Guest Editors’ Introduction

Procedural Methods for Urban Modeling

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As computer graphics simulations of our natural world continue to improve, effectively depicting our human environment is becoming increasingly important. Our everyday world consists not simply of basic materials and objects, but also of the things we make from them. Our cities are simultaneously the most complex and the most common of these things. To automate city modeling, researchers are beginning to revive research on procedural modeling, simulating not only natural processes but the human processes that shape our urban environment. This special issue captures a good snapshot of work in this emerging area.

The tutorial by Watson and colleagues surveys prior work and studies in using procedural urban modeling. Procedural Inc.’s CityEngine is one of the most mature procedural urban-modeling tools; its applications include film, archeology, and urban planning. However, procedural modeling has yet to make significant inroads into computer game production. The tutorial examines existing uses of procedural modeling in the games industry and suggests improvements to the technology that would increase its use.

Convincing urban models require detail at scales that range from miles to millimeters. At the city-spanning end of the scale, Chang and colleagues present methods for controlling the complexity in urban environments. Their technique improves traditional model simplification algorithms by measuring urban detail with methods drawn from Kevin Lynch’s The Image of the City (MIT Press, 1960).

Aliaga and colleagues describe a new system for editing urban layouts. Rather than executing these edits on elements of a geographic information system (GIS) or image raster, users can perform move, copy, cut, or paste operations in the more appropriate grammar of streets, blocks, and parcels.

Of course, we also perceive urban detail at the scale of buildings, windows, and cornices. Mendez and colleagues describe a system for visualizing the underground infrastructure that all urban residents rely on, but most know so little about. Their method accepts annotated 2D GIS data as input and procedurally transforms that data into 3D models at runtime. This just-in-time transformation supports a wide range of visualizations derived from input annotations.

Finkenzeller describes a method for modeling building facades, floor plans, and roofs that segments modeling into a manual sketch of a rough shape and a procedural elaboration of that shape using a certain style.

Finally, urban environments aren’t completely devoid of natural objects; they include greenery running along streets, populating gardens, filling parks, and growing on any patch of dirt available. Weber’s work describes how to animate procedurally generated trees in real time.

We thank all the contributors to this special issue for submitting the results of their creative work and the reviewers for taking the time to consider these results thoughtfully. We look forward to interacting with all these colleagues in the future, as we continue to develop the new and interdisciplinary field of procedural urban modeling. We’re also grateful for the IEEE Computer Society editors for finding the mistakes we missed, making all this work presentable, and putting up with
our vagaries. Finally, we thank the IEEE CG&A editorial board for affording us the opportunity to produce this special issue.

**Benjamin Watson** is an associate professor of computer science at North Carolina State University. His Design Graphics Lab focuses on the creation of meaning in imagery and spans the intersections between graphics and perception, design, and interaction. His work has been applied in digital entertainment, computer security, financial analysis, education, and medical assessment. Watson earned a doctorate in computer science at the Georgia Institute of Technology. He cochaired the Graphics Interface 2001, IEEE VR 2004, and ACM ISBD 2006 conferences, and was coprogram chair of ISBD 2007. He’s an ACM and senior IEEE member. Contact him at bwatson@ncsu.edu.

**Peter Wonka** is an assistant professor in the computer science department of Arizona State University. His research interests include real-time rendering, procedural urban modeling, and the application of computer graphics and visualization to various urban planning problems. Wonka received a PhD in computer science and an MS in urban planning from the Vienna University of Technology. He’s a member of the Partnership in Research and Spatial Modeling lab. Contact him at pwonka@gmail.com.

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