From Vision to Simulated

Video game technology takes planning visualization to a new level.

Art by Kendig Keast Collaborative

Imagine flying high above a three-dimensional model of your city before swooping down to show a concerned resident how a proposed high rise will affect the view from her living room window. Picture switching between alternative building designs and seeing where each option would cast a shadow at 3 p.m. on the shortest day of the year. Now, imagine doing all of this from your laptop in a real-time computer simulation.

While planners have always had access to visioning tools, a major advance in spatial imaging is coming from an unlikely source: online games. That's because games supply the third dimension.

For the past 15 years, planners have relied on GIS to meet their spatial information needs. While two-dimensional maps can be extremely useful for data analysis, GIS applications running on Windows-based desktop machines often lack the processing power to accurately render 3-D images.

Real-time 3-D environments, such as the popular online game Second Life, rely on powerful rendering algorithms developed by the video game industry over the last decade. In recent years, some visionary spatial analysts and software developers have recognized an opportunity to apply this game technology to visual analysis of the built environment.

One such company is Simmersion Holdings in Canberra, Australia. Its Simurban software suite uses Microsoft's Direct X multimedia interface to create and deploy a real-time simulation on a desktop or notebook computer. Simurban allows planners to import preexisting spatial data to generate a lifelike simulation of an actual or conceptual environment. Users interact with the program like a video game—building, making,

Reality

By David Morley

Planners from Kendig Keast Collaborative used Simurban software to simulate various riverfront redevelopment scenarios in Paducah, Kentucky. The firm modeled the city's historic core, natural features, and proposed residential and commercial development, an overlook area, and a water park.

and seeing changes on the fly, rather than waiting for image rendering.

In essence, Simurban is a 3-D GIS platform with some dramatic but practical flourishes. It amalgamates geo-referenced data—such as orthophotography and digital elevation data—ground-level pictures, and CAD models into a simulated environment. The software also contains tools that allow planners to augment their spatial data with wind, sound, water, and a mathematically driven solar engine that places spatially correct light and shadows depending on the time of day and the season.

Gavin Duffy is the director of RealSim, Ltd., an affiliated service provider for Simurban in Ireland. Over the past three years, his firm has worked with local governments and developers in Galway and Dublin to build models for both development review and marketing. "If a planner can immerse him or herself in a virtual representation of the built and proposed environment, then he or she can better understand the consequences of the proposals," Duffy says.

Simurban goes beyond the capabilities of 3-D block models or even level three architectural models by adding interactivity. While sophisticated designers can use tools like Google's SketchUp to create simple "drive-by" or "fly-over" movies of a project site or redevelopment area, viewers cannot interact with the models in real time.

Like GeoImmersive video (see "Tech Hybrids—in Hand and on the Horizon," *Planning*, July 2006), Simurban simulations provide 360-degree views of project sites. However, because these simulations draw on a variety of geospatial data, including 3-D models, instead of extensive omnidirectional photography, they have much more potential for studying future development

scenarios. Also, Simurban's simulations are not limited by preexisting video libraries. With aerial photographs and geo-referenced height information, users can create fully interactive environments for any place on the globe.

Simurban is a powerful tool, but it's also a costly one. The software suite consists of three applications, at prices that range from $3,333 a year for the most basic—the World Simulator, which allows interaction with existing structures—to more than $30,000 for the World Generator, which allows users full creation and editing functionality. Users might also want to purchase additional input data such as orthophotography and overlay images for surface textures as well as terrain height files.

Real-world applications

Such simulators have obvious potential for master planning and development review. They help planning staff, appointed officials, and stakeholders to understand the impact of changes in the built environment before a single shovel strikes the ground.

While 3-D simulations of the built environment have been slow to catch on in the U.S., Simmersion's CEO Robert Quodling estimates that 30 percent of all local governments in metropolitan Sydney, Australia, have used Simurban in development review. Others have used it to create "what if" scenarios for future development.

One early adopter of Simurban is Gosford, a city of 160,000 people about 50 miles north of downtown Sydney. Gosford started using a prototype of the software in 2002 to construct a simulation of its central business district. Today, the city's Three Dimensional Virtual Reality, or 3DVR, model contains about 680 buildings and 50,000 trees. The city layered orthophotography at half-meter resolution over the terrain. Roughly half the buildings have ground-level photographs mapped to their surfaces, and each building has a unique identifier that allows users to turn any structure on or off to explore various scenarios.

Gosford planner Greg Flynn, who won an award in 2004 from the Planning Institute of Australia for his innovative use of Simurban, says the software removes some of the emotion from development review by allowing all stakeholders to get the same objective view of a new project. The city even tested its new downtown development regulations in the 3DVR simulation before making them law. "It is certainly comforting to know exactly what a cityscape will look like if the controls are complied with," Flynn says.

Using the software also affects the city's bottom line: Flynn estimates that Gosford saves $1 million or more a year in legal fees due to its accuracy. "As they say, 'a picture is worth a thousand words,' and it certainly is in town planning decision making," he says.

Here in the States

According to Quodling, Kendig Keast Collaborative, based in Sturgeon Bay, Wisconsin, is the only firm in the U.S. currently using the Simurban software. Like Ireland's RealSim, KKC is an affiliated service provider with an unrestricted license to build simulations for its clients, which include developers and local governments.

In 2005, KKC used Google SketchUp and AutoCAD's 3D Studio Max to help El Lago, Texas, conceive of—and see the potential results of—new waterfront redevelopment regulations. Despite its success with the project, it was time consuming since the programs could not handle large amounts of data simultaneously, says Mac Birch, a principal in the firm's Chicago office.

By the time KKC completed its next modeling project in 2006, the firm had a new tool at its disposal—Simurban. Birch and his colleagues built a 3-D visualization model for a 50-lot subdivision on a 9.3-acre tract in Oakley, California, northeast of San Francisco. The developer's site plans included street and lot layout as well as unit placements for each of four distinct single-family home designs and variations.

The team built CAD models for each design, meticulously varying building materials, roofs, and color to avoid monotony. Next, team members imported the models into a Simurban simulation prepopulated with geo-referenced aerial photography and terrain elevation data. Then, Birch's team brought the proposed subdivision to life with the addition of street trees, vehicles, signs, and street lighting. Ultimately, the developer used the simulation to attain city approval for the project.

Subsequently, Birch and his colleagues worked with Paducah, Kentucky, to produce a simulation for a riverfront redevelopment planning study. Their model recreated a part of the city's historic core and proposed new elements such as floating piers, a new Ohio River overlook, a water park, and residential and commercial redevelopment areas.

Birch says that his company was "delighted when Simurban came along, even though it is far more expensive [than the previous approach] and has a learning curve." The program is "particularly good at modeling wide areas where there is lots of vegetation," he adds.

On the horizon

KKC founder Lane Kendig believes that in the coming years American planners will use technological shortcuts to make visualization easier. However, he points out that the city-scale projects undertaken in Australia, though impressive, have met resistance due to costs, and that like GIS, this new approach will take time to reach the mainstream. Right now, Kendig says, tools like Simurban are well suited to smaller-scale simulations, such as alternative visualizations for redevelopment, corridor studies, and transit oriented development.

"Fifteen years ago, we were beginning to speculate on the impact of GIS on planning," says Birch. "Three-dimensional modeling is the next wave. Future planners that do not embrace this technology will be left in the dust."

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Levels of Modeling

Not all three-dimensional building models contain the same level of detail. CAD builders and designers often refer to their models using a shorthand that denotes the amount of underlying data used in construction.

- Level 1: a simple block object model with no depiction of detail. In Simurban, users can create Level 1 models on the fly.
- Level 2: block objects draped with ground level photography. When modeling existing structures, Level 2 drapings can create the illusion of building materials and architectural details.
- Level 3: a final architectural model with rendered polygons representing building materials and architectural details. Developers often use Level 3 models to sell their visions.
- Level 4: a final architectural model with interior as well as exterior building details. Simurban allows users to move inside 3-D structures.