Simulations

are poised

to change

the direction

of e-learning.

But who will

take the wheel?

Like Life?

By William Powell

My father calls to tell me that he has just flown from Orlando Executive to Charlotte/Douglas International, a night flight in bad weather. And despite an instrument landing, he set his Cessna down like a feather on water. He's excited; I'm excited for him. For months, our conversations have revolved around his travels and such terms as cross wind, tail wind, rate of descent, and cruising speed. He has mastered coordinates, GPS, and fuel consumption. Then he, miraculously, flies from New York to Paris, skillfully piloting a craft the weight of three blue whales. I'm impressed, but would I get on a plane captained by him? Not on your life.

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The good folks at Microsoft may have put together a convincing flight simulator—the tag is, "As real as it gets"—but there's a world of difference between a simulation on a computer and the real thing. I know that for a fact. I've built cities, sleuthed my way through detective stories, and flown airplanes from here to Riven and back. Aside from the multimillion-dollar simulators deployed by the military, simulations are mainly games, entertainment in the guise of learning. No one gains knowledge of any importance from simulations run on their PCs. At least, that's what I used to think.

A new generation of e-learning companies has seen the potential of PC-based simulations and wants to transform the way you learn.

It's about the pedagogy

The splash page at Indeliq.com ◁⑴ indeliq.com a Chicago-based developer of simulations for training soft skills, features a cockpit. The metaphor of learning to fly through a simulation is woven into the site. The implication is that if you can teach someone through simulation to master the complexity of flying a 747, surely simulations can teach how to be a better manager. Say "simulator" and likely the first thing people think of is the advanced, multimillion-dollar simulators used to train military and commercial airline pilots. Try to envision a simulation for management. That's a big problem soft-skills simulation designers have to face.

For some designers, the model is TV and video; for others, it's computer games. Yet, as Indeliq's chairman and CEO Daniel Hamburger puts it, "Simulations are not about the media. They're about the pedagogy."

Hamburger reduces computerized simulations to these stages: reference, application, and remedy. He makes the point that when it comes to simulation, you don't have to have 3D graphics or high-quality video. A simulation can be performed with pen and paper; trainers have been conducting role plays for years. But what if the trainer were replaced with, say, an advanced artificial intelligence engine, a unique set of problems, and a simulated office environment and was delivered at users' leisure via the Web? Now you're talking about current computer simulations. Whereas traditional CBT begins and ends with the reference layer, computer-based simulations add height, depth, and width to "put the content into context," says Hamburger.

Simulation designers don't have to rely on video or computer animation, but they're using those media to create slick and sophisticated products. Design times take up to a year, and development costs commonly top US$1 million. Designers pull content models from the hottest business gurus and academic institutions and, though the designers are all about business, they want users to have fun. But it's unlikely you'll mistake simulations, however entertaining, for video games. Still, motion capture and skeletal animation, the basis for most video games, do bring characters to life for developers such as SimuLearn ◁⑴ simulearn.net and Boston Dynamics ◁⑴ bdi.com. Ninth House Network ◁⑴ ninthhouse.com and Imparta ◁⑴ imparta.com use video and top-notch acting to bring story lines to the computer screen. So, though simulations may be about reference, application, and remedy, they're anything but boring.

Hard sell, soft skills

Selling a computer-based simulation might seem like trying to sell a Ferrari to an accountant, especially when there are perfectly sensible e-learning alternatives. But it's e-learning's current offerings that just might get a learning executive to take simulations for a test drive.

Much of e-learning still isn't very exciting. *Tell and test, use and snooze,* and *e-boring* are just a few of the descriptions critics throw around. But like it or not, much e-learning has excellent content, and the tell-and-test models are all that employees need to master simple skills.

But what about soft skills? Behavioral skills? What about management, sales, and performance training? Emotions? No one actually needs a Ferrari, but a good salesperson can make a compelling argument for an emotional need for a ride that goes from 0 to 60 in a few heartbeats. And it's impossible for an owner's manual to capture the nuance, excitement, and sensory cues when we slide into the plush leather seat and hit the open road.

Think back to the last time you tried to close a sale or called in an employee for reprimand. You were probably nervous and perhaps even sweating. Such situations are charged with emotion and unpredictability. There are no multiple-choice answers or quick references for what to do. That's real life. Life is emotions, temporal and visceral. Action and inaction have different consequences. If the knowledge of how to react and

RULE OF THE BONE

The beauty of computer-generated animation isn't just skin deep, it's to the bone. Through the processes of motion capture and skeletal animation, such simulation designers as SimuLearn and Boston Dynamics bring animated characters to life. It's a simple two-step process that belies the complex engineering behind it and gives designers a tremendous amount of control. If you've seen *Toy Story*, you've seen this process in action.

The first step is motion capture. Human actors don black body suits with ping-pong-ball-like nodes attached. Sensors, located throughout the room, record and track motion and store it for later application to a simple computer-generated skeleton. Designers can capture libraries of hundreds of basic motions.

The second component of the animation process is a piece of software, or a control algorithm, that takes those fragments of real motion and stitches them together in real time—one image every 1/30th of a second. The control algorithm then blends one motion to the next, thus giving the skeletons lifelike movement. Once that's set, all that's left is to add the skin.

"We have mathematical formulas for how to move every single joint," says SimuLearn's Clark Aldrich. The process gives designers complete control over their simulated actors. "If you want a character to [look] bored, you can have him lean back in his chair, pick at his nails, look at his watch, or play with his pen. Then, you can say something like, "By the way, you're fired." Immediately he's leaning forward, he's mad, and he's looking around to other people for help.

"You don't have to prerecord every single possibility. You create the underlying skeletal animation to mathematically go from position A4 to position B7 and figure the best path to do it given the fact that the person has certain muscles that bend and certain bones that don't."
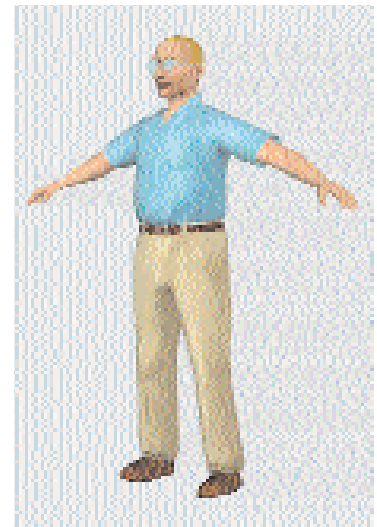
interact isn't residing comfortably in your subconscious, then it's useless. That's what the best simulations promise to provide—something lifelike yet new and a chance to practice, practice, practice until the information or behavior becomes experience.

Jeff Snipes, co-founder and president of Ninth House, respects the initial offerings of e-learning but says he is witnessing a "customer evolution" away from first-generation content.

"First-generation content was a stick-your-toe-in-the-water approach," says Snipes. "Manufacturers wanted to get a lot of courses out there just to see how they worked. What came out of that was a lot of text on the Web, a lot of e-reading. It was fast, cheap, and easy. Now that e-learning has been out there for a few years, there's got to be something better."

Clark Aldrich, co-founder of SimuLearn, sees it this way: "My absolute premise is that skunk works is the best form of training, bar none. However, the second best learning environment is role playing. It's real, emotional, and very high baud. You can watch people act and hear the subtlety in the dialogue. But if you don't have scalability, you can't affect enough people to matter."

The solution? Computer-based simulation. Though it may be the goal of simulation companies, bringing the qualities of live role play to the computer screens of thousands of corporate users creates its own difficulties—and solutions.

Different directions

At Ninth House, video-based simulations play out like TV dramas. Production quality is extremely high, and you're likely to recognize a few characters from some of your favorite TV shows.

Following a brief video to set the situation, you're asked to choose from a series of responses that direct the course of action—made possible by a technique known as branching video. Body language, facial expressions, and subtle nuances are here in spades. No doubt it's entertaining, but is it necessary? I ask Snipes to explain Ninth House's approach.

"You can't teach [behavioral skills] very well if you can't look the characters in the eye and practice role playing with real people," he says. "You don't get that kind of subtlety without using high-quality video and storytelling."

In fact, Ninth House found that users develop certain affinities for one character over another and enjoy playing different roles. For instance, one week you can choose to be the VP of HR. The next week, you can be the director of marketing. That flexibility gives users the chance to experience the same problems through different perspectives. Another advantage of using video, claims Snipes, is that it allows a shallow learning curve while providing a robust experience.

"We've had more than 10,000 learners," says Snipes, "and we've learned that by simplifying the interface and keeping it intuitive, you don't have to spend a lot of time mastering the functionality. Your attention is drawn more to the behavior onscreen and to the learning experience."

But a balance must be struck: If video is relied upon too heavily, interactivity, user control, and immersion suffer. The user becomes more of an observer and less of a participant. Users, especially younger ones who've grown up on Nintendo and Playstation and with computer games that offer loads of user control, can become frustrated with a less interactive approach. Older users may feel more comfortable with something that reminds them of TV.

A new beast

Favoring a high level of immersion are simulations from Boston Dynamics and SimuLearn. Both companies rely solely on computer-generated graphics to create their 3D simulacrums, and both rely on a high level of user control through a relatively simple interface. The look and feel of their products are much like video games, but they aren't the ill-fated virtual reality simulations of five years ago; you won't have to don a pair of silly goggles to use them.

"I think that computer games definitely teach us that computer graphics are absolutely necessary," says Aldrich. "There's a freshness, dynamic interactivity, and level of information that are without equivalent. Nothing even comes close."

Environments within such sims are created with complex design elements that govern how the objects interact with each other. Artificial intelligence engines churn away behind the façade of computer-generated characters, and little stands in the way of breaking users' suspension of disbelief. Information isn't presented so much as gleaned through character reaction and the user's interface with the environment. A dialog box doesn't pop up to tell you that

your response was incorrect; you discover that from character reaction or through the chain of events that follow. Though computer-generated environments, at present, don't offer the subtlety of emotion that video and a good actor provide, they do have more flexibility in the design process and enable users to pursue a greater number of solutions to proposed problems. That in turn allows for greater customization for the purchaser or user and a sense of limitless action within the simulated environment. There's a dynamic quality to computer-generated simulations, a sense that events are taking place in real time, and that you the user are in control.

"Currently what people think about simulations is closer to the book model," says Aldrich, "but I don't think that many people would consider them simulations by the definitions young kids have. I think there needs to be a new beast."

SimuLearn is on the verge of releasing its first training simulation, and Aldrich approaches the release and current state of sims with caution and skepticism. "Not until 2003 will you start to see a significant proliferation of simulations. That's when I think they'll really take off," he says.

Aldrich is also cautious of the recent swell of interest in simulations and worries that many companies will jump on the bandwagon and repackage current offerings. "If you don't have all of the necessary criteria, the simulation will just fall apart."

Aldrich considers the following elements necessary for a successful sim design:
● authentic and relevant scenarios
● applied pressure situations that tap users' emotions and force them to act
● a sense of unrestricted options
● replayability.

When it comes to putting pressure on a user, Boston Dynamics has it down pat. Its simulators have trained aircraft carrier launch officers, taught police officers how to control the use of deadly force in protecting citizens and themselves, and trained emergency response personnel on how to deal with accidents. Now, the company has its eye on the corporate market.

Boston Dynamics is unique in that it provides only part of the end experience. Through its PeopleShop and DI-Guy products, users are given a customizable tool.

"The key advantage of real-time 3D simulation is that the users themselves can modify the training sce-

narios to make modifications or adapt the simulator for their specific needs," says Marc Raibert, president. "Such end-user modifiability isn't possible with video. Furthermore, our tools allow subject matter experts (application specialists) to create and modify the training content without being dependent on the engineers who build the simulators."

For Imparta, the design is buttoned-down, but users can run amok in the depth of their simulated world. Through a hybrid approach of video and computer animation, a realistic business situation is created that tests a user's skill level through a variety of simulated business interactions. Backgrounds are static; computer-generated images of exceptionally high quality that force you to blink to see whether it's the real thing. Amid the backgrounds, human actors

No one knows what a good simulation should look like...

filmed against a blue screen portray characters who respond to your decisions. As you work your way through a complex problem-solving adventure, the characters stare out at you from a simulated video phone or apprise you of your progress. The goal was to create an immersive environment while conserving bandwidth. A single title might include 10,000 lines of dialogue, which is a huge amount of information and a hurdle for online delivery. Still, CEO Richard Barkey says Imparta simulations will be ready for online delivery in six months.

In Imparta's sims, video integration is seamless and effective. An animated expert, or mentor, sits patiently in the corner offering advice dependent on user per-

formance: Novices get more, experts less. After the user completes a section, the mentor provides feedback and suggests how the user could improve. The importance of the feedback is arguable. Some sim designers are reluctant to break the flow or reality of a simulation to reflect on what has been learned.

At Indeliq, Ninth House, and Imparta, simulations are only part of a title's offerings, with many simulations providing interactive links to glossaries and additional coaching resources. Ninth House frequently customizes material for the classroom and encourages a blended approach, giving its products the feel of suites rather than single applications. A value-added approach never hurts: This early in the game, it's possible that prospective buyers will be put off by a simulation-only offering. Though the ideal is a simulation that foils completion until a user has mastered the required skills, that's still in the works. Completion, feedback, and replay will make up the model for the foreseeable future.

Speed bumps

Simulations face a number of obstacles that may slow their adoption. Among them are the difficulty of differentiating sims from first-generation e-learning, stringent hardware requirements, and the promise of online delivery. Differentiating on looks alone isn't enough; quality content is essential. Sim designers such as Ninth House and Indeliq are partnering with proven models from Peter Senge at MIT and sales training expert Miller Hyman. Says Indeliq's Hamburger, "We don't pretend to be experts in the content or the subject matter so we partner up with best-of-breed content providers. Our expertise is the technology, the pedagogy, and the distribution."

And let's face it, companies trust what's familiar. Many firms have been teaching Tom Peters or Peter Senge in the classroom for years. Simulation companies that can't bring that kind of expertise to the table will struggle.

"The problem is that no one knows what a good simulation should look like," says Aldrich. "There's a lot of 'trust me.'" Co-branding with notable experts and time-tested models eases the fear of purchasing and increases the chances of simulations' success, but having an SME's name on the box doesn't guarantee the quality of the simulation.

More pressing problems are bandwidth and the demands that computer-generated graphics place on networks and users' computers. Internet delivery offers easy deployability to a wide number of users throughout an enterprise and furthers e-learning's promise of anytime-anywhere learning. Most e-learning companies in the corporate market foresee online delivery and, eventually, handheld delivery as the next steps in simulation evolution.

Indeliq already offers 100 percent Web delivery, though that somewhat sacrifices the immersive environment. Depending on bandwidth limitations, Indeliq offers three versions. The most basic eschews video and images almost entirely—a tradeoff the company was willing to make to be competitive with other e-learning offerings.

Like many simulation developers, Ninth House was convinced that the adoption of streaming media would happen faster than it has. In the meantime, Ninth House has backed off of bandwidth-hungry simulations and streaming video and now offers NetCDs with its courses. Those CD-ROMs contain all video content, enabling companies with slow Internet connections to run the simulations without sacrificing video performance.

Offerings from SimuLearn and Boston Dynamics rely heavily on the hardware side. The use of computer graphics eases the bandwidth requirements, but high-processing speeds and video cards are a must to render computer-generated animations on the fly. Unfortunately, it hasn't been until the last year that affordable desktops have offered adequate performance. "I think we're just entering a time where hardware is capable of doing something kind of interesting," says Aldrich. "You can't buy a machine that's less than 450Mhz, and graphics cards are becoming commonplace. Clearly, the power is getting there." Still, many companies are reluctant to put multimedia machines on employees' desks, are removing soundcards, and are increasing the use of smart terminals.

Regardless of delivery format, a successful simulation company will be able to differentiate itself in quality of content. But what do you do when your product resembles a video

Scenes from around the world on Imparta's *Marketing Copilot* simulation.

Motion capture sensors record an actor's histrionics at Boston Dynamics.

Simple gestures belie complicated mathematical calculations, in a simulation from SimuLearn.

Don't be a Jimmy. Scenes from Ninth House Network's video-rich simulations.
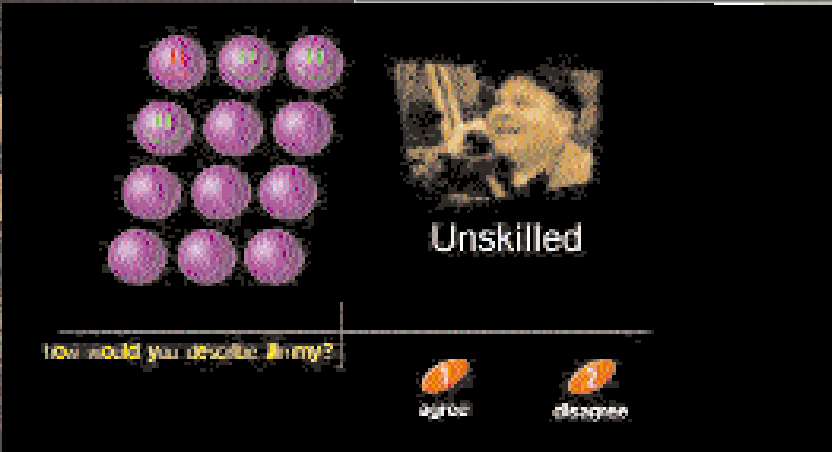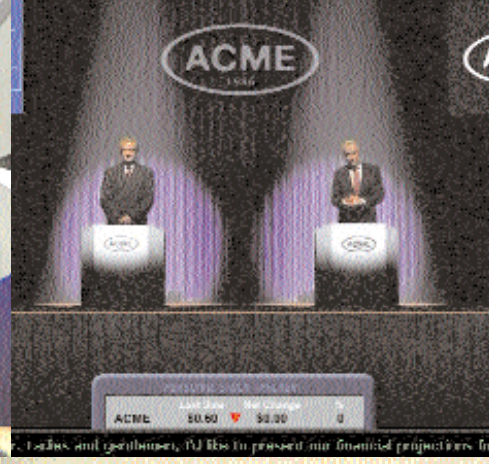
Simulations are the ultimate promise of e-learning...

game or a TV show? It's hard to make a case for ROI. Aldrich feels that dilemma acutely. Computer games have had a strong influence on SimuLearn's products, which look nothing like current e-learning offerings.

"We don't have a cultural competence with computer animation," says Aldrich. "We're kind of sprinting in the dark. A lot of people will say they don't get it or don't know what they learned. There's no professor telling you what to learn or 10 bullet points telling you what to memorize. In terms of walking away with the satisfaction of having learned 15 points, you just won't have it."

So, do you back away from computer game models and provide the 15 points? Or do you go all out and create something that appears to have been made for the X-Box? Aldrich worries that younger users, experienced with computer games, will be unsatisfied with simulations that don't go far enough. "People who are older than I am," the thirty-somethings, Aldrich says, "[typically] aren't comfortable with the notion of simulations. They don't really get it. But younger users who go home and play great simulations and great games—and have a ball with them—tell us there are 10 things we could have or should have done that we didn't. Either way, I don't believe that e-learning as an industry will get really interesting until the whole simulation thing happens."

The next e-thing

So, are computer-based simulations the next e-thing? The technology makes a pretty strong case. But in terms of revenue, simulations don't even register on a stock analyst's radar. It's still early, really early. As with any new technology, its direction is likely to twist and turn several times before an eventual shakeout. In the meantime, simulation developers fuel themselves on the potential of a technology that, frankly, leaves current e-learning offerings in the dust. Will the best technology win out? Analysts are keeping a watchful eye on simulations to see.

"Simulations are the ultimate promise of e-learning in terms of being able to actually improve on instructor-led training," says Trace Urdan of ThinkEquity Partners. "So rather than being a substitute, you have something that has the potential to be better than stand-up training." But Urdan hastens to add that simulations are still a niche segment of e-learning. "There's still an education process of getting people to understand what's offered and why it's unique. Ultimately, I don't think simulations can be successful without having a broad range of titles and without being able to price and position them so [you won't] have to go head-to-head with the big guys."

IDC's Cushing Anderson agrees: "I think that simulations are going to play only a limited role in education. And I think that animation will play only a limited role in online education." Anderson says that though visual learning is important, the content is more important. "Most things that we have to teach, most things that make us good at our jobs, don't involve that kind of rendering or that kind of environment.

"So, maybe in six months or two years from now, simulation developers will be able to do a lot more than they can do right now, and the applicability of simulations may dramatically increase. But they will never become an overwhelming part of the learning people do."

But—and there's always a but—Anderson also says that for what simulations can do and do well, there are huge upsides. "I just can't argue with all of the reasons someone would say it's important to do simulations," he says. "The only thing I would argue with is how much of what we learn is suited to that kind of environment. Not much."

There's no doubt in Urdan's mind that there's a potential with simulations for lessons to stick in a way that they don't through other types of asynchronous e-learning. But that alone may not be enough. Static training budgets and e-learning's failure to dissolve initial skepticism put training simulations in a precarious position.

"Buyers are becoming more sophisticated, and budgets are flat," says Urdan, "It's going to be very hard for this industry to take off." **TD**

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