

# Curriculum Vitae – Carsten Dachsbacher

## Personal Information

Name Carsten Gerhard Dachsbacher  
Birth 1. December 1976 in Neuendettelsau, Germany  
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## Education

03/2006 Received PhD degree (summa cum laude), for thesis on "Interactive Terrain Rendering: Towards Realism with Procedural Models and Graphics Hardware" (Supervisor: Prof. Dr. Marc Stamminger). Awarded with the "Promotionspreis der Technischen Fakultät der Universität Erlangen-Nürnberg" (price of the technical faculty of the university).

2002-2006 PhD student at the Computer Graphics Group, University of Erlangen.

1997-2002 Student of Computer Science at the Friedrich-Alexander-Universität Erlangen (University of Erlangen). Received Diploma with honors in Computer Science. Diploma thesis in Computer Graphics on "Point Based Rendering on modern Graphics Hardware" (Supervisors: Dr. Christian Vogelgsang, Prof. Dr. Günther Greiner).

## Employment

04/2008-09/2008 Visiting Professor at the University Konstanz.

Since 10/2007 Assistant Professor for Visual Computing at VISUS at the University of Stuttgart, Germany.

05/2006-09/2007 Post-Doctoral Fellow (Marie Curie Intra-European Fellowship) at the Institut National de Recherche en Informatique et Automatique (INRIA) in Sophia-Antipolis, France.

2002-2006 Full-time researcher at the Computer Graphics Group, University of Erlangen. Tutor for lectures "Interactive Computer Graphics", teaching of courses in Computer Graphics, advisor of several undergraduate and master theses.

2001-2002 Research Assistant at the Department of Physiology and Experimental Pathophysiology, University of Erlangen.

1998 Research Assistant at the Computer Graphics Group, University of Erlangen.

## Research Topics

### Interactive Global Illumination

Global illumination computations are often a pre-process, resulting in a solution that can be rendered interactively as walkthroughs. For dynamic lighting conditions however, a pre-computation is often not possible or too memory consuming. Therefore plausible approximations of global illumination effects have to be computed instead. In this field of research I have developed methods for the interactive rendering of translucent materials and indirect illumination.

Supported by a Marie-Curie Intra-European Fellowship I developed a novel approach for efficient global illumination computations based on a reformulation of the rendering equation and implicit treatment of visibility.

### Parallel Computing, GPGPU

Exploiting the power of parallel architectures is, and will be, important for photorealistic rendering, simulations, and numerical methods in general. This requires the development of dedicated algorithms, methods, and tools to facilitate the programming of such architectures. We develop tools and extensions to existing programming languages to provide higher scalability and ease of programming, and we also use GPUs for general purpose computations in numerous projects.

### Interactive Photorealistic Terrain Rendering and Procedural Models

Terrain rendering is important for applications such as flight or driving simulators, geographical information systems, landscape architecture and computer games. Photorealistic renderings at interactive frame rates are desirable and necessary for most of the applications. The terrain elevation and surface data can either be acquired from the real-world, e.g. satellite images, or generated procedurally. An important research aspect is the complementing synthesis of real-world and procedural data when the real-world data cannot be acquired at the required accuracy or cannot be stored due to its amount.

### Point Based Rendering

Interactive rendering using point primitives instead of traditional triangular representations has been one focus of research. Based on previous rendering algorithms, new approaches were developed for the maximum utilization of graphics hardware and improved image quality.

### Acoustics and Perceptual Rendering

I have been working on two new interdisciplinary projects. We investigated acoustic simulations using GPUs for efficient computation of sound scattering. Within the EU CROSSMOD project, we worked on rendering techniques which take human perception with respect to masking and contrast into account.

## Research Projects

### University of Stuttgart

- Real-time rendering for video games, funded by Crytek GmbH
- Visualization of light transport, funded by the "Juniorprofessorenprogramm des Landes Baden-Württemberg"
- Coupled Simulation of Light and Sound Propagation in Complex Scenes, within the Cluster of Excellence on Simulation Technology

### Past Projects

- Scalable Global Illumination, Marie Curie Fellowship/INRIA Sophia-Antipolis
- Visualization of Procedural Models on Programmable Graphics Hardware "VisProMo", DFG Project at the University Erlangen-Nuremberg
- BMW Driving Simulator, Project at the University Erlangen-Nuremberg with BMW Research
- 3D Image Analysis and Synthesis, Fellowship of the Graduate School GRK 244

## Awards

2002-2003	Scholarship of the graduate school „Dreidimensionale Bildanalyse und -synthese“
2005	Scene.org Award 2005 „Best 4K Intro“
2006-2007	Marie Curie Intra-European Fellowship (post-doc scholarship)
2007	PhD thesis award of the Technical Faculty of the University Erlangen-Nuremberg
2008	Best paper award <i>CUDASA: Compute Unified Device and Systems Architecture</i> at EGPGV08

- [1] **Structure-Preserving Reshape for Textured Architectural Scenes**  
Sylvain Lefebvre, Marcio Cabral, Carsten Dachsbacher, George Drettakis  
in *Computer Graphics Forum (Proceedings of the Eurographics 2009 conference)*, 2009
- [2] **The Gödel Engine – An Interactive Approach to Visualization in General Relativity**  
Frank Grave, Thomas Müller, Carsten Dachsbacher, Günter Wunner  
in *Computer Graphics Forum (Proceedings of EuroVis 2009)*, 2009
- [3] **Granular Visibility Queries**  
Thomas Engelhardt, Carsten Dachsbacher  
in *Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics & Games 2009*, 2009
- [4] **A Compute Unified System Architecture for Graphics Clusters Incorporating Data-Locality**  
Christoph Müller, Steffen Frey, Magnus Strengert, Carsten Dachsbacher, Thomas Ertl  
in *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 2009
- [5] **Data-Parallel, Hierarchical Link Creation**  
Quirin Meyer, Christian Eisenacher, Marc Stamminger, Carsten Dachsbacher  
in *Proceedings of the Eurographics Symposium on Parallel Graphics and Visualization*, 2009
- [6] **Imperfect Shadow Maps for Efficient Computation of Indirect Illumination**  
Tobias Ritschel, Thorsten Grosch, Min H. Kim, Hans-Peter Seidel, Carsten Dachsbacher, Jan Kautz  
in *ACM Transactions on Graphics 27(5) (Proceedings of the ACM SIGGRAPH Asia 2008)*, 2008
- [7] **Octahedron Environment Maps**  
Thomas Engelhardt, Carsten Dachsbacher  
in *Proceedings of Vision, Modelling and Visualization 2008*, p. 383-388, 2008
- [8] **CUDASA: Compute Unified Device and Systems Architecture**  
Magnus Strengert, Christoph Müller, Carsten Dachsbacher, Thomas Ertl  
in *Proceedings of the Eurographics Symposium on Parallel Graphics and Visualization*, p. 49-56, 2008
- [9] **Improving Image-Space Caustics Via Variable-Sized Splatting**  
Chris Wyman, Carsten Dachsbacher  
in *Journal of Graphics Tools 13(1)*, p. 1-17, 2008
- [10] **Implicit Visibility and Antiradiance for Interactive Global Illumination**  
Carsten Dachsbacher, Marc Stamminger, George Drettakis, Fredo Durand  
in *ACM Transactions on Graphics 26(3) (Proceedings of the ACM SIGGRAPH 2007)*, 2007
- [11] **TileTrees**  
Sylvain Lefebvre, Carsten Dachsbacher  
in *Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games 2007*, p. 25-31, ACM Press, 2007
- [12] **A Novel Perceptual Rendering Pipeline using Contrast and Spatial Masking**  
George Drettakis, Nicolas Bonneel, Carsten Dachsbacher, Sylvain Lefebvre, Michael Schwarz, Isabelle Viaud-Delmon  
in *Rendering Techniques 2007 (Proceedings of the Eurographics Symposium on Rendering)*, p. 297-308, Eurographics Association, 2007
- [13] **Instant Sound**  
Nicolas Tsingos, Carsten Dachsbacher, Sylvain Lefebvre, Matteo Dellepiane  
in *Rendering Techniques 2007 (Proceedings of the Eurographics Symposium on Rendering)*, p. 111-120, Eurographics Association, 2007
- [14] **Prism Parallax Occlusion Mapping with Accurate Silhouette Generation**  
Carsten Dachsbacher, Natalya Tatarchuk  
in *Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games 2007 Posters Program*, 2007
- [15] **Splatting Indirect Illumination**  
Carsten Dachsbacher, Marc Stamminger  
in *Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games 2006*, p. 93-100, ACM Press, 2006

- [16] **Procedural Reproduction of Terrain Textures with Geographic Data**  
Carsten Dachsbacher, Tobias Bolch, Marc Stamminger  
in *Vision, Modeling and Visualization 2006*, p. 105-112, Akademische Verlagsgesellschaft Aka, 2006
- [17] **Reflective Shadow Maps**  
Carsten Dachsbacher, Marc Stamminger  
in *Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games 2005*, p. 103-107, ACM Press, 2005
- [18] **Hexagonal LOD for Interactive Terrain Rendering**  
Gerd Sussner, Carsten Dachsbacher, Marc Stamminger  
in *Vision, Modeling and Visualization 2005*, p. 437-444, Akademische Verlagsgesellschaft Aka, 2005
- [19] **Heightfield Synthesis by Non-Parametric Sampling**  
Carsten Dachsbacher, Martin Meyer, Marc Stamminger  
in *Vision, Modeling and Visualization 2005*, p. 297-302, Akademische Verlagsgesellschaft Aka, 2005
- [20] **Progressive Radiosity auf programmierbarer Grafikhardware**  
Anja Borsdorf, Carsten Dachsbacher, Marc Stamminger  
in *Workshop: Hardware for Visual Computing, 2005*
- [21] **Rendering Procedural Terrain by Geometry Image Warping**  
Carsten Dachsbacher, Marc Stamminger  
in *Rendering Techniques 2004 (Proceedings of the Eurographics Symposium on Rendering)*, p. 103-107, Eurographics Association, 2004
- [22] **Perspective Accurate Splatting**  
Matthias Zwicker, Jussi Räsänen, Mario Botsch, Carsten Dachsbacher, Mark Pauly  
in *GI'04: Proceedings of the 2004 conference on Graphics Interface*, p. 247-254, Canadian Human-Computer Communications Society, 2004
- [23] **Realtime Isosurface Extraction with Graphics Hardware**  
Frank Reck, Carsten Dachsbacher, Marc Stamminger, Roberto Grosso, Günther Greiner  
in *Eurographics 2004, Short Presentations and Interactive Demos*, p. 33-36, INRIA and Eurographics Association, 2004
- [24] **Sequential Point Trees**  
Carsten Dachsbacher, Christian Vogelgsang, Marc Stamminger  
in *ACM Transactions on Graphics 22(3) (Proceedings of the ACM SIGGRAPH 2003)*, p. 657-662, 2003
- [25] **Translucent Shadow Maps**  
Carsten Dachsbacher, Marc Stamminger  
in *EGRW'03: Proceedings of the 14<sup>th</sup> Eurographics Workshop on Rendering*, p. 197-201, Eurographics Association, 2003

## Invited Publications

- [26] **Extending Geometrical Acoustics to Highly Detailed Architectural Environments**  
Nicolas Tsingos, Sylvain Lefebvre, Carsten Dachsbacher, Matteo Dellepiane  
für *19<sup>th</sup> International Congress on Acoustics, 2007, Madrid, Spanien*

## Book Chapters

- [27] **Efficient and Practical TileTrees**  
Carsten Dachsbacher, Sylvain Lefebvre  
in *Shader X6: Advanced Rendering Techniques*, Charles River Media, 2008
- [28] **Sequential Point Trees**  
Carsten Dachsbacher, Marc Stamminger  
in *Point Based Graphics*, Morgan Kaufman/Elsevier, 2007
- [29] **Interactive Diffuse and Glossy Indirect Illumination**  
Carsten Dachsbacher, Marc Stamminger  
in *Shader X5: Advanced Rendering Techniques*, Charles River Media, 2006
- [30] **Cached Procedural Textures for Terrain Rendering**  
Carsten Dachsbacher, Marc Stamminger  
in *Shader X4: Advanced Rendering Techniques*, Charles River Media, 2005

- [31] **Interactive Indirect Illumination**  
Carsten Dachsbacher, Marc Stamminger  
in *Shader X4: Advanced Rendering Techniques*, Charles River Media, 2005
- [32] **Perspektivische Shadow Maps**  
Marc Stamminger, George Drettakis, Carsten Dachsbacher  
in *Spiele-Programmierung Gems 4*, Hanser Verlag, 2004
- [33] **Perspective Shadow Maps**  
Marc Stamminger, George Drettakis, Carsten Dachsbacher  
in *Game Programming Gems 4*, Charles River Media, 2004

## Tutorials/Courses

- [34] **Real-Time Global Illumination for Dynamic Scenes**  
Carsten Dachsbacher, Jan Kautz  
*SIGGRAPH 2009, New Orleans, USA*
- [35] **Core Techniques and Algorithms in Shader Programming**  
Wolfgang Engel, Carsten Dachsbacher, Vlad Stamate, Manchor Ko, Jerome Ko, Marco Salvi, Maxime Beaudoin, Marc McCubbin  
*Game Developers Conference 2008, San Francisco, CA, USA*
- [36] **Core Techniques and Algorithms in Shader Programming**  
Wolfgang Engel, Tom Forsyth, Matthias Wloka, Kenneth Hurley, Martin Mittring, Lutz Latta, Vlad Stamate, Carsten Dachsbacher  
*Game Developers Conference 2007, San Francisco, CA, USA*
- [37] **Point-Based Computer Graphics**  
Marc Alexa, Carsten Dachsbacher, Markus Gross, Mark Pauly, Jeroen van Baar, Matthias Zwicker  
*EUROGRAPHICS 2003, Granada, Spain*

## Theses

- [38] **Interactive Terrain Rendering: Towards Realism with Procedural Models and Graphics Hardware**  
PhD Thesis, Friedrich-Alexander-Universität Erlangen-Nürnberg, 2006
- [39] **Point Based Rendering on modern Graphics Hardware**  
Master Thesis, Friedrich-Alexander-Universität Erlangen-Nürnberg, 2002

## Invited Talks

- [40] **Modellbildung und Simulation der Lichtausbreitung**  
ASIM Workshop, 18.-20. February 2009, Stuttgart, Germany
- [41] **Advances in GPU-Based Real-Time Global Illumination**  
Keynote Talk, 6th Eurographics Italian Chapter Conference, 4. July 2008, Salerno, Italy
- [42] **Terrain Rendering**  
Lehrstuhl für Graphische Datenverarbeitung, Friedrich-Alexander-Universität Erlangen-Nürnberg, 9. Mai. 2007, Erlangen, Germany
- [43] **Approximate Global Illumination and Procedural Terrain Texturing**  
Core Technology Group/Rockstar Games, 14. March 2006, San Diego, CA, USA
- [44] **Interactive Rendering of Indirect Illumination**  
Max-Planck-Institut für Informatik, 14. February 2006, Saarbrücken, Germany
- [45] **Interactive Rendering of Indirect Illumination on GPUs**  
Institut International de Recherche en Informatique et Automatique, 16. November 2005, Sophia-Antipolis, France
- [46] **4K-Intros in a Nutshell, Postmortem: Parsec**  
Computer Grafik Kolloquium, Technische Universität München, 21. June 2005, München, Germany
- [47] **4K-Intros in a Nutshell, Postmortem: Parsec**  
Informatik Kolloquium, Universität Ulm, 5. June 2005, Ulm, Germany

## Technical Reports

- [48] **Analyzing Visibility Configurations**  
Carsten Dachsbacher

## Other Publications

More than 70 articles in the German, monthly computer magazine "PC Magazin" on multimedia programming, mainly focusing on computer graphics. Topics among others were: (Interactive) Ray Tracing, Computer Aided Geometric Design, Terrain Rendering, Rendering of realistic materials/Advanced Rendering Techniques, Non-photorealistic Rendering, Physically based simulation of water, Programming of various Graphic APIs (DirectX, OpenGL, GDI+)

## Reviewing

Reviewer for the following conferences and journals:

SIGGRAPH ASIA 2008, SIGGRAPH 2006/2007/2008/2009,  
Eurographics 2003/2004/2005/2006/2007/2008/2009, I3D 2006/2007/2008/2009,  
EGSR 2003/2005/2006/2007/2008/2009, IEEE Visualization 2004/2005/2006/2009,  
Graphics Interface 2004/2005/2009, Pacific Graphics 2004/2006,  
GRAPP 2007/2008/2009, SIBGRAPI 2006,  
Computers & Graphics, Graphical Models, Computer Graphics Forum,  
IEEE Transactions on Visualization and Computer Graphics

Member of the program committee:

Eurographics 2009, Eurographics Symposium on Rendering 2009, ACM SIGGRAPH Interactive 3D Graphics and Games 2008/2009, Eurographics Area 2009, International Symposium on Visual Computing 2009 (Special Track), GeoWeb 2009, Afrigraph 2009, SIBGRAPI 2006, GRAPP 2007/2008/2009, Symposium on Point-Based Graphics 2007/2008, Vision, Modelling and Visualization 2008/2009

Member of the program committee and section editor of the "Global Illumination"-chapters of the "Shader X5", "Shader X6", "Shader X7", "Shader X8" books, Editor: Wolfgang Engel, Cengage Learning Services.