

Physically Based Daylight Simulation and Visualization

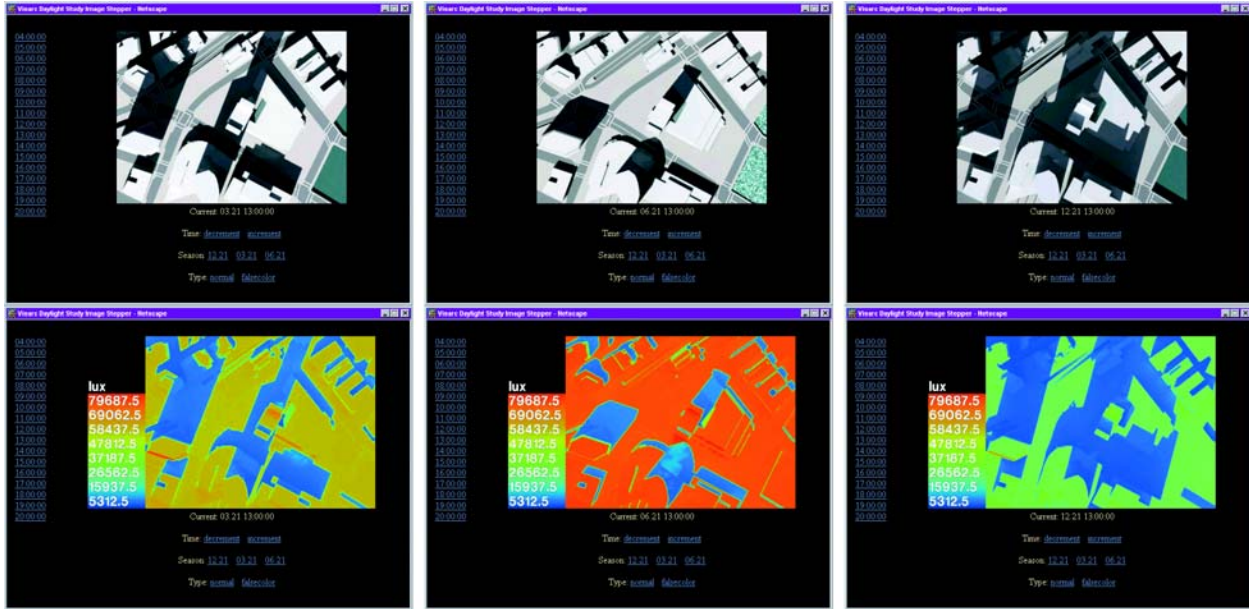
John de Valpine
Visarc Incorporated, USA

Benjamin Black
Visarc Incorporated, USA

While architects typically agree that daylight is a powerful influence for design, architects rarely collect and use daylighting data to help make informed design decisions. This deficiency exists partially because there are no common tools available to provide useful and accessible data. The objective of this project is to provide accurate daylighting data of a prominent urban building site and present it in a clear way so that the architects can make well informed design decisions that respond to site daylighting conditions and improve architectural performance.

An urban 3D computer model was created with AutoCad, a commercial CAD application. Daylight was simulated with Radiance, the physically based rendering engine developed at Lawrence Berkeley National Laboratory. The standard CIE model for clear sky and sun was used to produce over 500 images that represent daylight conditions for three different times of year at 10 minute intervals in both luminance and illuminance formats.

The simulation data was packaged for analysis with a unique browser tool that enables the architect to easily cycle through the data to evaluate and compare behavior by time of day and by season. The architect can also toggle between luminance and illuminance format to easily visualize both qualitative and quantitative data. The exploration and use of the simulation data can be applied with sensitivity to inform the design and decision making process for the exterior building site.



Interface showing plan view simulation of daylight at 1:00 pm during March/September (left), July (middle), December (right). Bottom row shows false color map to indicate numeric lighting levels.



Plan view normal simulation of daylight at 8 am, 10 am, 12 noon, 2 pm, 4 pm during March/September