

Architectural Fractures: Computation and Form in the Work of Le Corbusier and John Hejduk

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INTRODUCTION

Ever since the refinement of orthographic projection in the early Renaissance, drawing has remained the predominant medium for architectural design. As Robin Evans pointed out, “architects do not make buildings, architects make drawings of buildings.”¹ In this way, the architect and the built environment are paradoxically both separated and linked by the plane of representation. Many theorists have characterized the introduction of the computer into the design process as a fracture in the history of architectural production that pits established hand-drawing techniques against new forms of digital representation. However, most of the initial applications of digital representation remained grounded in the tradition of orthographic projection, making the fracture between the hand and the computer a subtle one confined to issues of texture and tangibility. And, while these textural differences between digital and analog techniques are not inconsequential, more recent research in architectural computing has focused on automated paradigms for generating form that present a far more dramatic fracture in architectural production. As computation lingers on the verge of exponential growth, the relationship between representation and design is called into question. By examining the complexities and nuances of this evolving relationship, this essay seeks to redefine the fracture that characterizes contemporary architectural practice, not as the conflict between digital and analog representations, but as the conflict between computational and formal modes of thinking. Through an analysis of the design processes of two twentieth-century architects, Le Corbusier and John Hejduk,

the essay will attempt to establish a context for discussions on architectural representation in the twenty-first century.

RELOCATING THE FRACTURE

By characterizing drawing as a process of design, this essay seeks to go beyond its traditional understanding as a means of translation, and instead, study drawing as an autonomous structure operating with its own biases and limitations that affect architectural production. In this way, drawing can be understood as the critical link between the architect and the building through which form is directly manipulated. In contrast to this direct model of design, emerging generative paradigms present the possibility of scripting form and bypassing the plane of representation altogether. Branko Kolarevic described one of these new design methodologies in his book, *Architecture in the Digital Age: Design and Manufacturing*.

Instead of working on a *parti*, the designer constructs a generative system of formal production, controls its behavior over time, and selects forms that emerge from its operation. In this model of design, a system of influences, relations, constraints or rules is defined first through the processes of *in-formation*, and its temporal behavior is specified; the resulting structure of interdependences is often given some generic form (*formation*), which is then subjected to the processes of *de-formation* or *trans-formation*, driven by those very same relations, influences or rules imbedded within the system itself.²

As Kolarevic explained, these emerging models for architectural production allow the architect to input a set of parameters into a programmed system, which, in turn, generates several formal iterations

that the architect sorts through and refines. And, while the abstraction of these computational systems demonstrates a dramatic dissent from traditional methods of drawing, they are by no means the first instances of computational design. It is critical to understand that this conflict, which involves processes of computation, is much deeper than the computer itself. The fracture between the direct manipulation of drawing and the abstraction of computation can be traced back as early as the Renaissance. However, the recent surge of automated and scripted procedures for generating form presents the possibility of taking these computational design paradigms into uncharted territory. As contemporary architectural practice hangs in the balance, this essay turns to the work of two twentieth-century architects in order to establish a context for addressing the questions raised by these emerging design paradigms.

LE CORBUSIER'S FRACTURE

Collision

Le Corbusier is a child of the Industrial Revolution. His fascination with machine technology pervades both his writings and his built work. In *Toward an Architecture*, Le Corbusier declared that, "[e]very modern man has the mechanical sense."³ It was this mechanical sense that guided Le Corbusier through the process of architectural design, influencing the structure and aesthetic of his buildings. Le Corbusier presented his five points for the ideal architectural form—the *piloti*, the *free façade*, the *ribbon window*, the *open floor plan*, and the *rooftop garden*—as a set of abstract conditions that held intrinsic value. Like the abstract and formless parameters in a computational system, these five points are external to the process of drawing. That is to say, they are ideas about architecture that originate outside of the act of drawing, and are only translated into drawings of architectural form at a later stage. However, this progression from idea to drawing is not consistent throughout Le Corbusier's work. For instance, in her book, *Privacy and Publicity*, Beatriz Colomina described the compulsive nature of Le Corbusier's drawing process through an anecdote about a set of figural studies he produced in the last year of his life.

For the months immediately following his return from Algiers up to his death, Le Corbusier seems to have produced hundreds and hundreds of sketches

on yellow tracing paper by layering it over the original sketches and retracing the contours of the figures...[T]he drawing and redrawing of these images became a lifetime obsession.⁴

These iterative drawings represent a process that is distinct from the definitive process implied by the Five Points. One might even characterize Le Corbusier as tragic figure—an architect fractured by the conflict between form and ideology. In his buildings, these two forces collide, making it difficult to tell if the idea is generating the form or the form is being generated in order to illustrate the idea.

Domino System

In his design of the *Domino System*, Le Corbusier presented a seemingly simple and straightforward concrete structure that consisted of three horizontal slabs, six columns and a stair that connected all three levels. His drawing of the system, which he published in *Oeuvre Complete* (1929), depicts the structural diagram of the design without any walls or infill. In this way, the drawing attempts to illustrate the structural principles that generated the design: the set back of the columns from the structure's perimeter and the resulting cantilever of the monolithic concrete slab that improves its structural strength.⁵ In his analysis of the Domino System, Peter Eisenman referenced Alberti's reading of Vitruvius' three principles.

If Vitruvius can be said to be concerned with commodity, firmness, and delight, when this is repeated in Alberti fifteen centuries later, it becomes not merely commodity itself but as also a necessary representation of commodity. Architecture was not merely sound, functional, and beautiful; it was also the representation of its soundness, its function, and its beauty.⁶

Eisenman went on to argue that Le Corbusier produced the Domino System as a pure diagram of his Five Points that reiterated Alberti's argument for representation. However, in an essay entitled, "Romanticism, Rationalism, and the Domino System," Paul Turner revealed how Le Corbusier negated several of the structural advantages of the system in order to make the design appear more diagrammatic.

Ironically, [Le Corbusier decided] not to use integral, monolithic slabs in the Domino System, instead, proposing a complex scheme for the slabs (involving the use of hollow blocks, held in place

by a special scaffolding, with concrete then poured over them)—a scheme in which the cantilever becomes a hindrance rather than an advantage and which, in face, would have been very difficult to build. Why did [Le Corbusier] get himself into this predicament? The answer seems to lie at least partly in the formal properties he wished to embody in the design...The one truly distinctive (and unprecedented) characteristic of the Domino System is not structural but formal: its columns and slabs are completely smooth—that is, its columns have none of the splay or brackets, and its slabs have none of the exposed ribs that characterized virtually all concrete construction of this period.⁷

In this way, Le Corbusier's *Domino System* is diagrammatic to the extent that the idea being diagrammed is no longer present in the design. The form and ideas of the *Domino System* construct a logical loop, wherein a set of ideas generate a form, which is then manipulated to more clearly illustrate the ideas, but, in doing so, the form negates the original intentions of the idea. The result is contradictory object that is neither formally nor ideologically resolved.

HEJDUK'S FRACTURE

Representational Systems

If Le Corbusier is said to be a child of the Industrial Revolution, then John Hejduk might be best characterized as a rebellious grandchild—spoiled rotten and irreverent. The machine was the problem of Le Corbusier's generation, not Hejduk's. Instead, Hejduk, along with contemporaries like Peter Eisenman and Bernard Tschumi, turned his gaze to the structure of architecture and its representational systems. The architectural forms of Hejduk's generation explore the relationship between subject and object, often projecting the act of representation onto the form itself. For instance, Bernhard Schneider noted that the form of Peter Eisenman's *House El Even Odd* (1980) was designed to share a resemblance with the visual properties of axonometric projection.⁸ For Hejduk's generation, this metacritical exploration of process complicated the relationship between computational and formal modes of thinking. In Hejduk's case, the act of computation is literally consumed by the form. (Or maybe it is the other way around.) In a set of formalist studies that Hejduk completed at the beginning of his career, the act computation and the manipulation of form merge into single procedure that creates a single graphic shape: the Diamond.

In his book, *Architecture's Desire: Reading the Late Avant-Garde*, K. Michael Hays described the motivating ideas behind the formal derivation of these early works.

In an early (1963) but often-repeated explication of the Diamond Houses...Hejduk constructs a diagram of the history of architectural space, declaring that the paradigmatic space of the present to be the compression onto a vertical two-dimensional surface of the space generated by the two legs of a right angle. The logic goes something like this: If the primitive condition of architecture is the square, the square is nevertheless generated as the isometric projection of a diamond, making the diamond paradoxically prior to, or more primitive than, the square. Yet if the diamond is understood perceptually as the plan diagram of an architectural space rather than as a two-dimensional graphic shape, then the most fundamental percept of the space of the diamond is another square now locked into the vertical plane, one that results form collapsing the two legs of the diamond's right angle, projected as vertical planes or walls, onto a picture plane.⁹

In this way, Hejduk literally drew the computational process through which space is perceived and constructed. The resulting architectural form is, in itself, a diagram of the computations that allow it to exist as a geometric structure. For this reason, Bruno Reichlin characterized the strength of the Diamond projects as "eminently graphic."¹⁰ According to Reichlin, "the architectural invention springs from a survey brought directly to bear upon the instruments of representation...[making it] difficult to establish what, in the last analysis, the object of research really is."¹¹

Subjective Computation

In Hejduk's later works, the formal and computational modes of thinking become untangled and are allowed to operate as distinct forces in the design. As a result, the diagram for Hejduk's architectural process began to resemble that of Le Corbusier, wherein a number of computational parameters are used to generate a form. However, these computational parameters, which appear first in the Wall Houses, but more explicitly in his architectural masques, do not claim to be objective principles, like Le Corbusier's five points, but fragments of a subjective narrative. In the architectural masques, which are a play on the tradition of the Italian *maschera*, Hejduk mined the cultural ground of several cities and towns, forming fictional narratives of inhabitation that he used to generate a

number of formal interventions. In *Architecture's Desire*, K. Michaels Hays described the playful content of these works.

[T]he masques propose various interacting human inhabitants and architectural characters—architectural troubadours, vagabonds, and itinerants—that travel in caravans from city to city (Berlin, Vladivostok, Lancaster, Hanover), twisting the mundane urbanism of their sites into carnivalesque narrative encounters. The taking of place is the masques' very mode of being.¹²

The subjectivity of the computational parameters, which Hejduk used to generate form, however, presents a number of implications for architectural production. For one, the act of architectural authorship, which might typically be associated with the manipulation of form, is now also projected onto the development of the computational system itself. That is to say, the masques contain two distinct moments of architectural authorship upon which they can be judged: their forms and the constructed narratives that give life to these forms. The masques operate as metacritiques of the architectural process. Through his sketches, texts, and drawings, Hejduk problematized the fracture between computational and formal modes of thought, requiring the viewer to become involved in the masque to point that he or she becomes fractured by its structure. However, in the end, Hejduk offers no solution to this problem; the masques are merely admissions of his awareness of the fracture, not a response to its implications.

ARCHITECTURE IN THE POSTDIGITAL ERA

A decade into the twenty-first century, it is an obvious premise that computers will play an integral role in the architectural process for the foreseeable future. However, given the context established by a review of Le Corbusier and John Hejduk, a second premise should accompany the first: not all applications of architectural computing are created equal. There is fundamental difference between drafting in a three-dimensional modeling program and defining the abstract parameters of a script. The argument could be made that architecture (and presumably other disciplines) is entering a postdigital era, wherein distinctions between analog and digital are no longer as significant as the structural distinctions within each medium. Perhaps architecture will remain a fractured discipline, but this paper asserts that the primary fracture ex-

ists between computational and formal modes of thinking, not between analog and digital methods.

As architectural critics sharpen their tools for dissection in the twenty-first century, it is the architectural process that emerges as this era's critical project. The recent influx of scripting in architecture raises a key question that remains to be answered: How should the architectural forms, which result from the computational scripts, be evaluated? This question, among others, will drive the conversation for the next generation of designers and theorists. However, it is still too early to predict the fate of representation: Will generative design paradigms force drawing into extinction or will computer interfaces be able to merge the roles of drawing and scripting into a single process? Only time will tell.

ENDNOTES

- 1 Robin Evans, "Architectural Projection." *Architecture and Its Image: four centuries of architectural representation: works from the collection of the Canadian Centre for Architecture*, (Montreal: Canadian Centre for Architecture; Cambridge, Mass.: MIT Press, 1989), 21.
- 2 Branko Kolarevic, *Architecture in the Digital Age: Design and Manufacturing*, (New York: Taylor & Francis, 2003), 26.
- 3 Le Corbusier. *Toward an Architecture*, (London: Architectural Press, 1927), 115.
- 4 Beatriz Colomina, *Privacy and Publicity*, (Cambridge: MIT Press, 1996), 84.
- 5 Paul Turner, "Romanticism, Rationalism, and the Domino System." *The Open Hand: Essays on Le Corbusier*, ed. Russell Walden, (Cambridge, Mass.: MIT Press, 1977), 32.
- 6 Peter Eisenman, "Eisenman: Inside Out," (New Haven, CT: Yale University Press, 2004), ix.
- 7 Turner, 35-36.
- 8 Bernhard Schneider, "Perspective Refers to the Viewer, Axonometry Refers to the Object." *Daidalos* no. 1, (Autumn, 1981), 91.
- 9 K. Michael Hays, *Architecture's Desire: Reading the Late Avant-Garde*, (Cambridge, Mass.: MIT Press, 2010), 90.
- 10 Bruno Reichlin, "Reflections Interrelations between Concept, Representation and Built Architecture." *Daidalos* no. 1, (Autumn, 1981), 63.
- 11 Ibid., 66.
- 12 Hays, 109.