

Hinging

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Knowledge offered in advance of any attempt to apply it cannot find a conceptual schema in the student's mind in which to reside, for the required schema can only be developed while struggling with a particular problem...the two sides of knowledge acquisition and application must be attacked simultaneously.¹

—Mark Gelernter

Neither solely static element nor solely dynamic mechanism, *hinging* is the ultimate ground in that it accommodates both arrest and movement. Just as the physically reversing mechanism of literal hinging overcame the static nature of the enclosing wall, so too does figurative hinging, which is a conceptual artifice of adjustment, enliven site and use, which are the more static elements of architecture.²

—Stephen Kieran and James Timberlake
MANUAL: The Architecture of Kieran Timberlake

This paper describes an introductory course in Building Information Modeling for fourth and fifth year architecture students, a course that seeks to develop, as well as critique, an alternate model for BIM courses in design programs. Rather than focusing on the mastery of computer skills, the course is devoted to the general consideration of the nature of design process in architecture and, in particular, to the investigation of the question “How can *Revit* support and enhance the compelling model of design process described in Stephen Kieran and James Timberlake’s *MANUAL?*”

What is required is an approach to teaching courses on topics in digital technology, visualization and representation to design students that pushes to the foreground those models of process in which the final result is not preconceived. And, for an introductory course in *Revit*, Kieran and Timberlake’s compelling proposition for a way of working based on the dialectical relationship between making and reflecting suggests a powerful pedagogical framework.

Building Information Modeling

At first glance, the images generated by Building Information Modeling software, e.g., floorplans and sections, axonometrics, and perspectives, appear similar to the drawings generated by a host of two and three dimensional modeling software products in widespread use in practice and academia, and one might erroneously conclude that BIM is simply a more refined, as well as more robust, version of those other programs. In fact, the revolutionary nature of BIM software is that it organizes the information describing a building is a series of databases that may be used in a

variety of ways: information in the databases includes properties related to materials, construction assemblies, structural and thermal performance, energy use, daylighting, and a multitude of other attributes. Thus, BIM becomes a powerful means for coordination and collaboration, for testing and analysis, for materials takeoffs, cost estimating, scheduling, structural and environmental analysis, energy performance monitoring, the development and management of furniture and equipment schedules and deliveries, prototype design, digital fabrication, and post-occupancy facility management and maintenance.

The significance of the impact of Building Information Modeling software on the practice of architecture over the next decade cannot be underestimated. In May 2005, Skidmore, Owings & Merrill announced that it would use Autodesk *Revit*, Autodesk's BIM platform, for the design and documentation of the proposed Freedom Tower on the former World Trade Center site. The design team—architects, consultants, and project engineers—collaborated using *Revit*. In addition to SOM, early adopters of *Revit* include a number of internationally known architecture firms, e.g., Arup, *Morphosis*, HOK, KieranTimberlake and DMJM. And, in May 2007, Autodesk reported that it had sold more than 200,000 seats of its *Revit* software platform, a 100% increase in seats over the previous year.

An apt illustration of the potential and the profound influence of BIM on contemporary practice is the list of projects recognized in recent design awards programs. In March 2007, The AIA recognized nine projects in its third annual Building Information Model Awards: the projects ranged from a single-family residence made entirely of prefabricated components constructed off-site (the *Loblolly House* by KieranTimberlake) to a large hospital complex currently under construction in London (*Royal London Hospital* by HOK and Skanska) to a lab facility at the University of Washington honored for using BIM to resolve building system conflicts *prior* to construction (*Benjamin D. Hall Interdisciplinary Research Building* by M. A. Mortenson).

MANUAL: The Architecture of KieranTimberlake

On reading *MANUAL*, one is struck by, on the one hand, the rigor of the book's organization and the consistency of the presentation of material in support of the authors' thesis and, on the other hand, by the beauty and expressiveness of the projects themselves, a quality that contradicts the implications of the monograph's title. These works are not the final step of a linear process, not the result of a set of instructions in the tradition of recipes or pattern books or technical specifications, not the end-product of a formula for a normative "successful design practice." These are projects that are poetic, expressive, conceptually dense, and multivalent.

Stephen Kieran and James Timberlake met while students in the graduate program in architecture at the University of Pennsylvania. Each is a recipient of the Rome Prize, Kieran in 1981 and Timberlake in 1983. The pair founded KieranTimberlake Associates LLP, located in Philadelphia, in 1984. Over a period of two decades, the firm has been recognized for design excellence in over 40 design awards programs, including two Gold Medals and two Distinguished Building Awards from the American Institute of Architects. Notable projects include the *Berkeley College Renovation* (Yale University), *Levine Hall* (University of Pennsylvania), the *Middle School Addition and Renovation* (Sidwell Friends School), and the *Loblolly House*.

MANUAL: The Architecture of KieranTimberlake was published in 2002, and offers a compelling portrait of some of the activities of the firm between 1987 and 2002: 29 projects, representing a wide range of program types, are described and discussed. The built work presented in Stephen

Kieran and James Timberlake's monograph is not organized, as one might expect, chronologically or by project type. Rather, Kieran and Timberlake use design projects to support a discussion of design activities and processes ("useful tactics") based on ten gerunds—operations or actions—Framing, Hinging, Joining, Lining, Patching, Profiling, Scaling, Selecting, Slipping, and Weaving. The authors state that gerunds are ambiguous, i.e., they are both noun and verb, infer stability as well as process, and are "at once simple and complex"; like gerunds, "aspects of buildings are similarly compound."³

Developing the important analogy between buildings and gerunds further, the authors identify building crafts, the repository of skill and tradition, as "the stable foundations" of architecture while technology and composition are the mutable and dynamic components. Building technology and assembly ("composition"), from the small scale of construction details to the much larger scale of site and context, progress in concert with *both* work ("artifacts") and reflection on the work.

Kieran and Timberlake set forth three important propositions that frame the discussion of "useful tactics" and the corresponding aspects of the projects illustrated in the monograph:

- First, the abstract model of architecture described by Kieran and Timberlake synthesizes two previous models. The first is Leon Battista Alberti's conception, in the prologue to *On the Art of Building*, of an architecture where material and design ideas are "mediated by the skilled craftsman."⁴ The second is Le Corbusier's definition of Architecture as the "masterly, correct, and magnificent arrangement of volumes brought together in light," an architecture based on assembly, composition, and principles, an architecture to be savored and experienced. Kieran and Timberlake's description of the essential nature of architecture and the process of design reverberates with echoes of those two familiar strains, the first emphasizing the relationship between architecture as a physical presence shaped by ideas and the second calling attention to architecture as an ordered arrangement to be experienced emotionally and spiritually as well as intellectually.
- Second, the design process is best understood as "an incomplete, open-ended venture."⁵ The particular nature of investigation in the discipline of architecture simultaneously illustrates architecture's affinities with the arts and sciences while distinguishing architecture from related fields: as Michael Graves has observed, the language of architecture demands consideration of both standard and poetic forms.⁶ The two forms, the first internal to building and responsive to technological and pragmatic requirements as well as the laws of statics, is complemented by a second form, external to building and responsive to the intangibles of culture, myth, and ritual.

MANUAL, rather than a mere compendium of projects, is an extended rumination on an open-ended design process and, as such, is a critique of those professional and academic models of design process where the outcome is preconceived. Alberto Pérez-Gómez, in his "Introduction" to *MANUAL*, notes the important distinction between the Aristotelian approach adopted by Kieran and Timberlake where "appropriate categories are discovered empirically and evolve from the bottom up" and a Platonic approach "dominated by preconceived ideas."⁷

- Third, Kieran and Timberlake offer a compelling description of a model of architecture where physical artifacts are inseparable from ideas and intent. The authors write:

To make an artifact requires conscious choice, and no artifact is formed without some degree of both aesthetic and technical intent. ⁸

The act of thoughtful making as part of the larger design process—an act that requires aesthetic as well as technical knowledge, awareness, and conscious choices—reveals new knowledge and suggests new ideas; furthermore, “an intense alertness is demanded in order to identify the spark that can be elaborated as a poetic strategy.” ⁹

Investigation + Discovery + Investigation

Kieran and Timberlake write that “Architecture is formed with materials; ideas are formed with words.” ¹⁰ The authors describe an iterative design process alternating between making and reflection, an exchange where each new work prompts a set of questions and each new question is investigated by developing new proposals. This is far more difficult than it sounds—the formulation of good questions and thoughtful responses is no easy task—and requires the development of good and effective mental habits.

Annie Dillard’s remarkable book *The Writing Life* opens with the following observation on the difficulties of extended reflection:

When you write, you lay out a line of words. The line of words is a miner’s pick, a woodcarver’s gouge, a surgeon’s probe. You wield it, and it digs a path you follow. Soon you find yourself deep in new territory. Is it a dead end, or have you located the real subject? You will know tomorrow, or this time next year.¹¹

Words on paper—thoughts, half-formed questions, outlines, descriptions, the glimmerings of ideas, reflections, arguments, and tentative theses—are an investigatory tool, a means of exploration as well as assessment. Dillard’s insightful commentary on the nature of writing and the potential for new discoveries as well as the dead ends, the fragile nature of the work, the underlying uncertainty of the writer’s journey, and the daunting prospects for failure recall the words of another author, Ernest Hemingway. Hemingway, describing the challenge of beginning a writing project and the contemplation of the first blank piece of paper in the typewriter, wrote “It is facing the white bull which is paper with no words on it.” One observes that the process of writing and the process of design are very similar: When you *design*, you make a set of marks. The marks are a miner’s pick, a woodcarver’s gouge, a surgeon’s probe—

It is evident that, from the standpoint of pedagogy, one of the instructor’s challenges is to promote an approach that emphasizes the investigatory nature of the design process rather than movement toward a preconceived or highly predictable result. But perhaps the biggest challenge is to establish and promote a vibrant culture of strong critical judgment, one in which students (a) become familiar with a variety of “models of design process” that, initially, can be adopted and, later, adapted; and (b) are encouraged to assess and evaluate using a variety of standards and critical stances whose strengths and weaknesses are made explicit. Such a culture lays the foundation for the good and effective mental habits mentioned previously. Clearly, the design investigator who survives the initial encounters with Hemingway’s notorious white bull must maintain an ability to look critically at his or her work at every phase of the investigation, must

remain open to new possibilities and alternatives for developing a project, and must think creatively, abstractly, intuitively and synthetically as well as analytically and rationally.

In the absence of a more clearly described methodology or more precisely drawn boundaries, however, the superb conversation where design questions and design responses inform one another quickly lapses into silence. A more focused investigation is prompted by Kieran and Timberlake's discussion of intent and by consideration of the phrase "thoughtful making" in the context of normative construction assemblies and craft traditions. "Techne is the Greek word for technology; it means 'the art of making,'" writes Gevork Hartoonian in *Ontology of Construction* [Gr.: *techné*: art, craft, skill; *logos*: speech, word, reason]. Carl Mitcham, in *Philosophy and Technology*, offers a more detailed history of the term "technology" and its kinship with the Greek *tékton* ("carpenter" or "builder"), and the Latin *texere* ("to weave") and *tegere* ("to cover"). Mitcham states that, for Aristotle, "Techne is not strictly activity, but it is a capacity for action, founded in a special kind of knowledge." Marco Frascari, in his seminal discussion of architectural details and the process of signification ("The Tell-the-Tale Detail"), notes that technology possesses a "double-faced presence as 'techné of logos' and 'logos of techné'." And so, in reflecting on a model of design process based on considerations of materials, assembly, technology and intent, one faces a most significant question: Is the focus of such an investigation the logic (or 'reasoning about' or 'order') of the art of making—also called "construction"—or is one better served by an intensive investigation of the 'art of making or building a constructional logic or order' ["construing" or "interpreting"]?

An Alternate Pedagogical Model for Introductory Courses in Digital Technology

Critics of introductory computer modeling courses in professional design programs are quick to note that such courses present tools, operations, and procedures but often without the concurrent consideration and development of critical judgment. In addition, the presentation of a conceptual framework for understanding the effective use or potential of modeling software or the biases, explicit or implicit, of the tools, operations, and procedures is absent in such courses. And, while graphic software typically increases at least one sort of making, it often seems to come at the cost of the diminution of thinking and awareness. Over the past fifteen years, the emphasis on utility, on the use of the toolset, has reinforced the perception that the goal of constructing a digital model is simply to depict what has already been determined. However, far more beneficial in the context of design education is an appreciation and understanding that the digital model is a *work-in-progress*, a thing to be tested, modified, and assessed through a range of critical filters.

While I have extensive experience teaching required courses covering a range of modeling software, this was my first foray into an introductory course in *Revit*. The semester long course was divided into four phases of different durations. The first three weeks of the semester were devoted to completion of the introductory tutorial on the *Revit Architecture* website as well as a number of short exercises based on material presented in *Mastering Autodesk Revit Building* by Paul Aubin. In addition, each member of the class read and discussed Kieran and Timberlake's *MANUAL*. As part of the initial series of class discussions, students were asked to identify works by other architects that reinforce and extend the discussion of gerunds as useful design tactics.

The second phase of the course focused on an abandoned and decaying industrial building on West Jackson Street in downtown Knoxville: a slot site with party walls at the sides and rear, an irregularly shaped lot, and a (nearly) symmetrical street façade that faced north. The students were asked to construct a digital model of the single story masonry building, with an emphasis on

accurately documenting and representing existing conditions: building components, assemblies, and joint conditions of a variety of types and scales, e.g., material changes, supports for structural members, connections between floor and wall and wall and roof, and window and door openings. In particular, the students were asked to represent those conditions that were distinctive, idiosyncratic, inexplicable, or unexpected: e.g., a metal roof scupper hanging precariously from the façade, a distinctive pattern of cracks in the floor slab, a steel bar and hooks fastened high on an interior wall, and a pair of bollards flanking the main door. An approximate digital model of the existing building can be built using the standard construction assemblies found in *Revit Architecture* but the emphasis to depict the distinctive conditions served two important goals: first, the students, to a greater or lesser degree, honed their *Revit* skills by constructing custom digital building parts and assemblies and, second, in several of the most intriguing projects discussed in *MANUAL*, the design spark, the poetic strategy, was based on unusual or idiosyncratic conditions or relationships—and often constituted a response to questions on the expectations and nature of thoughtful making.

In the third phase of the course, each student was asked to develop a proposal for renovating the building based on a design brief that set forth programmatic requirements for a downtown studio and exhibition space for the College of Architecture and Design and local design professionals. Furthermore, each member of the class was encouraged to select and investigate two of the gerunds described in *MANUAL* and asked to demonstrate how an initial response to program and site might be re-framed by Kieran and Timberlake's "useful tactics." Over the course of several weeks, the proposals were discussed, assessed, tested, and modified in a series of individual discussions, informal group critiques, formal interim reviews, and writing assignments that each aimed at formulating and clarifying a set of questions that were subsequently "answered" in the form of new representations of the design proposal. Studies and analyses used *Revit* as a vehicle for visualization, modeling and testing.

In the fourth and final phase of the course, each *Revit* model was analyzed for daylighting efficiency using a third-party software product, *EcoTect*. Each student was asked to modify his or her design proposal with the goal of improving daylighting efficiency based on the effective use of daylight to augment or replace artificial light sources, but without diluting or undermining either conceptual clarity or the expressive potential of the proposal. Student responses ranged from minor modifications to the design to at least one scheme that was a radical departure from previous schemes. Each modified design was retested and the results compared to the first series of tests. The final review for the course was structured to focus discussion on design process and approaches to investigation rather than products.

Hinging

Kieran and Timberlake describe the gerund *Hinging* in terms of opposed ideas of movement and stasis as well as opposed conditions of open and closed, and seek to foster an appreciation of both the literal and figurative understandings of the term. *Hinging* is most familiar as a mechanical device, a means for transforming a static architectural element, a wall, to a dynamic element that simultaneously separates and joins adjacent spaces. Furthermore, the degree of openness or closed-ness of a door or panel in a threshold or aperture, and the corresponding degree of separation or connection between spaces on opposite sides of the wall, can be adjusted as desired. At the level of figurative speech and thought, *Hinging* is also a means of adjustment, a device for modifying, mediating and focusing. Here *Hinging* is about conceptual pivoting or swinging, about orientation and alignment as well as

clarification and hierarchy. As a conceptual device, *Hinging* in architectural design holds the potential to “enliven site and use,..the more static elements of architecture.”¹²

Kieran and Timberlake support the discussion of *Hinging* with a number of projects, notably a 1995 interior renovation of the Esther Boyer College of Music (“Rock Hall”) at Temple University. Here a suspended wood paneled ceiling and its void hinges modulate and enhance the spatial, acoustical, and visual properties of a new recital room. The irregularly shaped and angled wood panels of the ceiling are not physically connected, but are linked in at least three ways: first, by the large void hinges between the panels, hinges whose presence is made legible by the suggestion of large-scale folds, second, by the careful alignment of a secondary orthogonal grid of metal fins on the ceiling panels, and third, by the careful delineation of a rectilinear spatial volume that nearly fills the lower portion of the recital room, a volume that seems to support the floating panels above in a contemporary manifestation of Laugier’s *Primitive Hut*. *Hinging*, assert Kieran and Timberlake, is “the ultimate gerund.”¹³

The activities of an introductory course in *Revit* based on the model described by Kieran and Timberlake were described previously. The course pedagogy aimed to offer an alternative to the way that courses in digital technology have often been taught: in this instance, a primary strategy was to focus on the development of critical judgment rather than the mastery of toolsets. A primary goal was the development and testing of a pedagogic model that not only celebrated, but directly reflected, the model of investigation described by Kieran and Timberlake, an iterative process of work and reflection within a framework neither limiting nor boundless. Specifically, the pedagogic model relied heavily on the description of *Hinging* for inspiration as well as clarification.

Like the figurative and literal meanings of *Hinging* in the context of design, the operations of literal and figurative *Hinging* in pedagogy are related but distinctly different. If *Hinging*, in the most literal sense of that term, is a device for defining, transforming and adjusting within a clearly established range or set of boundaries, then those materials which define and adjust a subject of study over the course of a semester—a semester schedule, assigned readings, assignment statements, selected readings, and the detailed description of the topics to be covered in the course as set forth in the course syllabus—may be provisionally accepted as the stuff of literal *Hinging*. These are the materials that describe the content of the course, sequence, boundaries, emphases, procedures, course resources, and the duration and intensity of the presentation, consideration and exploration of each topic. Not only can these components be modified, but there is little doubt that different instructors will adjust the components of a given course in different ways. Figurative *Hinging*, in the context of pedagogy, is also about adjustment and modification, but here the adjustments aims at conditions of alignment, orientation, connection and focus in the service of understanding, revelation, and critical judgment.

¹ Mark Gelernter, “Reconciling Lectures and Studios,” *Journal of Architectural Education* (Cambridge: MIT Press Journals, Winter 1988), p. 49.

² Stephen Kieran and James Timberlake, *MANUAL: The Architecture of KieranTimberlake* (New York: Princeton Architectural Press, 2002), p. 34.

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- ³ *MANUAL*, p. 10.
- ⁴ Leon Battista Alberti, *On the Art of Building in Ten Books* (Cambridge, the MIT Press, 1988), p. 422-423.
- ⁵ *MANUAL*, p. 10.
- ⁶ Michael Graves, "The Case for Figurative Architecture," in *Michael Graves: Buildings and Projects, 1966-1981*, ed. Wheeler, Arnell, and Bickford (New York: Rizzoli International, 1982), p. 11-13.
- ⁷ Alberto Pèrez-Gòmez, "Introduction" to *MANUAL: The Architecture of KieranTimberlake* by Stephen Kieran and James Timberlake (New York: Princeton Architectural Press, 2002), p. 7.
- ⁸ *MANUAL*, p. 10.
- ⁹ Alberto Pèrez-Gòmez, "Introduction," p. 7.
- ¹⁰ *MANUAL*, p. 10.
- ¹¹ Annie Dillard, *The Writing Life* (New York: HarperPerennial, 1990), p. 3.
- ¹² *MANUAL*, p. 35.
- ¹³ *MANUAL*, p. 35.