al potere. Trent’anni nel gruppo Finsider (Bologna: Il Mulino, 1993). The local was harnessed to the vision of the global and the U.S. vision to “rebuild” Europe was multilayered...there was a different agenda to Allied and Axis powers and Italy in its later shift into the Allied was to receive its rewards. But as a Mediterranean country with little or no energy resources it was an interesting story. Already from the CECA competition we see the organization forming to pull together a notion of an allied Europe as political agent and economic forum. Goods and trade made these inter-national, (yet Continental ) issues transgress boundaries. However, even within the nascent state or Republic structure of Italy, the Marshall Plan revealed extraordinary rifts and boundaries between north and south, public and private, rural and urban questions.

648 Ranieri, 212.
promoted, including the enormous plant at Taranto in the southern region of Puglia, built between 1960-64 and an essential component of Italsider.\textsuperscript{649} Given the desire for more centralization of the steel industry, Konrad Wachsmann was approached in 1961 to design the headquarters for Italsider, which took over the operations of all the steel plants from Finsider (which would remain in Rome and be the financial arm of the national steel industry). Genoa was chosen as the location for the headquarters, anchored as it is near the largest, and most profitable plants at Conigliano, which was built and organized with Marshall Plan Funds in 1951.\textsuperscript{650} Wachsmann, already familiar with Italy, was chosen by the Italian Steel manufacturer Italsider S.p.A. to design a fully prefabricated office tower to rise at the edge of the historic center of Genoa at the port. Wachsmann accepted this commission, and produced a novel response to the request for a housing tower that was to rise at least 40 stories above the port.

Wachsmann, in residence at the Hochschule für Gestaltung (HfG) Ulm in the late 1950s, had created, with his colleagues and students, a critical testing ground for modularity in architecture and a deep study of manufactured components that would be brought together to make “Industrialized Buildings.” As such, he was the logical choice to design this project. While many architects in the same time period used techniques of seriality and permutation in the design process, Wachsmann was uniquely qualified to apply rational strategy of industrially-produced component parts to create the larger structures required for the project in Genoa.\textsuperscript{651}

This enormous commission for an urban plan and harbor development for Genoa included the headquarters for Italsider that was to be 40-50 stories, with parking for 3,000 cars. Because Genoa is

\textsuperscript{649} Ibid., 213.
\textsuperscript{650} Ibid., 213.
\textsuperscript{651} Rinaldo Semino, a young architectural student in Genova at the time, was inspired by Wachsmann’s work and that of the HfG Ulm. His access to the magazine \textit{Ulm} was influential in his own work on prefabricated steel elements, and the design of joints, many of which he developed in model prototypes.
the major port for the industrial triangle of Turin, Genoa, and Milan, site of a major international airport, and a major hub on the railway that connects Rome-Pisa-Genoa-Nice and north to Milan and Switzerland, the proposal for the building was only the beginning of larger infrastructural plans. Other aspects of the evolving plan for the harbor and city included a tunnel underneath the harbor connecting the north and south portions of the city, a train station, a bus station, a new port structure with piers, and a heliport on multiple levels, connecting at its upper level to the city which rises rapidly above the harborfront.

For the design of the skyscraper, Wachsmann proposed that the building be composed of three identical sections which would be partly fabricated in the nearby steel plant in Cornigliano/Savona and then brought by water to the construction site at the edge of the harbor. The middle section of the building was to house executives and other directors of Italsider. The lower floor would house a computer center. The upper levels would house the enormous archive of the company, and the portion closest to the city would be for employees. Wachsmann embraced this challenge with a singular focus, and saw in the project the possibility of synthesizing every aspect of his research thus far. He stated in his autobiography:

> Every conceivable problem, which I think determines the function and form of spatial organisms, was an essential part of this project.

> The site was located directly at the harbor front on one side and at the edge of the inner center of town on the other side. It appeared that the building itself was only a fraction of the whole task and there was no question that all traffic arteries of the old town would be affected. Genoa is squeezed in between a mountain chain and the Mediterranean shore. There is no open space. All the streets are much too narrow and if any project of the magnitude of this building were to be built, it had to affect the equilibrium of the whole city. Therefore, it became a problem of city planning, involving the existing modes of traffic and

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the issue became more complex than simply the development of a building system at this point. Furthermore, in its location so close to the harbor, it would doubtlessly require a complete re-evaluation of the harbor installation.

If the container shipping, passenger traffic, airport and railroad facilities and superhighways were to be incorporated, the true center of gravity of this project was not so much the building but what was around the building. 653


Figure 168 Paolo Portoghesi and Filippo Lagomaggiore, “Nuovo porto per Genova di Wachsmann: Uno spunto per dibattito,” in *Marcatré* (1965): 267.
The project did not gain approval, in part because of the split between two authorities—those of the city of Genoa and a separate harbor governmental authority—and in part because it was constrained by the Institute of Fine Arts, which had been opposed to any highrise, modern building. In addition, Italian law mandates that all original correspondence and documents regarding any public or private agency be maintained in original, and not in microfilm form. This initially created the need for an enormous structure in Genoa, which then became superceded when a law was passed that required documents regarding national agencies be stored centrally in Rome. Of these developments, Wachsmann wrote, “This gave me enough time to finish the model of the harbor project for Genoa. Although Italsider at the moment was not interested anymore in any further development, I had to continue the work on the design of the harbor area. I was certain this had to be done.”

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655 Ibid., 216.
Journalist Eugenio Carmi wrote in his article, “Einstein’s Architect who Genoa Refused” of Wachsmann’s toils:

…Konrad worked day after day at this model which comprised a new asset of the harbor, conceived for the future development of a new and modern city, projected into the ocean. But the provincialism had the upper hand and one day he said ‘thank you’ and ‘basta’, it does not serve anything.…

This story both conveys a sense of Wachsmann’s conviction in the importance of his building systems, and reveals a fascinating use of his terms, describing a building system and a corporate entity as an “organism.” With the future of its development remaining highly indeterminate, Wachsmann advocated for the use of a (his really) building system that would permit the greatest possible flexibility, “so much that practically the whole building in part or as a whole could adapt itself to any new condition.” The theme of flexibility, indeterminacy, and the relationship of whole to part are dominant in his work. This was echoed in the article, “Nuovo porto per Genova di Wachsmann: Uno spunto per dibattito” published in Marcatré in 1965, emphasizing the dynamic and open concept of Wachsmann’s project which, rather than focusing on an individual building, was conceived of as an evolving and open system.

However, the project had the possibility to be more in keeping with its context than was presented. According to this plan, all parts of the project were to be constructed of component elements, and rather than using these to develop a flexible structure, or urban fabric (tissue), the piers and building were to be rigid and did not conform to the shape of the harbor. Further, the circular heliport placed on the central axis of the plan reinforced a retrograde use of symmetry and classical hierarchy. The project could have learned from, and expressed much more of what was seen in the adjacent urban

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657 Wachsmann, Timeline, 213.
fabric with its variations and asymmetries.\(^{658}\) While Wachsmann’s project was never developed, and the Italsider headquarters moved to Rome in 1964, the larger infrastructural and transportation issues that had been identified as corollary aspects of the original Italsider office building project still needed to be addressed. Genoa remained the main commercial port for northern Italy, and rail, road, and sea connections still needed to be addressed in any future development of the city.

**InArch/Finsider Genoa Port Container competition, 1967**

In 1967, a competition was announced to address the design of harbor structures for the port of Genoa, specifically calling for a Container port transfer structure. Rinaldo Semino’s project for the competition used a repetitive steel construction element to produce a landscape-scale shipping container transfer project. Consistent with his emphasis on the construction system, the details for the project are well-worked out, but the drawings that describe the overall project were quite abstract, and did not give an adequate description of the project. Despite this drawback, Semino’s verbal description of the project in *Zodiac* 22 clarified his interests in his scheme. This project was clearly a megastructure, and we see Semino continue this study in a more clearly articulated manner in his proposal for a bridge over the Strait of Messina.

\(^{658}\) Paolo Portoghesi and Filippo Lagomaggiore, “Nuovo porto per Genova di Wachsmann: Uno spunto per dibattito,” in *Marcatré* (1965): 260-1. See the next issue, *Marcatré* 14/15 (1965) for further discussion on this project. At the end of this article (pages 268-9) there are four questions that sought to spark a debate that would be published in the following issue: 1. Do you think that the study of new 3-dimensional structures may contribute to the development of spatial hypotheses for a new configuration of the modern city?; 2. In the example of Genoa, the editors have suggested that there is a classical aspect of the project (symmetrical arrangements of elements, a certain monumentality. Do you see a limit in the technical possibilities of this project or how it frames a spatial vision of the designer.; 3. Do you think that the recent hypotheses proposed by new structures are adaptable to an organic conception of architecture that takes into account psychological, social, and environmental aspects?; 4. Do you believe that the divorce between and juxtaposition of architecture and engineering is destined to perpetually repeat over time? Do you think that the ability to calculate new and experimental structures can bring about a progressive integration of design?
Figure 170 Left: Rinaldo Semino, IN/Arch Finsider competition for Genoa container port in *Zodiac* 22, (1973): 152-3. Right: Photo of model by Rinaldo Semino taken by author, 2008. Courtesy of Rinaldo Semino.

Figure 171 Rinaldo Semino, “Concorso InArch/Finsider Piastra Porta-Containers nel Porto di Genova,” in *Zodiac* 22 (1973): 152-3. Left: Plan view of the container port in relation to the scale of the city and the connecting roadways. Right: Section through the three layers of the container port transfer structure.

Semino’s project was composed of a series of levels that are suspended above the water of the harbor so as to permit container ships to pass underneath the structure and unload containers at the first level, 30 meters above the water level. The ships could load and unload while being partly covered by the platforms above. As is notable in these two drawings, which are the only representations of the larger scale functions of this massive project, Semino imagined that the first level, at 30 meters above sea level, would have rail connections; at 40 meters above sea level would be a level that would be used to store the containers; at 50 meters above sea level, tractor-trailers
would pick up the containers; and at 60 meters above sea level, automatic bridge cranes would be housed to move the containers. Semino did not even indicate a container or container ship in these sketches which is a missed opportunity, as conceptually, this is a very interesting project. Instead, he (very much like Wachsmann) obsessed over the details of the prefabricated system of component parts.

Figure 172 Rinaldo Semino, “Concorso InArch/Finsider Piastra Porta-Containers nel Porto di Genova,” in Zodiac 22 (1973): 152-3.

The base element, he described, is a tetrahedral shape that is composed of two deep-drawn metal sheets that are bolted together and welded closed on all its edges to make a double-walled surface. With these elements, it was possible to construct flat and curved surfaces and macrostructurally scaled projects such as the container port project.

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Semino then included a number of drawings of how the component elements might be combined to make larger structures. He used what he termed a *cellular tissue or fabric* that would have a similar morphology at the scale of the individual unit as that of the whole project. He adopted the use of tetrahedral building elements that were connected at their corners and allowed for an open structure, flexible enough to accommodate the various programs.\(^{660}\)

In this project, ecological repercussions of industrialization were addressed. Genoa is in the region of Liguria, where the Maritime Alps meet the Mediterranean sea, and where the lack of flat land inhibits industrial development. Semino’s project proposed a new “industrial landmass” so as to not corrupt the flat valleys with industrial buildings. His was a novel scheme for a multistory container port that would utilize multiple levels in order to maintain a compact footprint in an area with very little flat land. In this project, Semino used his characteristic steel unit combined in aggregate forms

\(^{660}\) Semino, *Zodiac*, 152.
to produce a large scale complex. This mode of constructing form diminished the emphasis on the overall form as the individual units began to adapt to the shape of the harbor. The project, though unfortunately not developed, had the ability to develop a complex relationship with the environment, responsive to the mountainous terrain by providing connections at multiple levels to the city’s infrastructural systems as well as extending over the harbor. Semino might have pushed the project further in seeing it as a new organism, an open system, responsive to, and in a symbiotic relationship with the environment. The use of the project as both a port, and a docking structure and potential breakwater could have enabled a dual reading of the project as building and as landscape. In placing the multiple piles to support the prefabricated steel elements that comprise the structure, he could have created an underwater support system that could have created a change in the habitat of fish and coral colonies, mitigating the negative environmental impact of such an enormous structure. This project invites comparison to two theoretical projects of the early 1960s, Kisho Kurokawa’s Agricultural City and Le Corbusier’s Venice Hospital, both of which utilized the concept of a mat building as an efficient horizontal distributive spatial model. This project is clearly a megastructure, and we see Semino continue this study in a more clearly articulated manner in his proposal for a bridge over the Strait of Messina.

**Bridging the Strait: between Scylla and Charbydis ANAS competition, 1969 for a rail and road link between continental Italy and Sicily.**

On one side beetling cliffs shoot up, and against them pound the huge roaring breakers of blue-eyed Amphitrite—
On the other side loom two enormous crags…
one thrusts into the vaulting sky its jagged peak,
hooded round with a dark cloud that never leaves—
The other crag is lower—you will see, Odysseus—
though both lie side-by-side, an arrow-shot apart.
Atop it a great fig-tree rises, shaggy with leaves,
beneath it awesome Charybdis gulps the dark water down.
Three times a day she vomits it up, three times she gulps it down,
that terror! Don’t be there when the whirlpool swallows down—
not even the earthquake god could save you from disaster.
No, hug Scylla’s crag—sail on past her—top speed!
Better by far to lose six men and keep your ship
than lose your entire crew.  

From ancient times, the Strait of Messina has been a mythical and dangerous place of passage.

Between a rock cave hiding Scylla—a twelve-handed, six headed monster—and the gaping maw of the endless whirlpool that is Charbydis, the Strait is a “place” evocative of only what it is not: in between the rock and a hard place, between the continent and Sicily, always a place of passage. Over the last 30 years, the Italian government has dreamt of spanning the Strait of Messina with a single span bridge. To give some background to this project: an international design competition was held in 1969, and while none of the projects selected were to be built, in 1971, legislation promoting the construction of the bridge was approved. However, true progress in terms of the design and execution of the bridge was never made.

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Figure 174 Strait of Messina – Satellite image

There has always been difficulty and a lack of communication and consensus regarding this project. The controversial project has been on the drawing board since the 1960s, and has been criticized

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because it would be a waste of public money in Italy, where public spending is already overstretched. Financial, environmental, seismic, wind, and other problems has stalled the process. Rather than being about a question of the feasibility of the bridge in terms of engineering prowess, which had been the focus of the prior thirty years of design, the recent criticism of the bridge is based more upon the inability of the project to resolve chronic problems in the southern regions of Italy, the mezzogiorno. Southern areas of Italy are marked by critical water shortages, inefficient health services, and inadequate public infrastructure. The bridge would have trumped local planning and investment in order to allocate funds for its construction, and local road and infrastructural projects would have had to be abandoned. This would pose an enormous problem, as most of the design and funding allocated for the bridge focused on the single span itself, and not the requisite (and non-existent) connecting roads and tunnels that would be necessary to connect the bridge to the adjacent state highways on both the mainland and Sicily. The impact of these connecting structures has never been adequately addressed, nor has there been an equal measure of design of these elements, which would run directly through, and above the existing towns on either side of the Strait. Further, sufficient funding has not been secured. These structures, in all of the proposed views of the bridge, look misleadingly minimal next to the majesty of the bridge itself, but are enormous in relation to their surroundings. And we can question the hubris with which a project like this is pursued. How critical is it to local conditions to have the tallest tower, the longest tunnel, or the longest single span bridge? These questions were not of primary importance, however, at the time that the competition call was announced in 1969.
On May 28, 1968, ANAS S.p.A. and the Ferrovie dello Stato opened an international competition for a stable road and rail connection between Sicily and the mainland. 143 teams participated in the competition, with only 85 projects following the guidelines established by the competition. Of these, 45 proposed suspension bridges with one or more spans, 19 proposed tunnels, and the other 12 proposed various solutions from dams, isthmuses, floating bridges etc. The jury met in November of 1970, and selected 6 first prize projects, 6 second prize projects, and a premio ex aequo for the best project for each typology.

For a single span project, engineer Sergio Musmeci’s group won; for three spans, the Ponte Messina company; for a bridge of fours spans, the group lead by Montuori was selected; and for five spans, the company Technital. Of these projects, the First and Second prize winners proposed single-span bridges. Sergio Musmeci placed first, and Pier Luigi Nervi second. The choice of a single span was not coincidental, as the proposed single span bridge would be the largest in the world. Controversially, however, it would rise in an area with high seismic activity and heavy winds. Long span bridges are susceptible to oscillations initiated by wind which then can be magnified by the internal periodic motion waves in the structure itself. These bridge projects countered this potential problem by calculating the material in such a way as to dampen the oscillatory effects.

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662 A.N.A.S., The State Highway Authority, (Ente nazionale per le strade) and the Ferrovia dello Stato (The State Railway authority sponsored the 1969 “Concorso internazionale di idée per un attraversamento stabile viario e ferroviario fra la Sicilia ed il Continente.”
Figure 175 Sergio Musmeci’s design for the Bridge for the Strait of Messina, 1969-70. In Manfredi Nicoletti, *Sergio Musmeci: Organicità di forme e forze nello spazio*. 1999), 42.

Musmeci’s winning scheme is notable, acting almost as a spinal column in that a complex tensile structure in which cables in tension suspend the rigid elements of the road and bed with a total span between the four main 603 meter high pilons at a full 3,000 meters. As Manfredi Nicoletti described the project, “What results is a tensile structure (*tensostruttura*) giving a double effect that expands in space around the rigid three-dimensional form.”

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663 Manfredi Nicoletti, *Sergio Musmeci: Organicità di forme e forze nello spazio*. 1999), 40. “Ne risulta una *tensostruttura* a doppio effetto che non giace in un piano, ma si dilata nello spazio, secondo forme tridimensionali che accrescono la rigidezza dell’insieme.” [Translation mine].
Rinaldo Semino’s project for the competition, which did not receive any prizes or citations, exhibits very particular qualities that address the idea of an occupied bridge or a territory-land bridge, a concept introduced years earlier by Giuseppe and Alberto Samonà, Manfredo Tafuri, Giancarlo di Carlo, Francesco Tentori and others, in the early 1960s. The concept of the bridge as a new city-
The use of his cellular building component, rather than on detailing the different elements in his bridge, which he describes in the text accompanying his essay in *Zodiac* 22.

As a direct precedent to this competition, Alberto Samonà’s Regional Plan of 1963 was focused on creating a way to develop an industrial infrastructure for the regions of the cities of Messina (Sicily) and Reggio-Calabria (Calabria). His plan for the expansion of the port of Messina led him to stray—productively—from the competition brief. Even this early on, Samonà referred to a city-region which would link the hinterlands above Messina, arch across the Strait, and connect to, and encourage industrial development on the Calabrian side. Samonà designated the communication and interrelationship between these various elements as an “organic.” His first musings in this article
about a “ponte sullo stretto” for a bridge across the Strait gained currency in the collective unconscious of Italy, and is the foundation upon which the competition brief is based.\textsuperscript{664}

In response to the 1969 competition brief, Semino utilized the structural unit that he had been studying since 1965 on the regional scale. His project was composed of twenty-five-meter concrete cellular units which were linked together. Each of these larger units were, in turn, made up of smaller units as he had proposed in his project for Genoa; however, his studies for the bridge showed a much greater degree of variation within the base unit.

Figure 179 Rinaldo Semino. Detail drawing through the section of one 75 meter element. One can see that larger unit is made of smaller units, composed of the smallest elements. Courtesy of Rinaldo Semino.

The larger units—made of concrete at the water line, and of steel above the water—would float on the water of the Strait, tethered only on either side. This enormous bridge was to be inhabited as a new city, an interregional linear city that would sit between two municipalities, Messina and Reggio di Calabria and between two Regions, Sicily and Calabria. This is very much in line with the planning of the two regions that Giuseppe Samonà had proposed in 1960. The bridge, then, would become

an autonomous city-region, creating housing and an administrative center in addition to providing roadways and rail lines for people moving back and forth from the peninsula to Sicily.

Figure 180 Rinaldo Semino, Zodiac 22, 1973. Rinaldo Semino’s drawing for the 1969 ANAS competition for a 4 km. rail and road connection between the mainland (upper left) and Sicily (lower right) over the Strait of Messina. The shaded area in the center indicates the floating bridge composed of 75 meter long concrete and steel elements fabricated from smaller units.
Semino studied the variations possible in the singular cellular element, and then, how to join them together to form a macrostructure. He considered the physical environment of the Strait of Messina, with strong sea currents, extremely deep waters, high winds, and seismic activity, and looked for a solution that would obviate the problems that underwater foundations would pose. As he stated, “I have for this reason looked at solutions in which the task of supporting the bridge could be entrusted to the waters.”

The spatial features of the structure led to the idea of linking the Strait by means of a floating plate, connected to a system of port-channels within the overall structure. Semino investigated different types of infrastructure that could be developed throughout the bridge. He proposed an interesting idea: the bridge itself could be occupied, and become the administrative

665 Rinaldo Semino, Zodiac 22.
center of a new “Strait of Messina Territory.” This would be an appropriate location, according to
Semino, because the location “is in fact in the geographical center of the region and would act as a
crossover between the local lanes and the express lanes of the bridge-territory.”666 A calm channel of
water would run down the entire length of the bridge, permitting an uninterrupted water route
between the two coasts for smaller boats. At the ends of the floating bridge, a clear zone, spanned
by high single spans (which Semino had admitted in conversation that he would redesign as being
much wider) would permit the passage of larger vessels and would act as anchor points for the
development of marinas on either side.

Semino envisioned the floating slab as being able to absorb all of the commercial and maritime
activities that had overdeveloped in the cities on either side of the Strait, so as to free the land on
either coast for residential use. The lower portion of the structure of the bridge was to be made of
reinforced concrete elements which would vary in size along the length and breadth, much as the
scales on a snake change their shape to conform to the curved surface of the snake’s body. An
average size of each element would be approximately 25 meters, made up of much smaller elements.
The concrete elements would float, and would provide transversal resistance to the force of the sea-
currents and the wind. The upper portion of the bridge was to be made of similarly shaped elements,
but they were to be constructed of steel, providing a mirror image of the lower concrete structure.
The two separate structures were to be moine, and would work together as a whole, giving
longitudinal resistance to loads. Semino left empty zones in the structure, organized in a triangular
and hexagonal mesh that were connected together to produce a double-shell structure. The steel
structure, like the concrete one, would be made up of 25 meter overall elements composed of an
assemblage of smaller steel pieces 1.38 meters in length on average. Because the elements were to
work together as a whole, force applied at one point would be distributed among the different

666 Ibid.
cellular elements. The structure would be an assembly of a series of interrelated similar parts which would act together as a whole, and may be seen as a concrete example of a system in action. While seemingly static, the forces operating in the structure would be dynamic such that it seemed that the whole was more than the sum of the parts.

Figure 183 Rinaldo Semino. Various sketches of section conditions and variations in the organization of the base elements. Courtesy of Rinaldo Semino.

Figure 184 Rinaldo Semino. Various sketches of section conditions and variations in the organization of the base elements. Courtesy of Rinaldo Semino.
Semino’s project was a unique proposal for a macrostructural project made of seventy five meter long units, in turn made of smaller components. The lower portion that would float on the water would be concrete, and the upper elements, though similar in form, steel. This three thousand meter long floating city would have been an extraordinary example of how individual cellular modules can be brought together to form a complex structural “tissue,” exhibiting complexities that would ordinarily be seen in cities that have evolved through time. This was attractive to Renzo Piano, who included Semino in his exhibit at the Milan Triennial of 1968 in “Mutations of Form in Nature,” an additional exhibit associated with the overall exhibition of The Greater Number.

**History of the Triennale**

The “First international exhibition of the decorative arts,” the Biennale of Monza was held in 1927. From 1927, the exhibition became known as the Triennale of Milano. The first two exhibits placed an emphasis on artisan designs, folkloric examples, and other figurative work. With the III Triennale di Milano of 1928, the exhibition moved towards the expression of Italian rationalism. The following year, the IV Triennale of 1930, placed an emphasis on new production technologies. This was refuted with the reassertion of Italian rationalism in the V Triennale of 1933 and the quest for pure form in the VI Triennale of 1936. The VII Triennale of 1940 shifted gears again, and the theme was “Commensurability in architecture—Theoretical modulation in production.” The 1947 VIII Triennale, with the theme “A house for all” held at the important QT8 experimental district at San Siro, near Milan emphasized standardization, modulation, and industrialization in the building industries. This Triennale would make a distinct break from the past emphasis of the Triennale on the decorative arts, and would emphasize the industrial arts. During the war and the postwar period, the Triennale did not hold to the three-year intervals, as implied by its name. Four years later, the IX Triennale of 1951 focused on expression in the arts. In 1954, back on a three-year schedule, the
theme of the X Triennale was, “The unity, and thus the correlation and virtual reciprocity of the arts. Co-operation between the world of art and that of industrial production.”

The 1957 XI Triennale continued the focus on the relationship between art and invention, and on implementation in the field of production. This echoes industrialist Adriano Olivetti’s conviction that technology could fuel industry and the production of industrial products (and design) that could be used for the betterment of the individual and society. One can note a shift in the focus of harnessing technology in the postwar period for social and mass housing in the theme of the 1960 XII Triennale: changes in the institutions of home and school, the interrelation between architecture and city planning, and interior decorating and equipment. The postwar economic boom brought about profound lifestyle changes. The theme of the XIII Triennale of 1964, “Leisure time and its links with the world of architecture, the arts, technology and production” was in striking contrast with the exigencies of housing displaced populations that had been of utmost concern not even a decade earlier in Italy. (This is a much larger discussion regarding reconstruction, mass migration to the strained urban centers, industrialization, and other issues that are unique to Italy’s history.)

The XIV Milan Triennial and *Il Grande Numero*

The theme of the XIV Triennale of Milan of 1968 was *Grande numero* (or “The Greater Number,” as translated into English). It was a critical event in the architectural and social milieu of Italy in the

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667 *La Triennale di Milano e il Palazzo dell’arte.* Edite by Dario Marchesoni with the collaboration of Luisa Giussani. (Milano: Electa, 1985). The authors provide a small description of each year of the Triennale and include an image of each poster and a photograph of each installation. See also Anty Pansera, *Storia e cronaca della Triennale* (Milano: Longanesi, 1978). See also Gabriella Lo Ricco, “La Triennale di Milano (1964/1974), in *Italia 60/70, una stagione dell’architettura*, Marco Biraghi, Gabriella Lo Ricco, Silvia Micheli, and Mario Viganò, ed. (Padova: Il poligrafo, 2010), 125.

668 *La Triennale di Milano e il Palazzo dell’arte*, 104-105. As the authors describe, the Theme of the XIV Triennale of Milan: international exhibition of modern decorative and industrial arts and of modern architecture was “Grande numero” or “Large numbers” in “relation to the far-reaching changes affecting contemporary civilization and the relevant problems arising in the fields of education, information, work, recreation and distribution, focusing on high-technology products, macro-
1960s. The theme, *Grande Numero*” or “Large numbers,” in the words of the organizers, was “in relation to the far-reaching changes affecting contemporary civilization and the relevant problems arising in the fields of education, information, work, recreation and distribution.” This theme was particularly relevant to the enormous changes in architecture, cities, and territories as a result of industrialization and the changes in society in response to the postwar economic boom in Western societies. The board of the Triennale was made up of leading architects, designers, and intellectuals of the time such as Giovanni Michelucci, Bruno Zevi and Ignazio Gardella, among others, and the executive committee was made up of Giancarlo De Carlo, Alberto Rosselli, Albe Steiner, Vittoriano Viganò, Marcello Vittorini, and Marco Zanuso. The main aim of this Triennale was to address the issues, both positive and negative, of the great increase in development afforded by economic prosperity and industrialization and to examine, through the exhibits, “the mistakes, intelligence and prospects” of the present time. The Italian magazine *Casabella* followed the events leading up to, and following the XIV Triennale di Milano in a series of articles. Carlo Guenzi discussed the theme of “Il Grande Numero” in *Casabella.*

The fourteenth Triennale opened May 30, 1968. Immediately after the official opening ceremony, the exhibition building was occupied by a group of protesters, who made it impossible to carry out the exhibition as scheduled. Thus, the exhibition itself was actually opened on June 23 of that year.

669 Ibid., 106.

670 Guenzi, Carlo “Il Grande Numero’ 14th Triennale di Milano – project for a future ambient” *Casabella* no. 320, November 1967, p. 58-63. *Casabella* followed the events through a series of articles in numbers 308 (1966), 320 (1967), 323 (?) and 325 (1968). In *Casabella* no. 327 (1968), in “Dibattito sulla Triennale: A debate on the Triennale di Milano, An invitation to readers to contribute ideas,” the readers are asked to submit ideas regarding the debate and crisis over the XIV Triennale. It asks the readers to consider issues at stake with the institution of the Triennale, and to posit what should be the role for cultural institutions in general. How would an institution be a vehicle for the
The exhibit included large scale installations that were reflections on the urban environment. Arata Isozaki presented his *Macro-Transformations of the Territory*, with images mounted on large cylindrical panels. Aldo van Eyck’s contribution, *The Small Scale for Large Dimensions*, Archigram’s installation *Mutations of the Environment in the Age of the Large Number*, and Gyorgy Kepes’s *The Form of the City at Night* were all investigations that looked into the relationship between the smallest constitutive element and its accretion into systems at large and extra-large scales. Many exhibitors addressed the problem through sober reflections on society, but the notion of mass consumerism was equally present in the exhibits, and provided an event in time and place which framed the struggles of the day. System thinking and cybernetic control, while thought earlier in the decade to provide solutions to questions of urbanism and housing, were increasingly seen as both sinister and controlling. The altruistic promise of the use of mass production of components for humane prefabricated housing was quickly being offset by the mass production of consumer objects, slated for immediate obsolescence and the advent of a “throw-away” society. One sees examples of both approaches in the range of the Triennial exhibits.

**Opening day: The Occupation**

The opening of the Triennale was scheduled for May 30, 1968, a date that had been set long before the events of ’68 were being played out. While student protests and occupations of various schools...
had been going on since the beginning of 1968 in Italy, the week prior to the opening of the
Triennale was the most active in the protests in Milan, with clashes between students and police
spreading from the State University to the Catholic University, the Polytechnic and to Boccioni
University. Two installations had been added to the Triennale by architect Giancarlo De Carlo, the
painter Bruno Caruso and the film director Marco Belloccchi in the days just preceding the opening
that were an attempt, on the part of the Triennale, to discuss current events. These included
documentation of political demonstrations organized by UFO, a radical group located in Florence,
and another exhibit on the student movement and youth protest. A declaration was mounted on the
wall that sought to contextualize the current protests within the scheme of the Triennale. The text
read, “The protest of the young constitutes a typical and intense expression of the contradictions
created in society by the transformations of the *large number*. The ways in which this protest is
expressed demonstrate the need for new principles of organization that will also affect the structure
and form of the physical environment and raise the problem of a new imagination in architectural
design and city planning.” The words of the German leader of the European student movement,
Rudi Dutschke, were also presented as a kind of manifesto for the event. Dutschke’s words called
for an opposition, not only to smaller events, but a “total opposition to the whole (system) and up
to now dominant way of life of the authoritarian State.”

While the last minute inclusion of these exhibits was a sympathetic gesture to the protest movement,
it did not satisfy the protestors, and they accepted eagerly the rest of Dutschke’s message that
invited creative solutions to existing social ills, stating that “our ability to boldly and resolutely
deepen and politicize the visible and immediate contradictions will depend on our creative

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dell’assemblea di occupazione della Triennale di Milano,* 95
“La Triennale è una delle tante infrastrutture del sistema in cui, altrettanto precisamente che nella
scuola, si manifesta la contraddizione fra ricerca e sviluppo tecnologico.”
capacities.”673 The Triennale opened in the middle of the fervent week of student protests in Milan, and was immediately occupied by students and joined by artists whose demands were against the Triennale as a vehicle of capitalism.674 Giancarlo De Carlo tried to negotiate with the protestors to no end, even though De Carlo and the others believed that the exhibit represented a counter-message to late capitalist culture in contrast to what the students and artists thought, and had worked devotedly over many years to avoid that message.675 The building was occupied, and the exhibit was not open again to the public until a month later, after having sustained heavy damage.676

This event, where life interacted directly with art, is an indicator of irrevocable breaks with the past, with a total faith in technology and power that would open up a new meaning to ideas of mass numbers, protest, ecology, and architecture. Seen in this light, then, the XIV Milan Triennial of 1968 was an event that speaks to, and allows an open-ended reading of the time and its polyvalent concerns.

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“La Triennale è una delle tante infrastrutture del sistema in cui, altrettanto precisamente che nella scuola, si manifesta la contraddizione fra ricerca e sviluppo tecnologico.
Changing Form in Architecture

A young newcomer to the scene, 31 year old Renzo Piano of Genoa designed an intricate hanging display system to exhibit the work of various architects who addressed the theme of the exhibition, *Changing Form in Architecture.*

Figure 185 Renzo Piano, “Changing Form in Architecture,” Exhibit at the 14th Triennial of Milan, curated by Renzo Piano for the Centre for the Studies of Science in Art, London. Courtesy of Rinaldo Semino.

The examples shown here represent a series of contributions, with each presenting a new aspect for a diverse visual point of view. In some cases, this new aspect is from a strictly technological point of view; in others, there are careful morphological studies. This was also studied from a point of view of a reconsideration of fabrication and implementation of the product. In all cases however, there is a focus on a profoundly changed methodology which looked at biological, material, and scientific advances in form, which was then tied into a larger discussion about the new morphological form for architecture that could arise because of new materials that were the products of technological

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678 Renzo Piano, “Changing Form in Architecture,” Exhibit at the 14th Triennial of Milan, curated by Renzo Piano for the Centre for the Studies of Science in Art, London.
advancements such as plastics (supplanting steel). In all, this small exhibit posed some very interesting questions about plastics and the relationship between scientific experimentation, investigating a new elasticity in materials that enabled greater freedom in architectural form.

Figure 186 Renzo Piano, “Changing Form in Architecture,” Exhibit at the 14th Triennial of Milan, curated by Renzo Piano for the Centre for the Studies of Science in Art, London. Courtesy of Rinaldo Semino.

Piano discussed the idea of morphology, and was inclusive about both organic and inorganic models of growth and form. His curatorial eye, similar to what had been seen at the 1951 exhibit *Growth and Form* at the ICA in London also compared images of microscopic and macroscopic structures. In
Piano’s case, architectural projects were linked by formal similarity, i.e. the resultant forms, on any scale, were seen to be informal structures linked in their form. The structures were not being derived from a preconception of a rational form, but the rationality of the resultant form was a “natural” outcome of scientific principles made manifest in the particularities of the chemical, structural, and biological processes. In some sense, this was the last time (until recently) when the technological was seen as being the way for humankind to harness processes to emulate, or to be in concert with the environment.

**Leading to a natural-technical consonance**

Within the pages of *ulm* magazine, there were fertile images that guided the iterative work of Rinaldo Semino. Questions such as: ‘How are series made?’ ‘What is the base unit?’ ‘What would be the rules of the change across time and space?’ are important questions for design. With a dual focus on the unit and its rules of assembly, many of the projects from the HfG Ulm provided exceptional inspiration. Such notions of modularity were certainly thought of in terms of their technological reproduction. How would one design in series, whether they be industrial consumer products such as typewriters, telephones, or prefabricated buildings? The answers to these questions relied upon a working premise that a scientific, rational, and abstract approach was most fruitful.
An inspirational figure for this approach was, again, D’Arcy Thompson. In his article, “An Argument for Basic Design” in *ulm* 12/13 of March of 1965, William S. Huff discussed the work of D’Arcy Thompson and the geometric packing of honeycomb, and the underlying geometry and Fibonacci series evident in the spiralling seen in nature—in the pine cone—connecting the rules of nature with those of technological reproduction. These rules, in combination with the General System Theory of Bertalanffy and Cybernetics theory of Wiener formed a critical basis for investigating and developing the models for prefabricated systems—closed systems of an interrelated and exclusive kit-of-parts that has been discussed throughout this work.\(^679\)

Looking at the inspiration that D’Arcy Thompson provided to designers allows me to come back full circle to the publication *Zodiac* and the writings of its editor, Maria Bottero. In her editorial, “Ricerca Tecnologica e Architettura” (Technological Research and Architecture) in *Zodiac* 21 of 1972, Bottero urged designers to look to nature to extract rules for harmonious proportions, the use of which, she asserted, would bring about an aesthetic clarity in the work. She was concerned that a consequence of industrialization and the production of objects in series would be a greater homogeneity of form, and looked to nature for inspiration. Citing the positive role of the modular in Modern architecture she, however, cautioned against thinking of function as it had been in the past, and instead called on designers to provide a new definition of “function”—one that would move beyond, and be able to address postindustrial problems of urbanization, mass society, and waste, while still taking advantage of efficient and maximum levels of production that seemed so necessary in the housing crisis.  

Bottero discussed the work of French architect Georges Emmerich, whose research and structural experimentation, she believed, held the potential to provide a new reading of “function” that would be both practical, and aesthetically pleasing. Emmerich’s work was expressive of “form” as the negotiation between internal forces and in response to external forces from the environment. In this issue of *Zodiac* and the following one, in which the work of Rinaldo Semino was included, Bottero advocated for an experimental morphological approach in which the design of architectural form could be analogous to the rules that shape the natural world, both of inorganic structures and of natural organisms. In this approach, through the rules of the natural world, Bottero proposed a new definition of architectonic language.  

680 Maria Bottero has continued this line of thought in her recent book Progetto Ambiente: la questione etica, la tecnica e l'estetica-sepsistemologia del paesaggio contemporaneo, verde e acqua nel paesaggio urbano, i fondamenti della bioclimatica. Milano: Libreria Clup, 2005.
Bottero’s point ties in nicely with the “metaprogetto” proposed by Alessandro Mendini, and Bottero’s looking towards nature as a model is a significant way in which she contributed to the questioning of the purely technological. The idea of “Fabbricazione Aperta”—or open fabrication—makes a connection to linguistic models of combination from simple elements. The module is the base of a dimensional coordination. The term “meta design,” as used by A. Van Onck, Giuseppe Ciribini’s discussion of modular coordination as a “metadesign,” and the “Metaproject” (“metaprogetto”) as discussed by Alessandro Mendini are all variations on this basic idea of producing complex form through the accretion of smaller, simpler elements by following simple rules, which is precisely what occurs in, and produces aesthetically pleasing natural form.

The discussion, however, remains open regarding the organic quality of this work; or, as in the case of the componenting systems of Joe Colombo, questions arise: might the openness be seen as a kind of antidesign? Or as G.C. Argan asked, was the role of the designer utterly changed? Would artists configure an environment, a “spatio-temporal situation” rather than creating a fixed form? Umberto Eco spoke about a kind of impermanence and discussed connections to language, as language occurs sequentially in time. Does prefabricated building have a similar processual sense in the action of assembly? Mendini, in discussing the inherent beauty that he saw in the “metaprogetto,” referred to Herbert Marcuse’s point in *Eros and Civilization* that social structures and the products of the human hand, and hence design, is a combination of both the intuitive and the rational.

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682 Giuseppe Ciribini, “Coordinazione modulare come metadesign,” in *Quaderno Aire*, no. 6 (1967) and in Prefabbricare, no. 1 (1968).
The XIV Milan Triennial of 1968 brought these questions to a head. With the theme of *Il Grande Numero* (The Greater Number), the rational contributions were wide-ranging. Carlo Guenzi, who covered the development and aftermath of the Triennial in a series of articles over three years in *Casabella* warned in his editorial in February of 1969, more than six months after the ill-fated opening, that architects, and society in general should be cautious about the risk of falling into a technocracy. In his analysis of the contributions to the Triennial, he was critical of many architects who had compromised themselves vis-à-vis the commercial system, and felt that they were serving a culture of capital and power. To go back to Marcuse’s or Eco’s formulations, these artists could be seen to be serving the logic of a rationality of capital, power, or technology that they were no longer questioning. The Triennial highlighted the irony of the entrance of the irrational into an unreflected rationality, and the consequences were emblematic: the Triennial was shut down; the technofilic dream appeared to be over.
To attempt to conclude a study of this type returns to the very question that the works of the architects, artists, and engineers I have discussed had raised. Dynamic systems have dynamic boundaries which means they are unclear and open boundaries. This investigation will extend to the contemporary moment but not necessarily in straight lines nor a continuous historical narrative. We see the evidence in the contemporary use of computation in the generation of architecture and in an increased interest in the crossover between the biological to question not only the static nature of architecture, but the process of the generation of architecture. Contemporary questions continue to arise regarding the boundaries of architecture; and as we have seen in the 1960s, the fundamental question about the relationship of the built to the natural environment persists. Where does architecture end and urbanism begin. What is the relationship between architecture and the environment, culture, and politics of a particular time? We have questions and not conclusions.

I have discussed a particular time in Italy as seen through the lens of an idea about an alternate organic approach that sought to connect the technological with the natural. A key idea that is questioned in this dissertation is the positivistic notion of the continual progress and the betterment of the human condition that was afforded by the technological society. At a point of view more than forty years past the period that I study, the same conversation is dominating architectural discourse with a seemingly new (renewed) fascination with technical prowess made possible through computing. This has triggered a renewed interest in systems and forms of great complexity. This is then magnified by the possibilities afforded by the computer-numerically controlled fabrication of the parts of architecture or even in the the possibility of 3-D printing entire buildings which would eliminate the necessity for architectural components at all. There is a new emphasis on dynamic systems that echoes the discussion of this earlier period, though I would venture to say that the
discussion in the 1960s was immensely more aware of speaking about the political, social, and economic implications of the advanced technological world along with the desire to produce products of immense complexity and aesthetic beauty.

So rather than conclude, I will come back full circle to where I began with the discovery of a drawing of a little known architect named Rinaldo Semino. As I had discussed in the “Introduction” when I first saw the image of the bridge, I was struck by how familiar these images are and seem as if they might have been produced using parametric modeling software. I felt that the images created by Semino could not have been made without referring to nature and natural form and could not have been made without a reference to technological advances of the time. While these images look contemporary I knew that these images predate and had not been made with contemporary technologies. However, even if the images had not been made through the use of modeling software, there is still evident the use of some kind of computational model that is based on natural processes. The curiosity about the isomorphic connection between these drawings made in the late 1960s and architectural projects today drove the project from the start.

My implicit approach holds a premise: by looking closely and investigating an image is a way to be lead into deeper questions. Michael Baxandall describes this as a kind of “reconstruction” of the
specific problem and circumstances that “the maker of a picture or other historical artefact” who was a person who had addressed a problem and the product (in this case a drawing) in a “finished and concrete solution.” The reconstruction in effect is a way to establish a narrative, of “relations of problems to solutions” to produce a “conceptualized constructs to a picture covered by a description, and of a description to a picture.”

Figure 189 Rinaldo Semino, sketch that rationalizes the organic form.

So in my first impression of Semino’s drawings of the bridge, the co-presence of the obviously technologically influenced repetition of the component parts that he had created using a xerox copier are fully merged with the ambiguity of the image as an organic pattern that could be found on a snake’s skin. I assert that a deep consideration of an image can lead into an exploration into those principles that generate design, both computationally designed and the designs of the biological world. The underlying rules then in some ways may be thought of as a technological not just a theoretical construct.

685 Michael Baxandall, “The Historical Object,” in Patterns of intention: on the historical explanation of pictures. (New Haven: Yale University Press, 1985), 10-11, 26-27. This is in the chapter where Baxandall unpacks the image of the Forth Bridge in Scotland.
While it was difficult at times I trusted what I saw and continued to interpret the related signification that is embodied in the image. Just as there are parameters in nature, there are parameters in software, and the relation to open and closed sets are common to both and is at the core related to systems theory. By following Semino’s image I discovered not only his work but looked carefully at a generation of engineers, artists, and architects who were working in postwar Italy. The works that I have discussed throughout were selected by adhering to these principles I employ the term Alternate Organics, to describe and define an approach and also as a resultant product and not an -ism.

These creative individuals tested new ground in their respective disciplines and in their mutual fascination in mathematical and scientific discoveries that exploded in the postwar period. All share, in my assessment, an abiding interest in the proposition that there are processes in nature that science was uncovering, and that by understanding these processes it would fuel their imagination to experiment with these processes in xerox, permutational art, programmed art and architecture, modular systems, and automorphic prefabricated structures that would move and change position in relation to the environment. In architecture the experimentation can be tracked as a micro-phenomenon at the scale of the single architectural component and the analogy of a building to an organic body, being built up from these cells to make tissue, organs and the body itself was a start. What this line of thinking actually promoted was a blurring of the boundary between architecture and urbanism, so that they actually meld: that a structure can become territory follows the same principles, employs similar computational models, and experiments with the same dynamic and is what was termed in Italian, the metaprogetto.

I believe that the people whose work I have discussed pursued their research with the firm belief that their interpretation of natural models through technologically-enabled making would benefit humankind and provide for a built environment that would be in symbiosis with the natural world.
However, the full and deepest irony is that in this work they began to realize that architecture when it is constructed at the scale of the metaprogetto must meet and merge with nature in all of her complexity and dynamism. This remind us of the idea of open systems, homeostasis, and cybernetic theories. It also relates to the appearance in the early 1970s of the idea of Second Order Cybernetics, in which the observer is no longer outside, but part of the system that is being investigated. This notion of humankind being part of the greater ecological system is crucial by the end of the 1960s. While D’Arcy Thompson analyzed individual organisms or other natural but inorganic formations such as crystals and soap bubbles, his view was quite focused at the small scale. His patterns of form are registered in the mutability of form based upon internal logics and of the environmental pressure upon that form. He doesn’t yet theorize the larger ecological system, but his attentive way of viewing individual form, when contemplated as the interaction of multiple forms in a complex systems resonates and reinforces the main point that I will take away from this work: anything that is created and built in relation to the environment must take into account that the environment is a living and organic system to be respected.

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