Shaping Cities, Pixels to Bricks

3-Dimensional Computer Models Make Architects' Ideas Accessible

By NINA TEICHOLZ

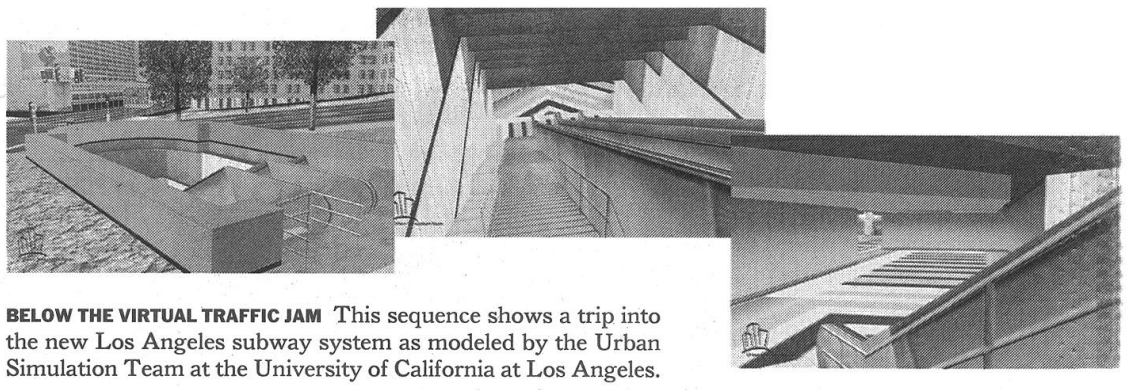
MIKE ROSEN, an architect, first glimpsed the future of his profession in an unlikely spot — the video game arcade at a nightclub. At the time, Mr. Rosen, who is the head of his own firm in Philadelphia, was having trouble getting local approval for a planned community he had designed in Chester County, Pa.

The problem was on his mind at the nightclub as he donned a virtual-reality helmet to play the game Virtuosity, hunting pterodactyls in a spare geometric environment. "I thought, this is a perfect visualization tool for architects," he recalls.

Mr. Rosen is part of a small cadre of architects who create three-dimensional models of cities on computer screens, a technique called urban simulation. It takes state-of-the-art virtual reality techniques, many of them borrowed from military flight simulation technology, and applies them to the basic business of urban planning.

The results are virtual cities: digital, three-dimensional models of cities like Los Angeles, Washington, New York and New Orleans. Mr. Rosen built a model of Philadelphia. "People can't read architectural drawings and they can't relate to models," Mr. Rosen said. "But I realized they found virtual-reality technology cool and that maybe I could relate to clients that way."

Some of the models are extremely detailed: a model of Los Angeles created by Bill Jepson, director of the Urban Simulation Laboratory at the University California at Los Angeles, is accurate down to the graffiti on the buildings and the signs in store windows.



BELOW THE VIRTUAL TRAFFIC JAM This sequence shows a trip into the new Los Angeles subway system as modeled by the Urban Simulation Team at the University of California at Los Angeles.

Depending on the sophistication of the program, viewers can navigate through these models as they would through a video game, flying over buildings, spinning 360 degrees and even changing features of the landscape with a mouse click. Some of the models are also "smart," that is, connected to a database. If you click on a building, you can get information on the building's owner, the principal tenants, even the current cost for each square foot.

These models are already changing the way real estate developers do business, said Michael Kwartler, director of the Environmen-

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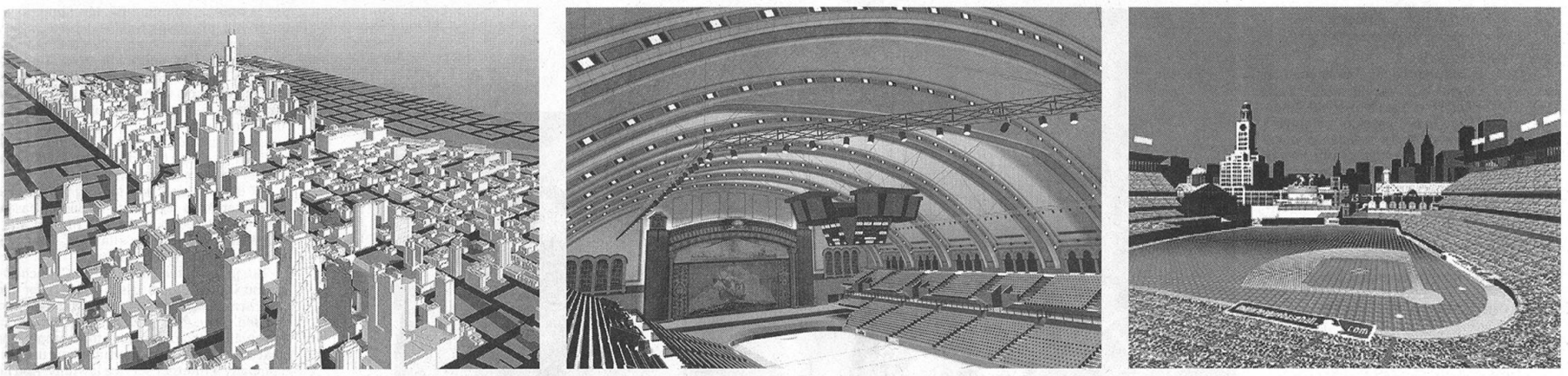
Shaping Cities, Pixels to Bricks, With 3-D Models



LIKE BEING THERE Simulations of Chicago, far left, an auditorium in Atlantic City and a new baseball stadium for the Philadelphia Phillies. The stadium model revealed a problem that averted a minor disaster for developers.

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tal Simulation Center in Manhattan. For example, he built a three-dimensional model of a SoHo neighborhood for a developer seeking to build a hotel there. "We showed the model to the community, let them fly around it and look at things from different angles," Mr. Kwartler said, "and we sailed through the public hearing. After all, it's much easier to do urban planning by consensus than by injunction."

In the not-so-distant future, the models should be so sophisticated that you could wander through the virtual streets looking for that little Italian restaurant you visited years ago, recognize the window display and click on it to look at the menu or perhaps make a reservation. Police and fire departments will probably be able to set up virtual command centers in virtual cities; critical information like floor plans and the locations of fire hydrants and hose bibs could be updated easily.

Using virtual reality technology to walk through or fly over the streets of simulated cities.

"This isn't just in the realm of imagination," Mr. Jepson said. "We're pushing hard to develop these emergency response applications."

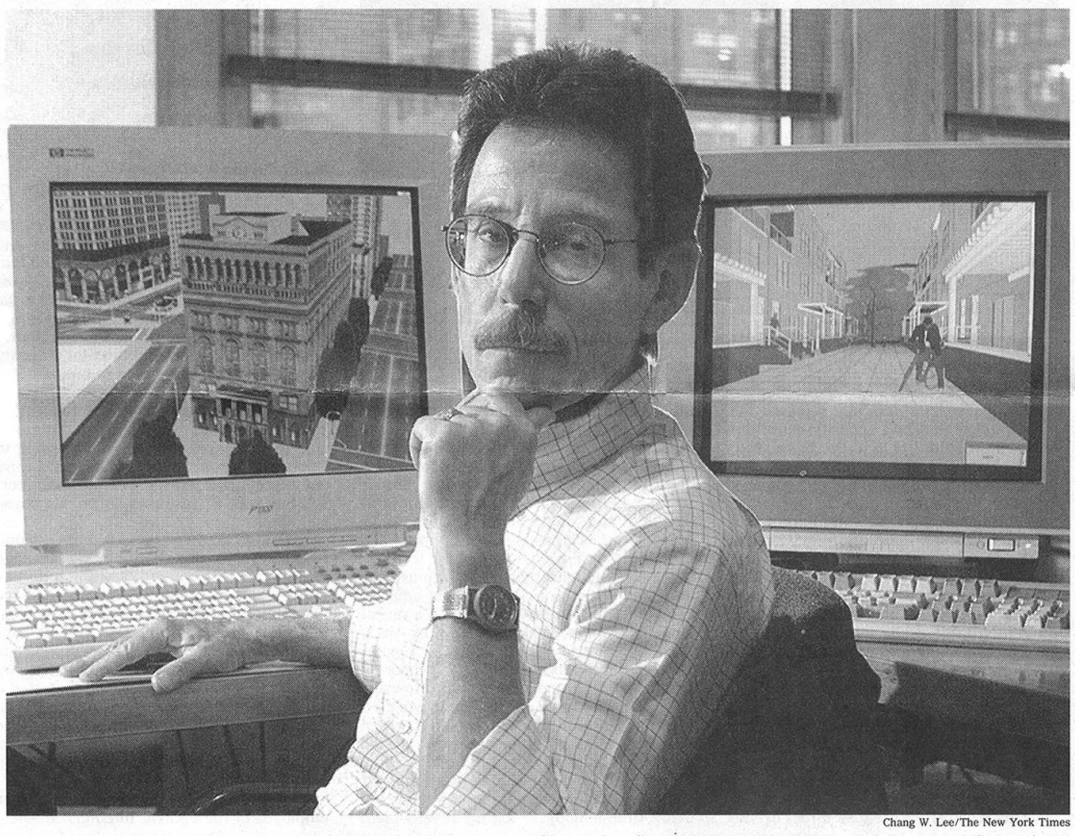
Mr. Jepson's laboratory is also building a virtual version of ancient Rome. The purpose is primarily educational: faculty and students could meet as avatars on Roman soil and perhaps get a history lesson from an actor playing Julius Caesar.

Two people looking at the same blueprint may imagine the object in radically different ways.

"Architects typically get fired in the middle of projects," said Joel Orr, an urban simulation consultant, "usually because the owner and architect think they have a shared assumption about how something will look, which is not true." Virtual tools, he added, "permit a far greater opening of communication channels between humans than has ever before been possible."

The first city to be simulated was an imaginary one, created at U.C.L.A. in the 1970's. NASA had given the school a grant to develop applications for the technology used to simulate the Apollo moon missions. Until modeling became common in the industry, architects would slide video cameras through physical models to try to capture the pedestrian perspective. The heat of the lights caused all the photographs to peel off the little model buildings, said a clearly unnostalgic Mr. Kwartler.

Today, urban simulation technology is so persuasive that the National Capital Planning Commission now requires architects to submit three-dimensional computer models of all proposed projects on Washington public land. These projects are then integrated into the citywide model. "It allows us to control what we're going to see as opposed to what the applicant wants us to see," said Michael Sherman, a community planner for the commission.



Chang W. Lee/The New York Times

PLANNING TOOL Michael Kwartler, director of the Environmental Simulation Center in Manhattan, uses models at public hearings.

Mr. Sherman used the example of the proposed World War II memorial on the Washington Mall: "We were able to evaluate the impact much earlier on. We could see whether the views of the Lincoln Memorial and other historical landmarks were blocked. It was very helpful to see the memorial from the perspective of a pedestrian, which you can't do with a physical model."

The basic tools for urban simulation are now within the reach of most architects. While more photorealistic modeling still demands a high-end Unix station costing at least $15,000, many architects can do less sophisticated work on a Pentium-class PC with a $300 graphics card. Software is more expensive. The programs for building a 3-D world (for example, Viz by Autodesk, MicroStation by Bentley Systems and Creator by MultiGen-Paradigm) and for real-time simulation (like Vega and GameGen by MultiGen-Paradigm) add up to about $15,000.

That money can save on costly construction fiascos. Before ground was ever broken on the mammoth Bellagio hotel in Las Vegas, for example, the developer made hundreds of changes based on reactions to the virtual model. In Philadelphia, developers of a new baseball stadium for the Phillies averted a minor disaster by consulting a virtual model built by Mr. Rosen.

"When we built the model and got down onto the field and looked toward the sky, we realized that the huge scoreboard hid a piece of the city skyline," Mr. Rosen said. So he moved the stadium over 40 feet and rotated it so that the developers had the design and view they wanted. "There was no other way to visualize that problem until the stadium was built," he said. "By then it would have been too late."

Virtual modeling is also aiding in the laborious search for rooftop or office space. When Chase Manhattan Bank was looking for 20,000 square feet of space recently, it went to Urban Data Solutions, a firm that has built a model, accurate to within a meter, of most of New York City. Telecommunication companies have hired Urban Data to scout out rooftop locations for their antennas and receivers. Standing atop any virtual building, a viewer can see if other buildings will block signal sight lines. Andrew Lerner, president of Urban Data, said he planned to use his model for emergency personnel training and maybe even for virtual backdrops for movies.

Some of the field's most innovative work is being done by New York's Environment Simulation Center. Mr. Kwartler has developed modeling software that works on a Pentium-class PC with an inexpensive graphics card, thereby enabling communities to do planning on their own. The software is like a 19th-century pattern book, with a kit of parts — houses, garages, trees, streets — that a town planner can use to paste together various development schemes. Each element is "smart," so when a new set of houses is placed on a street, the software immediately calculates the additional tax revenue versus the new cost of road and utility maintenance.

The model can even make sophisticated predictions about outcomes. Build an upscale mall in your town, for example, and the software will project what kinds of people might shop there, how much money the mall might generate, and so on. Build a low-end mall, and the model will assume that some nearby homeowners would move out of town.

"It creates a kind of accountability," Mr. Kwartler said. "You can't be seduced by someone's perhaps overly optimistic vision."

The town Mr. Kwartler has modeled most extensively is Ascutney, Vt., (population: 1,000), which is considering several ways to develop its tiny downtown. Mr. Kwartler's group presented its simulated models during the summer. "It was like someone flipped on a light switch in the room," said Gary Smith, a consultant who is gathering data for the project. "People who would barely talk to each other because they couldn't agree on where to build new roads suddenly had at least a willingness to explore more."

For the architects and developers accustomed to controlling what people see, these advances can be threatening. "Normally, an architect goes to a meeting with three drawings — each of them a very manipulative view that's favorable to the developer," Mr. Kwartler said. But modeling technology levels the playing field; a client can visualize just as well as an architect. "Architects find this technology very uncomfortable," said Mr. Sherman at the National Capital Planning Commission. "We're running into a lot of resistance because they don't want to give the government their 3-D files. They don't want to lose control of what's seen."

Other critics say computer models fail to capture the tactile quality of a development landscape. "I get the criticism we even make all the ugly stuff look good," Mr. Kwartler said. The limited power behind most models means that they can't show every gritty detail — cabs honking, trash cans overflowing, power lines. "If you saw a model I did of Chinatown," Mr. Kwartler said, "absent all its hustle and bustle, and then you went to the real place, you'd be totally shocked."

Mr. Rosen blames high expectations among viewers of the technology for some of the criticism. "They've come to want the photorealism of 'Toy Story' and 'Jurassic Park,' " he said. "That's just too expensive for us."

But three-dimensional modeling is a giant step toward allowing cities and towns to have meaningful conversations about aesthetics. The whole point, Mr. Kwartler said, is to avoid the experience of someone saying, "Gee, I didn't know it would look like this!"