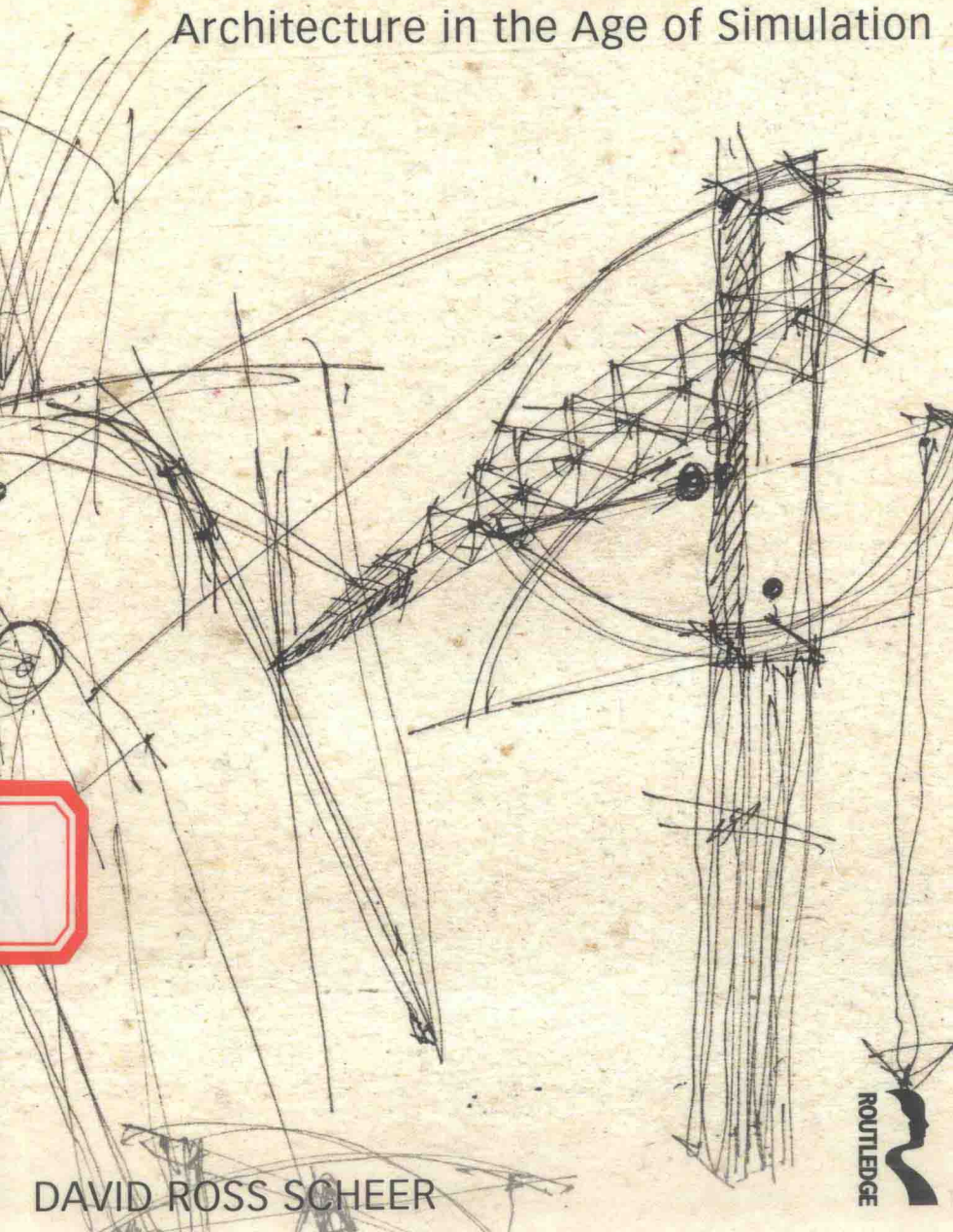


# THE **DEATH** OF DRAWING

Architecture in the Age of Simulation



DAVID ROSS SCHEER

ROUTLEDGE



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Architecture in the Age  
of Simulation

*David Ross Scheer*

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Front cover image, paperback edition: Wesley Taylor, sketch of the "Spirit Bell" (2008). Part of a competition entry for the Contrabands & Freedmen's Cemetery Memorial.

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# THE DEATH OF DRAWING

*The Death of Drawing* explores the causes and effects of the epochal shift from drawing to computation as the chief design and communication medium in architecture. Drawing both framed the thinking of architects and organized the design and construction process to place architects at its center. Its displacement by building information modeling (BIM) and computational design recasts both the terms in which architects think and their role in building production. Author David Ross Scheer explains that, whereas drawing allowed architects to represent ideas in form, BIM and computational design simulate experience, making building behavior or performance the primary object of design.

The author explores many ways in which this displacement is affecting architecture: the dominance of performance criteria in the evaluation of design decisions; the blurring of the separation of design and construction; the undermining of architects' authority over their projects by automated information sharing; the elimination of the human body as the common foundation of design and experience; the transformation of the meaning of geometry when it is performed by computers; the changing nature of design when it requires computation or is done by a digitally-enabled collaboration. Throughout the book, Scheer examines both the theoretical bases and the practical consequences of these changes.

*The Death of Drawing* is a clear-eyed account of the reasons for and consequences of the displacement of drawing by computational media in architecture. Its aim is to give architects the ability to assess the impact of digital media on their own work and to see both the challenges and opportunities of this historic moment in the history of their discipline.

*The Death of Drawing* is accompanied by a blog and forum at DeathOfDrawing.com. The site features the book's illustrations in color and offers interested readers the opportunity to initiate and participate in discussions related to the book.

**David Ross Scheer** received his Master of Architecture degree from Yale University in 1984. He brings a broad background in practice, teaching and research to his thinking about the effects of digital technologies on architecture. He has taught architectural design, history and theory at several schools of architecture around the U.S. and has lectured and written extensively on building information modeling (BIM). He has explored the uses of BIM and other digital technologies in his practice for nearly twenty years. As a longstanding member of the advisory group of the AIA Technology in Architectural Practice Knowledge Community (and its Chair in 2012), Mr. Scheer has gained a broad awareness of the evolving uses and effects of BIM and computation throughout the building industry.



Frontispiece, Karl Friedrich Schinkel, "Die Erfindung der Zeichenkunst" ("The Origin of Draftsmanship," 1830). This painting depicts a story by Pliny the Elder about a girl named Diboutades who traces the shadow of her departing lover as a keepsake. This story has been taken up by many painters as an allegory for the origin of painting. In Schinkel's interpretation, however, it is used to describe the nature of architectural drafting. As Robin Evans points out in *The Projective Cast*, at least three features indicate this. First, the light is that of the sun which casts parallel rays, making the shadow an orthographic projection. Second, there are no buildings in Schinkel's painting, indicating that drawing must precede building. Finally, Diboutades is not making the drawing, but directing someone else, reflecting the distinction between the vision of the architect and its translation into drawing.

Source: Image courtesy of von der Heydt Museum, Wuppertal.

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"Lotus 7.0": Studio Roosegaarde.

"Minimal Complexity": Vlad Tenu.



“Galapagos”: John Locke.

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# INTRODUCTION

I

Like many architects, my enjoyment of drawing played a large part in my choice of career. I like the feel of a soft pencil on good sketch paper, like the texture of finely ground coffee between my fingers. I like watching and feeling my hand find a form on paper I hardly knew I had in my mind. I even like the laborious process of making presentation and working drawings, the slow, fastidious accretion of marks that leads to a supremely satisfying result. In architecture school, I studied the drawings of architects past and present, and came to feel that I understood them by the way they drew. I embraced the idea that my drawings should demonstrate the qualities I wanted my buildings to have. And I earned my living for several years by my skill as a draftsman, of which I was quite proud. Years later, when I started my own firm, I surrounded myself with people who drew well and resisted CAD as long as I could. When I finally decided I could hold out no longer, I shopped around and found something cool and (at the time) unique: a computer program that would allow us to create “three-dimensional” models and then produce drawings by “cutting” them. The term did not exist at the time, but I had discovered building information modeling, or BIM. BIM allowed my small firm to do more and larger projects than would have been possible with CAD, let

alone hand-drafting. We made fewer mistakes because the drawings were automatically coordinated. And we had some kind of fun watching our projects develop in 3-D.

Fast forward 16 years: BIM is being widely adopted throughout the building industry. Our world is being turned upside down as BIM and other digital technologies transform the professional landscape. Younger architects and students immerse themselves in virtual worlds and few learn to draw as I did. Older architects struggle to understand how best to use these technologies and keep their firms competitive. Our profession is changing dramatically even as we go about our daily work. Things are changing so fast that few architects have time to reflect on what, exactly, is going on. Based on my experience using and teaching these technologies, and taking part in discussions about them with building professionals and technologists from all over the world, I believe that we are in the midst of a transformation that will ultimately reshape architecture to an extent not seen in over 500 years. This experience has also shown me that very few architects appreciate the magnitude of this sea change. These technologies are not “another pencil;” they are both evidence and agents of fundamental changes in the nature of architecture. These changes reflect the incorporation of architecture and the building industry as a whole into a pervasive social and cultural movement towards virtualization and predictive control through digital simulation. Architects need to understand why this is happening and its effects on how we think and work if we want to continue shape the design of the built environment. This, in a nutshell, is the purpose of this book.

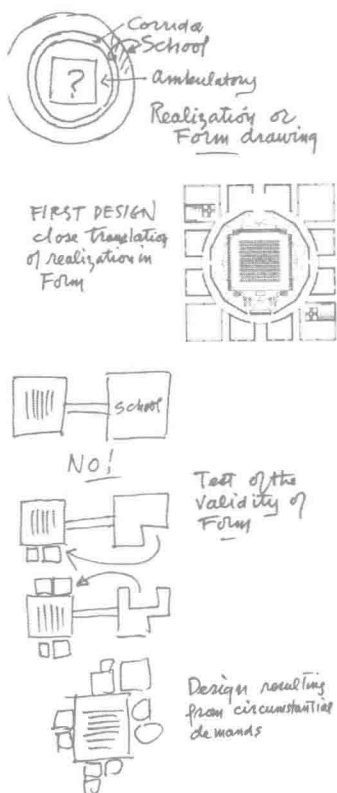
## II

The modern profession of architecture was invented during the Renaissance, due largely to Leon Battista Alberti and his epochal book *De Re Aedificatoria* (*On Building*). The revolutionary idea at the heart of this book was that the architect’s role is to design, not to build. Architecture became a purely intellectual endeavor and the architect’s proper domain of knowledge was what we would call theory: the reasons *why* buildings should be designed in certain ways. Furthermore, following Aristotle, Alberti deemed this knowledge of “why” to be superior to the builder’s knowledge of “how,” placing the architect above the builder as the true author of a building. Drawing became essential to architecture

as the expression of architectural ideas, the architect's work product and the link between thought, design and construction.

Drawing in architecture has two essential aspects: as medium and as craft. As a medium, it provides the basis for both architectural ideation and signification. Representing three spatial dimensions by two requires the architect to establish an imaginative connection between a drawing and the building it represents. This ability takes years to develop. Drawing provides the structure for the architect's thought, as vague ideas begin to take shape on the page. It can do this in a practically infinite number of ways, and the architect can choose among various types of drawing and different media to develop a particular idea. It is in this imaginative space between idea and drawing that design truly takes place. This space allows the idea and its visible representation to exist separately. It makes of the drawing a cloudy reflection of the idea, while the idea begins to take visible form in the drawing, which it must in order to become building. The work of design is to refine an idea by seeing what visible forms it gives rise to and allowing these forms to shape the idea so that it can more fully inform the design. Louis Kahn expressed this process well in his notions of form and design.<sup>1</sup> Form was his term for the ideal order that structures the building. Design denoted the visible manifestation of the form, modified by practical demands. Kahn allowed that a form could be modified to accommodate these demands, but only up to a point. If the distortion of the form became so severe that it obscured the form, then it was necessary to find a new form (Figure I.1). Form and design meet in drawing where an abstract idea about space encounters the realities that begin to turn it into the plan of a building. Drawing has the capacity to represent both idea and plan and so allow interplay between them. It thus becomes an essential tool for architectural thought. Drawing influences architectural thinking in several important ways.

Drawing trains the architect to think in *representational* terms. The marks on the sheet stand for something else, and the qualities of the marks exert a reciprocal effect on what is represented. In this sense, learning to draw teaches the architect how buildings acquire meaning. In learning to draw, the architect learns how representation works and gains direct experience of the interplay between an idea and its visible expression. Buildings so conceived are representations of the architect's ideas. Building is of course a very different medium than drawing, but it also involves the representation of ideas by visible forms. As architects gain



**FIGURE 1.1** Louis I. Kahn, plan diagrams and floor plan for the First Unitarian Church and School (1959). Kahn's initial, highly ideal, plan (top) evolves through a series of diagrams into a quasi-binuclear diagram that better accommodates the program. For Kahn, the form must accommodate the building's functional requirements without losing its integrity, or a new form must be found.

Source: Louis I. Kahn Collection, The University of Pennsylvania and the Pennsylvania Historical and Museum Commission.

experience in seeing ideas realized in buildings, they learn how buildings represent and this affects their drawing practice. Their drawings come to represent ideas that are capable of expression in building, creating an ever stronger tie between drawing and building.

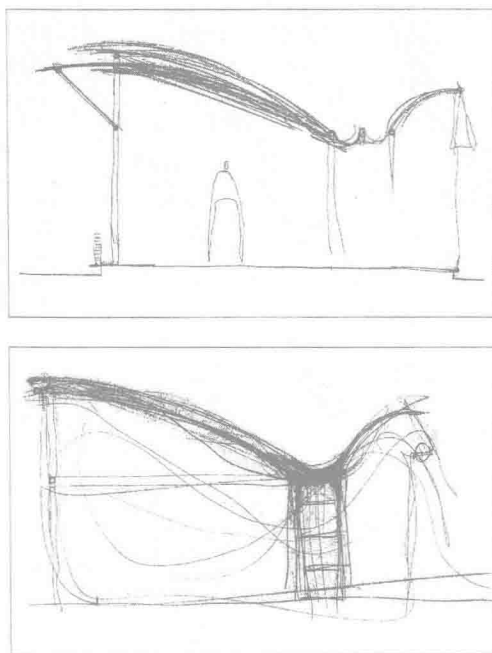
Of all the aspects of a building, drawing emphasizes its form by its very nature. Architectural drawing was developed for the specific purpose of communicating a building's form to its builders.<sup>2</sup> Alberti believed that properly architectural knowledge concerned the means of arriving at the building's form. At the time, building construction involved a very limited palette of materials which the architect could rely on builders to understand. However, the architect not only did not need to tell the builders how to build the design, it was not his job—form was the primary object of his study and the result of his work. Over time, drawing has been adapted to changing conditions of building. New building materials and increasingly sophisticated technical systems obliged architects to include more information in their drawings, much of it in non-graphic form. The modern practice of detailing evolved as construction became more complex and builders needed more specific direction to carry out a piece of construction. These changes in construction technology have

gradually enlarged the scope of the architect's responsibility. In spite of these developments, form has remained the architect's chief concern. Proof of this can be found in architectural magazines—the buildings featured there are nearly always remarkable for their form. This privileging of form in architecture has its historical basis in the Renaissance and the medium of drawing has been the key to its perpetuation.

The medium of drawing structures the modern building industry. As a medium of communication, drawing can communicate form very well once certain conventions are understood. On the other hand, only a small fraction of a building can be shown in a drawing set of reasonable size, so drawing places a premium on typical or repeated construction existing in many places in the building. This was not a significant limitation when building designs had a high degree of symmetry and construction methods were fairly constant from building to building. Now that asymmetry is the rule and each building can involve a unique set of construction methods, drawing effectively limits the variety of conditions a building can encompass. To mitigate this limitation, conventions have developed in the building industry governing what information is provided by designers and contractors respectively. These conventions allow designers to limit the amount of information contained in their drawings and rely on contractors to supply the rest. Thus, Alberti's separation of design from construction has been maintained in principle, although the purview of each has changed and expanded. The medium of drawing, originally adopted for its ability to describe form, must now be stretched to contain more types of information. However, the qualities of drawing as a medium still affect what and how much information the architect can provide to builders.

Whereas the medium of drawing has conspired in the separation of the intellectual from the physical aspects of building, the craft of drawing serves to unite them. Drawing is the skill which is the foundation of the craft of architecture.<sup>3</sup> Craftsmanship is essential to the work of the architect. To achieve the high levels of creativity and quality necessary for good architecture, the motivation to work can only come from an interior impulse, a personal satisfaction gained by doing good work. The work must be its own reward and the worker thoroughly engaged in the work.<sup>4</sup> This is the essence of craftsmanship. It is a shared sense of craftsmanship that underlies the profession of architecture.

The craft of drawing has traditionally been the hallmark of the architect. Involving as it does the mind, the eye and the hand, it builds understanding of its object on several levels. An idea that originates in the mind is expressed by the hand in such a way that the visible result is the product of both thought and action. The eye guides the hand, but the hand has, as it were, a mind of its own. The drawn form begins to acquire meaning through the body, as the building eventually must. As Juhani Pallasmaa writes, “[S]ketching and drawing are spatial and haptic exercises that fuse the external reality of space and matter and the internal reality of perception.”<sup>5</sup> Sketching is especially important in this regard. Its inherent imprecision and immediacy allow thought to occur in real time as the hand seeks a shape that corresponds to an idea in the mind (Figure I.2). A unique kind of thought occurs while sketching. It may even be that the tactile experience of drawing gives the architect greater understanding of the architectural experience of what he is creating: “[t]ouch is the unconsciousness of vision, and this hidden tactile experience determines the sensuous qualities of the perceived object.”<sup>6</sup>



**FIGURE I.2**

Glenn Murcutt, sketches for the roof of the Magny House (1982–84). The architect’s hand and eye search for a form.

Source: Glenn Murcutt. Courtesy of Architecture Foundation Australia.



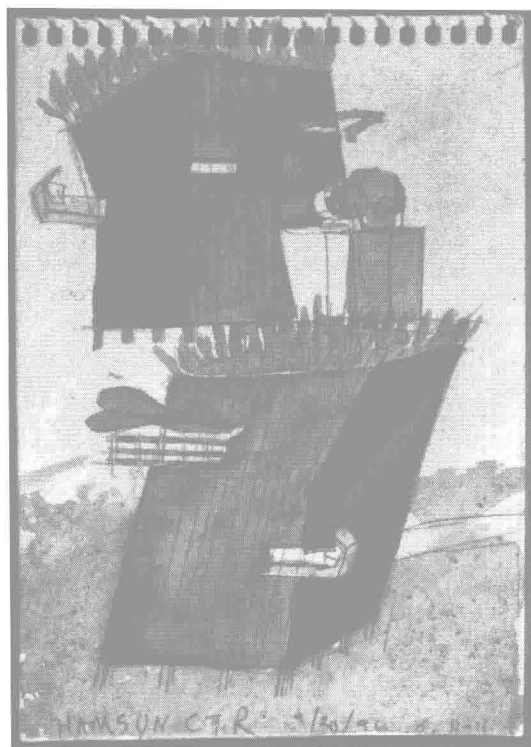


FIGURE I.3 Steven Holl, watercolor sketch for the Knut Hamsun Center (1996). The choice of media for this sketch captures a quality of irregularity the architect wishes the building to have.

Source: © Steven Holl.

Furthermore, the hand is engaged with the physical media of pencil and paper and its action is conditioned by the qualities of those media. The architect's experience with the difficulties of getting pencil and paper to obey his wishes produces an understanding of how materials shape the ideas they are called upon to express. This encounter with drawing materials can be seen as a prelude to later encounters with building materials (Figure I.3). It teaches the architect to work with materials, to respect their qualities in finding a form rather than imposing one on them. "The work of the craftsman implies collaboration with his material. Instead of imposing a preconceived idea or shape, he needs to listen to his material."<sup>7</sup>