

NEW BUSINESS IN THE INFORMATION AGE

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Architectural software has evolved from an "automator" of two-dimensional drafting to a three-dimensional simulator of building. Architect using this new breed of CAD software are quickly becoming the creators and caretakers of virtual buildings, and as a consequence seeing their roles in the building process continue after the occupancy permit is issued. As a result of this ability to construct a "virtual building" on a desktop computer - to simulate the building's behavior both before it is built and throughout its life cycle - fundamental changes are taking place in the architect's design process, fee structure, and relationship with the client, contractor and the community. In addition to transforming the architect's own practice, ownership of the 3D computer model carries important competitive advantages in procuring all future work associated with the same building.

In fact, the new set of services surrounding the maintenance of the virtual building will bring to center stage of society the only professional who is trained as a generalist to conceive geometric solutions to social and economic problems: the architect.

To better understand the course of this evolution, we should think of the practice of architecture through the ages in three major phases :

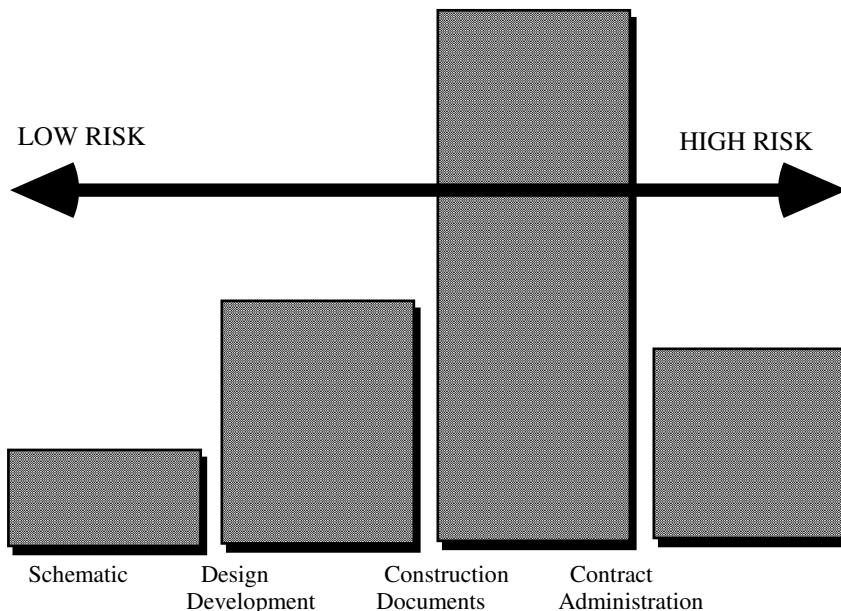
- the "empirical" phase when architects were actually the "master builders" who DIRECTED the construction of temples, castles, and cathedrals;
- the "abstract" phase when architects REPRESENTED buildings using drafting techniques (and later CAD software) to generate complex instruction sets and sophisticated illustrations from which others could build;
- the "simulation" phase when teams of architects will CONSTRUCT buildings using software instead of hammers, in a simulated environment instead of a real one.

Obviously, this next major phase is dependent upon advancing computer technology, yet computers and CAD software have been with the profession for almost 25 years. So, why aren't architects well into the "Simulation" phase today?

The answer is that architects have been using their computers for the past 25 years to automate drafting, which is a logical first step to introduce new technology in any profession. But, architects in the next 20 years will simulate buildings. This nuance presents the profession of architecture with its most incredible opportunity to define itself since architects stopped cutting cathedral stones 400 years ago and started drafting.

Implying massive changes in professional education and culture, architects will adopt the process-oriented approach of doctors and lawyers, and abandon the project-oriented approach of Howard Rourke and other heroic figures of architectural mythology. Architects will become more closely associated with their client base than with their buildings as they work continuously to construct, maintain, upgrade, and sell their clients' buildings using computer-based models in their offices. Their revenues will flatten (!), but the peaks and valleys of building cycles by which they have learned to live since the Renaissance will be replaced by a new metaphor already known to other professions: the "revenue stream."

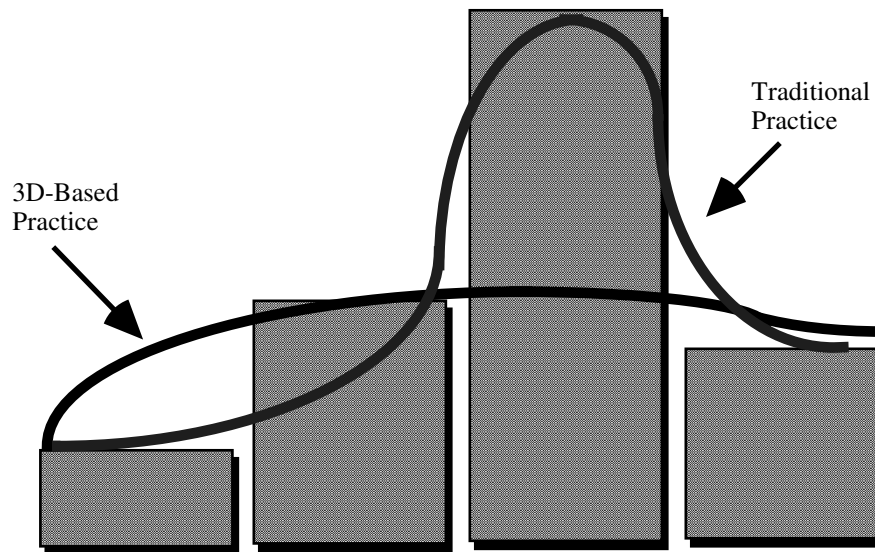
The graph below, the breakdown of architectural fees according to the traditional AIA contract, should be familiar to any practicing architect. The fee structure is more or less based on the historical work load and labor expenses incurred by an architectural firm during a typical building project with the majority of the fee and expense occurring during the construction documentation phase.



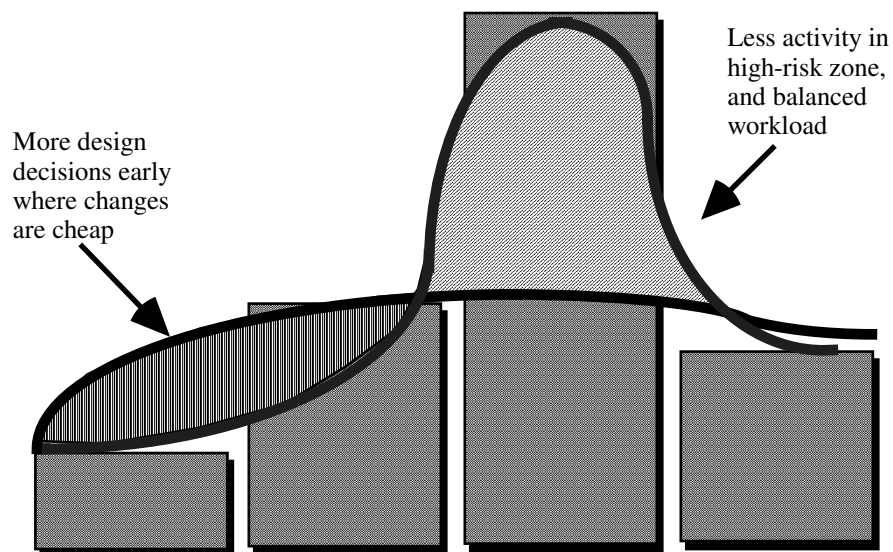
Understandably, any work which is done early in the design process can be considered low risk and inexpensive. It's low risk because nothing is built and inexpensive because there are fewer drawings to change and fewer engineers and consultants to re-engineer and re-consult. Conversely, the deeper change occurs in the design process, the more expensive it becomes because of the number of subsequent drawing changes, and the riskier it becomes because it may not be coordinated among all of the various engineers, consultants, and contractors. And, as most architects know, the deeper in the design process change occurs, the larger the specter of litigation looms.

A study published several years ago by the Association for Computer-Aided Design in Architecture - or ACADIA - found that the labor expenses of architectural practices using no CAD software or 2D drafting software followed roughly the same work pattern as the traditional fee structure.

Practices using 3D-based systems, however, showed a very different pattern. Their work was "front-loaded," meaning more time was spent early in the design phase, but, because of that invested time, they saved during the documentation phase. They were able to level out their work loads and labor expenses and avoid the trauma of hiring on and laying off that is common in traditional practices.



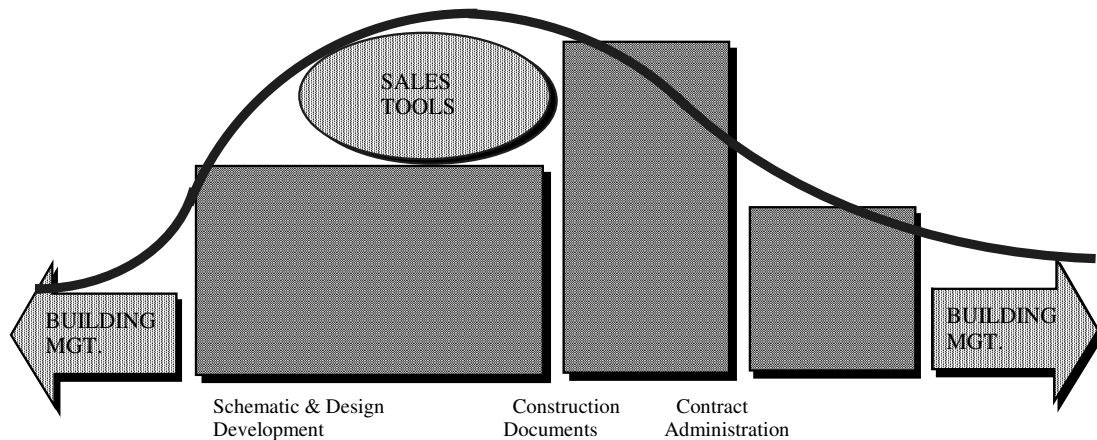
A closer look at this graph also reveals that architects using 3D-based integrated CAD software spent their time where it was cheapest and the most fun - and they were the most free to explore design alternatives. Because they were starting with a well-developed 3D model, they could produce working drawings in less time. Also, because they produced more building information up front, these architects could make better design decisions with greater confidence and avoid many costly and risky changes later in the process.



As integrated CAD software becomes a standard tool of every architectural firm, and “virtual buildings” replace “digital paper,” the architect’s standard fee structure should evolve to reflect more accurately the firm’s activities and resource allocation. Traditional Schematic and Design Development should merge into a single phase as 3D-based software offers the increasing (and

dangerous!) ability to render even the most tentative designs with great and often misleading precision and completeness. [Note: one of technology's little ironies is that software which actually puts the tentativeness back into computer generated drawings is becoming popular among architects!]

As a result of the merger of schematics and design development and the additional work being done in the project's early stage, clients will pay a relatively lower fee for the actual construction documentation phase. The same proportional fees should remain for standard construction administration because, although 3D-models, laptop computers, and modem connections to the home office make administration more efficient and error-free, they do not substitute for the time needed to visit the site, consult with contractors, produce reports, etc.



Of far greater interest, however, are two new sets of architectural services which will evolve from the "virtual building" which the architect has created, the client has paid for, and which exists alongside of the real building.

The first set of new services are providing sales and marketing aids such as renderings, VR "virtual reality" tours, animated movies, and quick cost estimates, to help the client sell or rent the project. These types of services are already becoming common among architectural firms using 3D-based software whose enlightened clients see the potential of 3D computer-aided design to actually market and sell their buildings. If architects are already expected to create and present projects to clients, government agencies, and contractors, they are also the client's natural partner when it comes time to present almost the same type of information to prospective buyers and tenants.

As they race to keep up with the expectations of the MTV generation, clients are increasingly turning to new media such as video, interactive computer screens, CD-ROM, and the Internet to market their projects. These media reward - even demand - the expression of the third dimension and can punish those who do not break out of two-dimensional thinking. Since the the base cost of the 3D model has already been amortized with the architect, why should the client pay someone else to do largely the same work again?

These new sales and marketing services do not mean that architects will replace advertising or leasing agencies. Architects will be effective suppliers of raw marketing materials for these agencies, however, as well as a constant resource for information which helps the client communicate with his or her own customers.

If the first set of new services is based on using the virtual building to market the constructed building, the second set of services is based on managing the virtual building model in parallel with the real one. These management services might include classic facilities management functions - but using the third dimension - as well as tenant services, explorations of design and maintenance alternatives, and the simulation and planning of design changes required over the life of the building.

For example, imagine that an architect has developed a 3D model, created working drawings from it, the client has built the building, and the occupancy permit is issued. Why should the architect's involvement stop there? His or her value to the building owner is only beginning.

- Climatic data from ASHRAE tables, and test data from manufacturers, can be imported and the 3D model can be used to predict when roofing and caulking should be changed.
- Data for wear and decoloration provided by carpet manufacturers can be used to render photo-realistic images of what carpets will look like after 5 years, thus helping the client make intelligent choices that weren't possible before.
- Visual and financial effects of changing glazing, lighting, or other energy conservation strategies can be accurately simulated and effectively communicated to focus groups, zoning commissions, financiers, and others for a small cost.
- Each new or prospective building tenant can explore their fitted out space in three dimensions using VR virtual reality through the Internet or CD ROM because the cost of the base 3D model - which the architect maintains - was amortized during the original construction.

Most significantly, imagine ten years go by, the building changes owners, and the new owners want to perform substantial renovations to upgrade the building. The reality of the traditional paper-based system is that the owner takes a set of the original or as-built drawings and shops for an architect. The original architect, although the creator of the original documents, is quite often powerless despite the existence of laws protecting his or her copyright.

The architect who already owns and maintains the building's 3D computer model, however, will have a tremendous competitive advantage in procuring all future work associated with that building. Of course, this will be interpreted as both good and bad news, nevertheless it does announce a significant change in the relationship between the client and architect and in the true value of the architect's work.

Because the architect is now both the creator of the virtual building and its caretaker, his or her role can continue after the occupancy permit is issued. The architect can stay with his or her creation and play a pivotal role in its maintenance and evolution well into the future.

This new model for architectural practice implies that architects will stay with their clients and provide ongoing services at reduced fees on a more or less continuous basis, and that the act of "building" will become an uptick in the architect's revenue stream from that client rather than the great traumatic event that it now is.

It also adds new meaning - and meat - to existing laws which protect the architect's copyright to his or her own design. Until now, ownership of a design had little meaning because essentially all of the design could be transmitted by a set of blueprints that could be easily copied and altered. A computer file, however, which is not a representation of how a building should be built, but a simulation of the building itself, should be much easier to protect, and, more importantly, its value should be much easier to defend so that others are not tempted to violate the copyright in the first place.

Using the development of the automobile as an example, we can begin to understand better why the real difference between a 3D-based practice and a paper or 2D-CAD based practice is the difference between automation and simulation.

Architects of this generation and 20 generations before are accustomed to drafting to communicate how buildings ought to be built. But, as architects know from their history and mythology, it wasn't always this way. The architect was once the "master builder" who directly oversaw the design and construction of buildings and taught workers on site how things should be built.

The development of drawings and drafting to represent buildings was an abstraction of the building process itself made necessary by expanding economies, increasingly complex building

types, and increasing specialization. Drafting became a language to communicate building, however, unlike a poet's or a novelist's words, the language of drafting never became the end in itself for architecture, just a means to instruct how architecture is to be made. Building always was - and still is - the goal of the architect.

Then, the computer arrived to revolutionize the lives of scientists, educators, bankers, insurance companies, and in time, almost everyone else on the planet. A few decades later, pioneering companies such as Autodesk also arrived to help engineers and architects put these computers to work. How they chose to do it was logical. They automated drafting, turning paper into "paper space."

They made the most tedious part of the architect's work go faster, but they didn't question his or her centuries-old methods. Like the horseless carriage which preceded the modern automobile, they accelerated and automated, but they didn't question any of the existing metaphors. Ironically, as 2D CAD programs developed their own sets of drafting symbols and conventions - their own "language" - they themselves began to abstract the abstraction of drafting and pulled the architect even farther away from his original goal of building as well as leading to such aberrations as "CAD departments" and "CAD courses" and even college degrees in CAD. The great tail of technology is wagging the dog.

The real question that architects should be asking themselves and those supplying them with computer hardware and software is, "Why should I use a computer to draw a bunch of parallel lines when I can use it to build a wall?" The promise of 3D-based integrated software is to find an original use for computers in architecture: to simulate building rather than merely automate drafting - ironically, to return the profession to its roots of centuries ago.

The architectural profession is on the cusp of the "Simulation" phase of architectural practice. Many architects using integrated software are already there. Clearly the architectural profession must embrace profound changes to survive and to prosper in the coming decade. Although software will continue to evolve and improve, it is now time for architects to embrace the best of what is available in order to educate themselves and to master NOT the technology, which has the half life of a rap video, but the new architectural process, which this technology will ineluctably engender.

Architects should learn the tools available now so that they will know how to learn the tools of the coming generations. And, above all, they should stop learning to automate drafting to be architects, and start learning to simulate buildings.