Architecture's Digital Model Problems

As the Albertian adage goes, architects do not make buildings; they make representations of buildings. Increasingly, strange conundrums are creeping up that may ask architects to reconsider some of the assumptions underlying this paradigm, and at their center lies the introduction of the digital model.

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The digital model situates itself in a gulf it has opened between conception and representation, suggesting a slew of changes to the nature of drawing, construction, and communication in architecture. Although we could say that Alberti's adage continues unabated, it goes without saying that some problems are quickly adding cracks in the transmission of an architectural idea to its representation then to building.

The following problems delineate some conceptual questions that digital models pose for architecture. They do not assemble an exhaustive list nor are their descriptions deeply penetrating, but serve more to suggest some areas for architects and scholars to expand as disciplinary knowledge. It is my assumption that some, if not all of these problems, may exhaust themselves over time and be replaced by others. In their current form, these problems assume that digital models exist in transmittable computer files, are displayed on a flat computer screen, operate with a keyboard and a mouse, are programmed by someone other than the architect themselves, simulate an infinitely large three-dimensional and full-scale environment, and must somehow be interpreted to make architectural drawings and physical models. I have no doubt these parameters will change over time and pose other problems instead.

THE PROBLEM OF DOUBLED *REVERSE DIRECTIONALITY*

When describing Karl Schinkel's 1830 painting *The Origin of Painting*, Robin Evans points out that unlike most painters' interpretation of Pliny the Elder's story, Schinkel's painting suggests that drawings are created *before* subject matter, or in our case, before building. This condition of drawing – that it exists before real things – is reversed in painting, where drawing follows nature, a principle of drawing that Evans terms *reverse directionality*.[1] Architecture is conceived in the drawing, which instructs building. And, if it so pleases, that building can then be the subject for the painter of another drawing.

But don't architects who conceive their work in digital models make drawings after they make the model? Caught somewhere between a sketch, a working space, and a simulation, this digital model arrives before drawing, as a kind of proto-medium. In this method, architecture is conceived in the digital model, then translated into drawing and lastly into building. It's like making a plan for a plan.

This suggests that it is possible, for instance, to read a plan both as a building proposition and as the trace of a digital model, in which case there are two forms of *reverse directionality* at play. The first is Evans's drawing-to-building and nature-to-drawing. As long as plans, sections, or even renderings retain their disciplinary value, this relationship will stay intact. But we might also consider the drawing as an intermediary between digital model and building, in which case we would describe the second *reverse directionality* as digital model-to-drawing and drawing-to-digital model.

If digital drawings are one step removed from the initial site of architectural thought, then they aren't the original documentation of an idea but could be considered documentation of a model. And so these drawings act as a doubled two-way mirror, reflecting both the building and the digital model simultaneously, while allowing information from one end to pass through to the other. The Problem of Doubled *Reverse Directionality* suggests that the digital model displaces drawing; one form of knowledge (ideas *directly* represented through manual drafting) is substituted for another (ideas *indirectly* represented in drawings of a digital model).

A STANDARD PROBLEM

> "The potential unlocked by the computer age only underscores our need for a resource like *Graphic Standards*. When all things are possible, we need to know what things are best."[2]
>
> - Robert Ivy

> "I even understand that it is in digital form on CD-ROM located in the back cover of this book. What's next, a *Graphic Standards* website?"[3]
>
> - Philip Johnson

Fifteen years after Philip Johnson's useful suggestion, there still isn't a *Graphic Standards* website, at least not one where we can download or even browse its content. Instead, there are websites like Turbosquid or Google Warehouse, offering a plethora of amateur digital models, ranging from a standard door to a standard bathroom to Mickey Mouse to Johnson's own Glass House. These sites provide readymade models that are fodder for any interested party; their architectural analog may be the default windows, doors, and walls of Building Information Modeling software such as Revit commonly used by architects. Yet neither rises to the level of a standard, or what Robert Ivy suggests as best practice. The readymade and the default, defined by their accessibility to the layperson audience, stand at odds with the professional standard bearer. Yet they

provide a resource that fully operates in a digital, non-hierarchical, and simulated world. *Graphic Standards*, on the other hand, remains a printed book solely related to architectural drawing.

If one property of digital information is its universal accessibility and another its ease of creation, then an expert set of standards seems to stand against all things digital. Yet architecture operates through standards: drawing standards, construction standards, specifications, office standards, archival standards, professional licensure, and on. Some standards are legislated; some are thought to be best practices. The architect's adherence to or rejection of standards is not at issue here: their existence continues to delineate an outline of the profession and even of the discipline. Today, many of these standards may be under assault from the introduction of non-hierarchical digital communication. In the face of digital changes, how should we conceptualize the effects of a different understanding of standards on architectural production?

Drawing practices are one place to examine the digital impact on the standards of architecture. As the Problem of Doubled *Reverse Directionality* points out, the digital model is preconscious to drawing. If *Graphic Standards* provides conventions to drawing, then perhaps one may arise for digital modeling as well. Much like the downloadable readymade, digital modeling software like Rhino or Maya includes readymade geometries, often termed *primitives*, that typically begin the modeling process. The digital primitive is more than a default in that its use is the first step before modification toward a more specific form. Even those architects whom write their own scripts within digital modeling software at some point make a choice that associates geometry to the script. In either case, primitive or script, the code that determines the original geometry biases possibilities thereafter (this bias is acutely present in the difference between NURBS-based modeling and polygonal modeling, for example). Out of these biases, some customs and habits have emerged towards best practices, efficiencies, and effects. For the most part they are wholly technical rather than conceptual, but they do offer a set of guidelines that acknowledges the algorithms coded into software while establishing conventions. The possibility for conventions exists within the digital model, yet there is not yet a set of standards associated with the model's translation to drawing, or for its concern of material, construction, and space planning. Modeling conventions are only one form of the changing measurement of standards in the digital age, yet they point to the possibility for digital standards to emerge.

THE FULL SCALE PROBLEM

Central to the digital model is its virtual, full-scale environment; a clear contrast to manually drafted, iteratively increased scale drawings. In the digital model, things are simulated at their actual size from the start, without an incremental change of scale that abstracts construction detail from overall organization; these exist simultaneously. This situation has produced a range of reactions, from drawings that simply ignore the digital model (architects who choose not to design digitally), or models that aim to replace drawing entirely (the aspiration of Building Information Modeling). Unlike these options, it's possible to continue considering the role of the digital model and of drawing as largely fundamental to architecture and The Full Scale Problem as a paradigmatic change in architecture's working space. While some have mourned the loss of an iterative, scaled working space as a form of "critical distance" in need of rescue, it's worth

considering what's gained by its disappearance.[4]

Simulation in the digital model begins with the readymade primitive; a generic geometry awaiting specificities of formal and material logic. The most basic specificity awaiting the primitive is the size to which it should be simulated. This initial decision can easily be reconsidered, but as the primitive is worked towards an architectural proposal, the readymade is molded and marked by the consideration of concrete facts. The most basic fact comes from default architectural features, like Revit's doors or windows, which specify referents to an actual size, translating an abstract, scaleless shape towards a concrete simulation. These software defaults, in spite of their origin in construction industry stock, represent a definitive way to mark a concretely sized referent into the digital model. Without the default, the architect must design these referents, modeling stairs or stud walls themselves, although without a standard case for best practice. The simulation of concretely sized referents, or any tectonic figure, is an important component in the thinking of digital modeling caused by The Full Scale Problem.

Another territory opened by The Full Scale Problem relates to the relationship of architectural form to its representation. If a long tradition in classical architecture was a symmetry, or *concinnitas*, of parts to the whole, then iteratively scaled drawing is associated with the move from larger compositional wholes to the smaller detailed part. Two drawings, at different scales yet similar size, may represent a whole elevation and a window side by side, creating an equivalency between them. Marks of the pencil at an initially large scale are developed, incrementally, at smaller and smaller scales. The original whole is conceived through more and more parts and, in a sense, scaled drawings are made up of parts that are tied together through representation. In a digital model, this is not so. It biases whole geometries over material parts. In its general use, the digital model conceives things as single objects seen from the outside, at full scale, and therefore it is much more likely that designs in digital models are evaluated as a whole rather than in discrete parts. One conclusion may be that The Full Scale Problem emphasizes whole-to-whole comparisons over part-to-whole, or even part-to-part.

These two aspects, proportional comparisons of wholes and concretely sized referents, are openings for design strategies for architecture. They suggest that the size of things is not absolute in the design process, but is rather a plastic quality that an architect can specify in many ways. Generally, the questions posed by The Full Scale Problem are caused by the replacement of scale with simulation, marking a shift in thinking in architectural design.

DIGITAL PROBLEMS

Any problem comes with opportunity. Changing the structure of architecture's working space will inevitable cause a rupture in the various mediums, disciplinary projects, and historical linkages that were strongly associated to a virgin Albertian paradigm. The digital model may not change this paradigm, but add an addendum to its conception, and especially to the conceptual role of the representation of architecture. It may take some time for these opportunities to be fully understood.

The problems listed in this paper define only some aspects of digital models: the drawings as a mirror of the digital model, the changes to the practice of standards, and simulation as displacement of scale. Taken together, they suggest an

added ghost floating behind the already tricky Albertian paradigm: architects work through representation, and this representation seems to be restructuring architectural thought. This brief list could be supplanted with other problems, including: The Copy Problem, posing a problem of authorship in the change from iterative sketching to copied versions of models; The Archiving Problem, relating to the difficulty of displaying the digital model and its obsolescence through software changes; and The Problem of Solidity Through Surface, or the digital model's representation of solidity through a watertight collection of infinitely thin surfaces.

As we continue to tread across the foundations of a digitized discipline, it is possible that problems will become an outmoded conceptual structure to describe the changes taking place. Problems have become shorthand for the shared conversations on conundrums that architects agree exist only in architecture. Like the Standard Problem, the problem is itself a mode of standardization. It is a model for establishing core sets of discussions of a definitive field of study. Yet in a field that is already broken up into many fragmented echoes of mediums and histories, a core set of problems seems at odds with non-hierarchical digitalization impacting most forms of knowledge. The biggest problem, it seems, may be the survival of the problem altogether.

1. Evans, Robin. "Translations from Drawing to Building." In *Translations from Drawing to Building and Other Essays*. London: Architectural Association, 1997. 165.

2. Ivy, Robert. "A View of Architectural Graphic Standards at the Beginning of the Twenty-First Century." In *Architectural Graphic Standards*. 10th ed. New York: John Wiley & Sons, 2000. xiii.

3. Johnson, Philip. "A Tribute to Architectural Graphic Standards." In *Architectural Graphic Standards*. 10th ed. New York: John Wiley & Sons, 2000. xv. This quote is ironically reproduced on Wiley's website, where you can purchase a copy of *Graphic Standards* in book or CD-ROM format.

4. Morris, Mark. "1: Whatever: The Collapse of Scalar Thinking." The Cornell Journal of Architecture 9: Mathematics (2013): 84.