Virtual Reality: How It May Change The Construction Workplace

By Kathy B. Sedgwick

Remember when a computer was a room-sized box of flashing buttons and whirring tape, the machine that would eventually replace all human workers? Few imagined how soon the monster computer would shrink to the desktop and notebook-sized machines used in nearly every workplace in the country.

Now computers are such an integral part of the contracting workplace that we wonder how we handled everyday business without them. And the computer systems that contractors use are getting more sophisticated by the minute.

Virtual reality—one of the most exciting new computer technologies available today—offers increasingly versatile applications for many different industries. Evidence is mounting that within the next decade most successful construction contractors will be using some form of VR in their daily business.

That may sound like a wild prediction, especially since VR is so strongly associated with science fiction and video games. But there’s much more to this amazing new technology than that.

VR offers many practical business applications. For example, Japan’s Matsushita Electric Worlds Ltd. showrooms offer virtual reality kitchens that potential clients can “walk through” before they buy. This gives customer’s confidence, which results in increased sales. The company reports 80 percent of those who use the VR buy, while only 35 percent buy who did not use it.

If they’re using virtual reality to sell kitchens in Japan, can VR in the contractor’s world be that far behind?

What is virtual reality? Ask 10 different experts and you will get 10 different answers. Put simply, VR is a three-dimensional world that can be created, viewed, experienced, interacted with, manipulated, shared and
Virtual Reality Takes on the Americans with Disabilities Act

“Wheelchair VR,” one of the custom systems that Prairie Virtual Systems Corp. has developed, gives people an opportunity to explore barriers that spaces pose to people who use wheelchairs. The software gives users a chance to experience exactly what it is like to function in an office or home environment.

According to John Trimble, president and founder of the company, “As far as we know, ‘Wheelchair VR’ remains one of the most practical applications of virtual reality. It is certainly the most significant application to the area of rehabilitation and ADA compliance.”

“ADA guidelines provide ‘suggested’ dimensions for environments for people who use wheelchairs that are based on standardized data. That’s fine if wheelchair users fit the middle of the bell curve; otherwise, the guidelines simply may not work for them. The reality of the situation that you must try various solutions to come up with one that best suits you.”

“Virtual world technology, such as the “Wheelchair VR,” gives people the flexibility to develop individualized and custom solutions. They can try before they buy.”

“In architectural design, the big question is, “Will this space work?” The only way you can answer that question is to try it. And as far as my company is concerned, the best way to try it is in the virtual world.”

“Using our software, you can alter the shape, size or position of anything in the environment. You can practice doing things like using a keyboard, opening cabinet drawers, or whatever it is you have to do in that space. Once you’re satisfied the environment is going to meet your needs, you can save it in a format that is compatible with most commonly used CAD software.”

“Many people believe “immersive virtual reality,” the kind where you use a head-mounted display is the only “real” virtual reality. I disagree. Whether you are viewing it on a graphics workstation, through a head-mounted display or inside a special room, it’s all “virtual reality.” What counts is that the technology gives you a “feel” for a computer-generated environment.

“Having said this, my company still firmly believes that immersive virtual reality is the best technology for giving people a sense of how an environment “feels,” as opposed to how it looks. It is also one of the few technologies that gives a group of people a way of sharing a space so that everyone can experience his or her own unique perspective.”
stored within a computer system.

John Trimble, president and founder of Prairie Virtual Systems, described virtual reality as “a new way of communicating three-dimensional design(s). It is a tool that allows people with different backgrounds and viewpoints to understand the subtleties of a design on a nonverbal level.”

As laboratories around the globe develop and test VR technology, it has become the subject of lengthy discussion among researchers and enthusiasts. In fact, VR has been the focus of numerous conferences, exhibitions and even a congressional hearing.

Industry training centers are quickly adding VR to their curriculum. Ron Gregg, department chairman for virtual reality and multimedia at the CAD Institute, Phoenix, Ariz., described the Institute’s VR program. “What we’re teaching is the design, the construction and programming of virtual environments, both hardware and software.”

THE STATUS QUO: CURRENT USES OF VIRTUAL REALITY

Jaque Davison, president of Davison Productions, a Springfield, Va.-producer of VR worlds, described the three levels of VR currently available. “Level One VR uses a flat, 2-D computer screen. Level Two VR uses a head-mounted display and a glove. Level Three uses a head-mounted display, a glove and/or some other input device with the addition of sound and motion to create a fully immersive system.”

Here’s a brief look at how all three levels of VR are being used today.

Helping Laymen Understand Construction Plans. Architects probably were the first construction sector users of VR. Walk-through programs—like the one Matsushita uses to sell kitchens—are already available. These systems are successful because they help laymen better understand the complexities of construction plans.

The average person doesn’t look at a blueprint every day. They simply cannot visualize how a building or complex project will look based on drawings alone. VR models make construction plans much easier for the layman to understand.

For example, urban planners in Los Angeles were studying plans for the renovation of an 80-block-by-80-block riot-damaged area of the city. Ordinarily, the planners would have been faced with a confusing stack of complex plans and drawings, a daunting task for just about anyone. But the planners also needed to involve members of the community in the review process. Using a VR model, planners and community reviewers could study a realistic view of the area from various perspectives.

Practicing Dangerous Tasks without the High Risks. Some engineers envision a day when construction sites will contain a fleet of equipment operated via computerized remote controls. Using VR to help operators better visualize the remote work area, they can move objects that are heavy, hazardous, distant or delicate.

Fujita Corp., a Japanese construction company, uses a VR system that...
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allows a human operator sitting in Tokyo to control a spray-painting robot located anywhere in the world. The system is particularly useful for spraying in enclosed spaces where the paint mist quickly destroys visibility. As the paint mist fills the air, the computer generates a view of the space, superimposed over the remote camera view, so that the operator still has a clear view of where the paint is going.

Reducing Costs of Product Development and Testing. Nearly 50 percent of the cost of a new product is expended during the original design phase. By the time the product goes into production, some 80 percent of the costs are set.

VR’s greatest cost savings potential probably will be realized in product development and testing. Creating a VR model costs roughly the same as a 3-D CAD model and considerably less than building an actual 3-D model. An added benefit is that the VR model can be altered much more quickly, easily and inexpensively than a real model.

Boeing used a VR system to design the company’s new 777 aircraft, the first airliner designed and engineered entirely within a computer. Once the VR model was created, pilots took “test flights” to check gauge positions, etc.

Maintenance crews also tested the VR design, performing routine repairs and maintenance on the model. By combining VR with CAD, Boeing designers avoided common maintenance problems, like when only a person of a certain height or arm length can tighten a particular nut or reach a defective part. VR technology made it possible to correct potential problems while the airplane was still in the design stage.

What Does VR Cost?

A/E/C SYSTEMS ‘94 sponsors speculated that truly convincing VR systems in the $80,000 price range will be available within the next years, and in the $8,000 range in no more than five years. Of course, when the technology requirements are simplified, prices will drop, just as they have for other computer technologies.

VR applications that represent 3-D worlds on conventional 2-D monitors are already priced within reach of many consumers. Virtus Corporation, for example, offers Virtus VR, which retails at $99 and requires no peripherals such as gloves or goggles. (The company’s more sophisticated program, Virtus Walkthrough Pro, retails for $395.)

Virtus VR offers three windows: a gallery of basic shapes, a 2-D design window, and a 3-D walk window. Using the basic shapes in the gallery, users create complex shapes in the 2-D window that are instantaneously converted to 3-D in the walk window. The system has a library of 3-D objects to which you can add textures (wood grain, wallpaper, window translucence or transparency).

Virtus VR system requirements are minimal. For a Macintosh system,
you can run Virtus on any Apple Macintosh LC, II, PowerBook, Quadra or Centris, a Macintosh Color Classic monitor, with 4MB RAM and a System 6.0.5 or later. (For best results, the company recommends the higher level machines, 8MB+ RAM and System 7.1 or later.) For a PC system, Virtus runs on an 80386-based (or later) PC with 4MB RAM, a VGA or SuperVGA display adapter and Microsoft Windows 3.1. (For best results, the company recommends using a 486 or later with 8MB+ RAM.)

**VR AND THE CONSTRUCTION CONTRACTOR**

It doesn’t take much imagination to see how VR applications will affect the construction contractor. The following are only a few of the ideas which materialized in the author’s personal crystal ball while researching this article.

**Reduced Need for Field Fixes.** The use of VR during the design stage of a construction project should reduce the need for field fixes. Design errors can be corrected before breaking ground.

What about compliance with complex building codes? The CAD Institute’s Ron Gregg suggested, “It’s feasible that artificial intelligence systems could check the design and see that it conforms to the codes. You let it run overnight and then get a report back in the morning with the corrections already made.”

**Opportunities to Sell Substitution of Materials.** Contractors win jobs by selling substitution of materials. The contractor must convince the client that the substituted materials will perform as well as the originally specified material and at a lower installed cost. With virtual reality, the contractor can literally show the potential client what the building or room will look like after the substitution is made.

**Worker Training.** One study predicts that training and simulation will be VR’s primary use by the year 2000. Contractors may use VR to teach workers how to exit a building in an emergency, the location of safety equipment on the project, etc. This could be especially useful for training related to abatement of environmental hazards such as asbestos or lead-based paint.

VR could also be useful for teaching why safety equipment or procedures are necessary. Imagine the results of a training exercise where a worker finds out what it feels like to fall off a 10-story building because he or she failed to wear appropriate safety gear.

As new materials and equipment are added to the construction worksite, workers can learn to use them in VR, without wasting costly building materials. This should also reduce the possibility of the worker getting injured (or injuring someone else) when a mistake is made.

**Product or Equipment Selection.** The “try before you buy” concept can help contractors make better buying decisions. Before you lease or buy that expensive piece of equipment, take it for a virtual reality test drive-without leaving your own office. Better yet, let the people who will be operating the new equipment test it.

**Take Potential Clients on a VR Tour of Your Most Impressive Work.** Photos and slides only tell half the story. In-person tours use valuable time your potential client may not be willing to spend. A VR presentation can show your best work to advantage, and at the client’s convenience.

**Enjoy Better Communication with Long-Distance or Overseas Clients.** The best way to explain this idea is with a real-life example. Cecil Patterson, information systems director for the Port of Seattle, is involved in the planning stages of complex, multi-hundred-million dollar development plans. Patterson’s work is made more complex by the fact that most of the
clients involved are Japanese, Chinese and others for whom English is not a native language.

Patterson believes that “misunderstandings, delays and bugs that are caused by the language problem might be mitigated if the engineers, planners and clients on both sides of the Pacific could walk through VR versions of the proposed construction during every stage of the planning process. That way, even though the spoken language barrier may remain, the pictorial mental models of what they are planning will be much more in accord.”

ARE YOU READY FOR VIRTUAL REALITY?

Of course, the decision to use VR (or even think about using it) rests entirely on the risk-taking style of the individual contractor.

“We are still on the leading edge of the technology adoption curve of virtual reality,” Trimble stated. “Right now it is where computer-aided design was in its early stages. As with any new technology, there is a certain amount of risk a certain cost for being the first person on the block. Large companies with the flexibility to explore new technologies are actively using it, and smaller companies are beginning to adopt it as they see that it gives their business a strategic opportunity.”

Trimble explained that new technology adoption has a sort of “life cycle.”

“At the very beginning of the life cycle are the “innovators,” people who appreciate the technology for its own sake and are willing to take the time and energy to learn everything about it. Innovators use the technology because they appreciate its potential for having a competitive advantage over the current crop of established technologies.”

“After the innovators come the “early adopters,” visionaries who have the insight to match an emerging technology to a strategic opportunity, willingness to accept the risk of translating that vision into a high-visibility project, and the charisma to get their organizations to buy into their idea. Like innovators, early adopters are willing to take risks with new technology because they see that it will give them a competitive advantage in their business.”

“Next come “late adopters” who buy and use new technologies because they feel they have to just to be competitive. Late adopters tend to enter the cycle when products are relatively mature and prices are dropping.”

Whether you decide to leap into using VR today or wait for the costs and complexity of systems to become more palatable, you can count on one thing: VR technology is here to stay. You can’t afford to ignore it; your competition may already be plotting how they can use VR to make their business grow!

Sources


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