



## **Architectural Automation: Facing the Challenges of Work-Culture**

A Cyon Research White Paper  
February 19, 2003

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### **Executive Summary**

The automation of architecture must overcome the challenges of well-established traditions within the venerable architectural profession, and of the time-honored but fragmented structure of the construction process as a whole.

James Glymph, a principal in Gehry Partners, characterizes the generally adversarial relationships among designers, engineers, and contractors, as “the Wild West.” And in a recent article in *Engineering News-Record* magazine, Deborah Snoonian, PE, says, “Technology for architects is in its adolescence.”

Between the immature state of the technology and the complex relationships of participants in construction projects, automation faces an up-hill climb before it will be widely accepted.

The “master builder”—the original role of the architect, which has become somewhat narrowed over time—has a long tradition. Architectural processes reflect that tradition more than considerations of efficiency or even productivity. The self-worth of architectural professionals—how they view themselves—is based upon it.

Threaten it at your peril—and perhaps to your profit. For while automation presents many challenges to traditional roles and workflow patterns within construction, it also promises substantial gains in efficiency and productivity.

## CAD in Architecture

Design is an iterative process. You have a set of requirements—physical, aesthetic, performance, and so on. You do a mystical creative thing—touch the mind of God, dip into your unconscious, whatever—and somehow come up with a design to meet those requirements.

That design usually begins as a sketch. As you examine the sketch, you experience new realizations about the design. You modify the design, making additional sketches.

At some point, you may build a model; it gives you additional insights, resulting in other modifications.

Eventually, you either experience the “kerchunk” of completeness, or—more commonly—you run out of time. You “freeze” the design, and begin to produce construction documentation.

Construction documentation includes the generation of drawings and schedules from sketches, physical models, and narratives. It was the area in which computers were first applied to the architectural process. The reasons are simple yet subtle: the creation of production drawings is deemed a rote process by most design firms. Just as the typewriter was initially used for copying, and not for composing, the first application of graphical computing was for the simple automation of drafting—*not* design.

Design has a great deal to gain from the use of computers. The iterative process of creating a model or sketch, learning from it, and modifying it, can become much faster. The computer lets you use the realism of 3D, solids, and photorealistic rendering to make models that look and behave much like the envisioned building.

In fact, not only can the computer provide a visual simulation of the design, it can simulate the *performance* of the building with respect to things like its construction cost, energy usage, and building-code compliance. This kind of simulation enables the architect to create “what if” scenarios early in the design process, to explore ways to improve the performance of the design.

Moreover, it can result in a *precise* model—so that the translation to production documentation becomes a simple mechanical process, and not an interpretative one.

But architectural designers—like most creative professionals—avoid thinking *about* their creative processes. Not only do they have difficulty defining or describing them—they have an almost-superstitious aversion to attempting to do so.

So, as with many other potentially productive forms of automation, architectural design automation has had to await a new generation of designers, who come to the computer without the prejudices of older people.

## Coming: The building information model

A significant proportion of the communication problems in construction projects derive from the fact that there are multiple overlapping—and sometimes conflicting—documents describing the same aspects of the project. The building-information-model (BIM) concept entails having one and only one centrally accessible representation of every part of the project documentation.

Implementing a building information model system requires workflow changes that are often uncomfortable for all project participants—partly because all change is uncomfortable, partly because each participant must recompute their “WIIFM” (“what’s in it for me”) factor.

However, the overall project benefits—most of which accrue to the owner—of the building information model ensure that this approach to project automation will become widely accepted in coming years.

## What architects like about CAD

- *Simplified production of construction documents.* The simple automation of production drawings is a reasonably big deal. These documents are viewed as a necessary evil by designers, and the less effort they require, the happier are designers.
- *Consistent drawings, simplified changes.* The visual quality of the production drawings is made much more consistent through the use of CAD. And changes, in general, are much easier to perform with CAD than without.
- *Powerful visualization and presentation products.* Architects, much of whose marketing is based on visual presentations, like what CAD has to offer in terms of production of photorealistic renderings, integration with photographs, “fly-throughs” and “walk-throughs,” and animations.
- *Higher likelihood that construction will properly represent the design.* The enhanced communication ability and minimization of error brought about by the building information model means that what the architect designed is what will wind up getting built.

## What architects don’t like about CAD

- *The use of CAD alters the design process.* It requires designers to think too precisely too early in the convergent progression that leads to a design. Some well-known designers believe they can identify buildings that were designed with CAD, because CAD makes it very easy to be utilitarian and unimaginative.
- *CAD de-personalizes drawing production.* Much of the architect’s self-image is bound up in the creation of drawings; architects have always seen drawings as their work product. CAD makes it easy for anyone at all to make professional-looking drawings.

- *CAD requires learning a new set of skills.* Like any new tool, CAD requires learning—and exercising a different set of aptitudes from the ones that made someone become an architect. So CAD might turn an experienced architect into an apparent novice, making lots of mistakes, requiring the help of junior people.
- *Changes in workflow could cost the architect money.* Architectural fees are often linked to construction costs in such a way that lower costs mean lower fees.

## **Architectural automation in 2003**

There are very few firms that do not use CAD for production. Indeed, the generation of CAD files in the format of a particular vendor is often a job requirement. But there are also few firms who have embraced CAD for design, or attempted to move to a total building-information-model process.

The average partner is still not entirely comfortable with computers. They may email, browse the Web, and create an occasional PowerPoint presentation. But the computer is not their desk, and certainly not their drafting board.

There is a generational component to the resistance. No doubt there are some old-timers who embrace technology, and a small number of young people who resist it, but age is a useful predictor of comfort with computers.

One of the ironies in the adoption of the building information model is that the strongest resistance does not come from the principals (who can see the value of this approach). Rather, it comes from the CAD operators, who feel their job security is tied to their expertise in a 2D CAD system. These are the same people who rallied against the manual drafters just 10 years ago, proclaiming that CAD was the future. Now that technological advances have made an even better future possible, these CAD operators have regressed, fearing loss of job security and the loss of their investment in 2D CAD standards development. This insecurity stems partly from the fact that building-information modeling systems require the user to have actual architectural design expertise, rather than just CAD drafting expertise, and this is something many CAD operators lack.

The recent growing trend toward design/build is speeding up the invasion of architecture by technology. Merging the business considerations of the design and construction phases makes the increased productivity of automation even more attractive.

## **Where is it all going?**

The economics of automating design and using a building-information-model project-management process are compelling. Resistance to them is cultural and personal. Architects sometimes feel automation will limit their creativity, cost them money—and even, in some unclear sense, demean them.

But it is not only economics that will drive the whole world of construction toward more and more automation. It is also the need for innovation.

In a recent Fortune Magazine article, Bill Gates was depicted as someone whose success grew from the realization that “you have to try everything, because the real secret of innovation is to fail fast,” in the words of a colleague.

There is no formula for good architecture—and certainly none for innovative architecture. But CAD, simulation, and analysis systems, built around the BIM, can provide a place to “fail fast”—and inexpensively.

## **What to do?**

By now, most construction professionals realize that it is not a question of *if* automation is coming to their desktop and projects, but merely *when*. And while there are many who pray fervently for it to happen after they retire, automation will have to be faced by all the construction professions.

Proactive professionals will not wait for it to happen, but will seize the day through simple steps:

- Evaluate: Diagram and catalog the business processes your firm, manual and automated. Inventory the existing automation facilities and practices.
- Envision: With the help of an internal or external expert, envision the automated firm and its processes. Map out stages for getting from where you are to where you want to be. Visit more progressive firms who might serve as models; invite their people to speak to your people.
- Enlighten: Discuss the unspoken issues of personal fears. Brainstorm approaches for avoiding the effects that frighten people. Choose and implement appropriate ones. Let your CAD operators know that a building-information-modeling system is the wave of the future, and one which will enable to build their expertise as designers rather than as drafters. For principals, let them know that this is an opportunity to get “back in the game,” since building information modeling systems are specifically designed for architects; as such, they are inherently easier to learn and use than drafting-based systems.
- Educate: Pinpoint knowledge “holes” for your staff. Plan and implement education and training courses, Web sites, and facilities for bringing everyone “up to speed.”
- Maintain and grow: Implement a continuous renewal process, one that acknowledges the inexorable rate of technological progress.

## **Summary**

Automation is coming to construction at large, and to architecture in particular. It makes good business sense, and it makes good professional sense. But it is frightening to people and institutions.

To minimize its negative impact, plan for it; embrace it; and deal squarely and openly with the cultural resistance that is inevitable.

## About Cyon Research...



Cyon Research Corporation was formed by CAD industry consultants Brad Holtz, Joel Orr, and Evan Yares to foster clarity and provide vision to users and vendors of CAD and PLM tools. Current products include: CADwire.net, a leading provider of online news and analysis; COFES: The Congress on the Future of Engineering Software; *Engineering Automation Report*, *A-E-C Automation Newsletter*, *Extranet News*, and *The CAD Rating Guide*<sup>™</sup>. More information can be found at: [www.cyonresearch.com](http://www.cyonresearch.com), 301-365-9085.

Cyon Research would like to thank Graphisoft for its support in sponsoring this white paper. Graphisoft is a pioneer in BIM (building information model) systems. ArchiCAD 8 bridges among 2D, 3D, 4D, CAD, and production drawings, giving users "best-in-class" support for drafting, schematic design, 3D/rendering, 4D time-based progress, and plotting. For more information, visit <http://www.graphisoft.com>.



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