
Approaching Irreducible Formations

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ABSTRACT

This essay codifies and extends contemporary conceptions of systemic organization using architectural case-studies within the context of 1950's space-time. Given the dominance of certain concerns within the profession of architecture during that time—prefabrication and strict modularity—the selected case studies reveal unprecedented characteristics which anticipate current developments in algorithmic and parametric formation. The projects in question demonstrate sophisticated strategies for differentiated part-to-whole relationships which predate contemporary organizational systems, now derived with the aid of digital computation. Their importance to current architectural discourse lies in distinguishing the manner in which they manifest notions of space-time, including transformation, continuity and modulation, as architects increasingly operate within dexterous and interconnected environments.

“TO DIVIDE UNITY, TO FUSE DISPARITY—SUCH IS THE LIFE OF NATURE.”—J. W. GOETHE

Contemporary architectural formations make use of systemic organization—modeling procedures based on rules, constants, and variables that operate within flexible frameworks. The use of such methods today, typically in the guise of software or individually authored scripts, has dramatically affected the conception of form. As the products of these processes are dependent on the manipulation of parameters set up by the architect, design strategies are increasingly characterized by the benefits and limitations of relational systems. Working in this way, designers no longer draw static assemblies of discrete elements but, instead, model dynamic and associative organizations of integrated, architectural componentry. Due to the procedural nature of computation, the discipline of architecture has recently been witness to a widespread, increased investment in such processes. The resultant formal organizations are often characterized by a perceptual inseparability of part and whole and are approaching irreducible formations.

Although recent technological advances have facilitated an increase in thinking parametrically, conceptualization of form as correspondingly flexible system(s) is certainly not without precedent. During the 1950s, as the scientific discoveries of space-time reached the creative disciplines—which encouraged observation and creation of formations as dynamic and in-flux rather than fixed and static—some architects tested new strategies for formal and material organization that surpassed standard, pre-fabricated, modular-design practices and tended toward higher degrees of complexity and flexibility. Historically registering the influence of these ideologies are four architectural examples that share chronological proximity, each being conceptualized and built between 1954 and 1960. They include Iannis Xenakis' fenestration pattern at The Monastery of Sainte Marie de La Tourette, Felix Candela's Church Iglesia de la Virgen Milagrosa, Eladio Dieste's Church of Christ the Worker, and Pier Luigi Nervi's Palazzetto dello Sport in Rome. Each design represents a unique method of incorporation of space-time principles and can be tested against (provisional) categories that highlight differences among methods of formation and design ambitions. These categories are: (1) proportion and dynamism, (2) geometry and continuity, and (3) simulation and flexibility.

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Organization of matter and processes of material formation are themes that underwent significant reconceptualization during mid-twentieth-century cultural production, as reverberations from the “new field of space-time” spread throughout creative disciplines. Matter, formerly understood to be comprised of static assemblies of discrete elements, by the 1950s had been reinterpreted as series of kinetic, associative, and interdependent systems. Limitations to conventional methods of observation were lifted in order to perceive likenesses between natural and synthetic morphologies. Ostensibly disparate scales became seamlessly linked, patterns and processes became fused, compositions and methods of transformation became coupled; in effect, cultural producers were “thinking in relationships.”

Despite a majority of attention being directed toward other architectural concerns during this time—such as, waning but lingering postwar reconstruction efforts, interests in prefabrication, the promise of products of the second industrial revolution, concentration on mass housing and scientific planning strategies—formal analyses were being executed, specifically, analyses highlighting shared characteristics between modern painting and architecture. Artists Laszlo Moholy-Nagy and Gyorgy Kepes initially endorsed “transparency,” a concept giving language to the effect of gestalt within an artwork, as a worthy indicator of the arrival of space-time to the arts. Later, architectural theorist Colin Rowe and artist Robert Slutzky further articulated the idea, distinguishing between “literal” and “phenomenal transparency,” substantiating their claims through comparisons of formal structure in painting and facade composition in architecture, both sharing a disposition to frontal alignment. Although their work underscored an important by-product of trans-disciplinary cross-examination, it limited its focus to effects produced on the painterly plane, to two-dimensional patterns, fields, and figures. The notion that multiplicitous legibilities can coexist (or persist) within a single object as a result of part-to-whole promiscuity has several formal manifestations, of which Rowe and Slutzky’s example is only one.



Figure 1 Iannis Xenakis, Sainte Marie de La Tourette, 1956–1960

An ambition of this essay is to direct attention to precedents from the late 1950s that are illustrative of novel methods of material organization, which likewise tend toward their own unique forms of irreducibility.

Irreducible formations are those material organizations that resist immediate discernment of their part-to-whole relationships. Abstractly, they refer to an inseparability of framework (latent or manifest) and matter. In contemporary versions—usually parametrically conceived organizations—interrelationships are designed as flexible networks around

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Figure 2 Eladio Dieste, Church of Christ the Worker, Atlántida, 1958–1960

which specifications for materiality are assigned. Instead of compositions that are conceptualized in a fixed state and, therefore, immediately sub-divisible, metric definitions in a dynamic state are capable of continually being modified, through time or space. In such formations, similar effects to those described by Rowe and Slutzky occur; temporary hierarchies are emergent, as are explicit but ephemeral patterns and configurations. However, in such cases, the fluctuation of transitory orders tends to be understood as belonging to a single system of differentiated homogeneity, rather than a heterogeneous collection of elements with multiple inter-allegiances. Within the bounds of this essay, the notion of space-time will serve as a datum from which differences in organizational strategies and formations between the selected architectural examples can be measured. Industrial-modular logic, utility, and efficiency were pervasive codes to which many architects adhered during the 1950s. Entrenched in the prospects of prefabrication and mass production, universality, and repetition, few professional architects produced works that ventured beyond strict modularity. However, several projects do exist that are evidential of architects using a wide array of techniques and concentrations.

Through their composition, form, and/or structure, these projects either represent a conscious deviation from standard modular-design practices or possess formal characteristics that imply dynamic continuity.

BEYOND STATIC PROPORTIONS

Systems of proportion govern relative measurements within compositions. Through use of a metric template, proportional orders privilege particular scalar or rhythmic relationships while preventing others. During the early to mid-twentieth century, shortly before the new field of space-time saturated creative disciplines, modes of measurement that were seen to perpetuate socioculturally embedded conditionings were challenged under the auspices of Modernism. In music, for example, the continued inheritance of the Western tonal system, one embedded with hierarchal structures, was scrutinized and proposals were made for its replacement. Composer Arnold Schoenberg, with others, devised a non-hierarchical system whereby each of twelve tones received equal value, shedding any points of reference to a tonal center. The neutralization of all intervals required the development of new strategies for formal manipulation and, likewise, a vocabulary to name the correspondent compositional attributes. Descriptions were no longer feasible in terms of a melodic-figure and harmonic-ground, but rather, terminology referencing the kinetic characteristics of twelve-tone music was introduced: directionality of a pitch sequence and its relative orientation. Similar experiments with spatial ordering systems were practiced architecturally.



Figure 3
Felix Candela,
Church Iglesia de
la Virgen Milagrosa,
Narvarte, 1955

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Iannis Xenakis, empowered by Le Corbusier to design the fenestration pattern at The Monastery of Sainte Marie de La Tourette, extended the relational possibilities inherent to Le Corbusier's Modulor. As a proportional system, it spliced Modern man into an infinite scalar range of interconnectivity. Its basic metric relationships referenced the anatomical subdivisions of the human body, while extensions in both directions were enabled by a sequence of addition (or subtraction), using Fibonacci principles. Until this time, Modulor had primarily been used as a dimensional guide for the arrangement of shifting rectangular panels and windows on a grid, other organizational potentials remained dormant. Xenakis, who was also an avant-garde musical composer, interpreted the system as one of continuity, of seamless expansion and contraction. The fenestration pattern at La Tourette is indicative of a practice of differentiation within a homogeneous system (fig. 1). Its compositional framework and material pattern are conflated to form a parametrically organized composite, the interrelationships of which are flexible and tunable. This difference in compositional strategy places the design in the spaces between matter, rather than in the material elements themselves. On the concept of degrees of difference and continuity in Xenakis' formal systems, historian Bernard Teyssedre notes, "You no longer use elements as starting points, but rather their relationships, their intervals, and in relation to one of these intervals, we could say that the elements would play merely a secondary role as 'trail-markers' between the two extreme points."

TOWARD DIFFERENTIATED REPETITION

Characterized by "elementary methods, primary forms, simple numbers and equal elements," variation in modular systems before the advent of space-time was limited to the finite results of unit-combination. "Combinatory possibilities seem to be the nature of things; the arrangement of atoms determines properties. There are, for instance, seventy-one compounds which have the same molecular formula but have differently arranged patterns of atomic symmetry." In



Figure 4 Pier Luigi Nervi, Palazzetto dello Sport, Rome, 1958

such compositions, variability was not expressed within the form, but by the extents, or outer perimeter of form, as in a molecular chain or a pre-established kit of parts. This produced constructions that were dependent on the innate variable-potential of a single, repeated, prefabricated module. The replacement of discrete modules with discreet modules—elements which are visibly and operationally de-emphasized relative to the larger formal system—created a subordinate or (in special cases) reciprocal relationship between part to whole, which displaced Modernist ideas of strict organizational hierarchy and enabled a new type of formal dexterity.

During the 1950s, Felix Candela and Eladio Dieste, in Mexico and Uruguay respectively, were testing the formal and spatial possibilities of systemic and incremental variability. For the elements that were shifting incrementally, the two architects geometrically described them within a continuous material system. This transition to a system of material homogeneity resulted in a change of formal logic from one dependent on a prefabricated unit to one guided by

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geometric principles, the elements of which were linear, sinusoidal, and hyperbolic-paraboloidal. In adopting a mathematically guided formal strategy, the architects promoted a systemic flexibility that was inherently based on reciprocal internal geometric relationships. With relationships established but formally pliable, formations were being conceived "parametrically," the variables of which were measured in periodicity and amplitude. This is best realized in Eladio Dieste's Church of Christ the Worker in Atlantida (fig. 2). Straight-line segments rotating relative to one another made forms that were seemingly complex but easily controllable and feasibly constructible. These forms act as records of dynamism: lines shifting through space and time made manifest by continuous material constructions, as can be seen in Felix Candela's Church Iglesia de la Virgen Milagrosa in Navarte (fig. 3). The conceptual increments of time that seamlessly blend the discrete linear elements are of equal or greater importance to their material registration. Richard Lippold, a sculptor active during the 1950s, once remarked, "Born into a place and an age in which space and time are our principle companions-in-concern, I find it inevitable to love them more than solid materials with which my ancestors were involved."

NEARING SIMULATION

A simulation is a manifestation (representational or physical) of the behavior of one system executed by a second system. Painter Ellsworth Kelly developed artificial means to simulate naturally occurring effects through the invention of synthetic systems that produced, managed, and manipulated differentiation. In *Study for Seine*, he used a grid as an organizational armature and devised a method of interpretation for the fluctuating light values caused by the river's reflection of the sun. The technique, one of translation, employed chance procedures in selecting which grid cells to fill, ensuring an approximate imitation of the randomized field condition. Reproduction of observed dynamic behaviors became a common practice across disciplines and was one that highlighted connectivity between the natural and the artificial. As artists invested in mechanisms capable of synthetically mimicking processes observed in nature, physicists and mathematicians were likewise working on developing equations to describe the complexities of natural processes over space and time. Mathematician Norbert Wiener suggested that, "the abstract artist need not confine himself to patterns which he has reached abstractly, but may compose freely about a theme suggested to him by nature, because they have a specific mathematical structure." Wiener's statement illustrates an overwhelming faith in the creative potential of natural processes and the ostensibly endless interrelationships between the arts and the sciences. Pier Luigi Nervi made architectural formations that simulated systems of force diagrams through the synthetic construction system of concrete and steel. The patterns of material articulation at once privileged a structural efficiency while remaining fused with the continuous surface. Laszlo Moholy-Nagy noted that, "space-time stands for many things: relativity of motion and its measurement, integration, simultaneous grasp of inside and outside and revelation of the structure instead of the facade." Previously understood as hierarchically distinct and materially discrete systems, enclosure and structure became one composite system capable of responsive reorganization dependent on force and space requirements (fig. 4). Such plasticity was made possible through the pairing of an advanced material logic and a structural logic, the capabilities of which are showcased in Nervi's Palazzetto dello Sport in Rome.

Descriptions of formations, such as differentiated homogeneity, systemic continuity, flexibility, and simulation, are terms that represent parallels between mid-century and contemporary practices. These material-organizational strategies of the 1950s marked a shift from those influenced by the Modernist canon—from juxtapositions of the rational grid and the free curve to those strategies that illustrated a new flexibility through the combination of both. These four projects sponsored a concerted effort to conceptualize formations that "divide unity" rather than "fuse disparity." They represent distinct and important advancements in design strategy that employ flexible relationships over static compositions. They act as precedents of renewed value, as form-making processes increasingly rely on the design of complex, interdependent and parametric relationships.

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