

# Carlos Eduardo Scheidegger

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## Research Interests

- Information Visualization, Big Data, Data Analysis, Computer Graphics

## Education and Professional Experience

- Assistant Professor. August 2014 –  
Department of Computer Science  
University of Arizona.
- Senior Member of Technical Staff. October 2009 – August 2014.  
AT&T Labs – Research  
Information Visualization Department, Big Data Organization.
- PhD, Computing, January 2005 – October 2009  
University of Utah  
Advisor: Prof. Cláudio Silva
- B.S., Computer Science cum laude, January 1999 – March 2004  
Universidade Federal do Rio Grande do Sul (Brazil)  
Advisor: Prof. João Comba

## Honors and Awards

- Honorable Mention for Best Paper Award at IEEE VIS 2014.
- Honorable Mention for Best Paper Award at IEEE VIS 2013.
- Honorable Mention for Best Paper Award at Eurovis 2013.
- Best Paper Award at IEEE International Conference on Shape Modeling and Applications, 2008.
- Best Paper Award at IEEE VIS 2007.
- IBM PhD Student Fellowship, 2007, 2008.
- School of Computing Distinguished TA Award, 2005.
- Brazilian Computer Society Distinguished Student Award, 2004.
- Graduated cum laude in Computer Science, total combined GPA of 3.75, 2004.
- First place, Entrance exam, Computer Science, Federal University of Rio Grande do Sul, 1999.

## Journal Publications

- [1] *An Algebraic Process for Visualization Design*. G. Kindlmann, C. Scheidegger. IEEE Transactions on Visualization and Computer Graphics. (Proceedings of IEEE VIS 2014) To appear, 2014. **Honorable Mention for Best Paper Award**.
- [2] *Visual Embedding – A Model for Visualization*. C. Demiralp, C. Scheidegger, G. Kindlmann, D. Laidlaw, J. Heer. IEEE Computer Graphics & Applications, 34(1):10–15, 2014.
- [3] *Nanocubes for Real-Time Exploration of Spatiotemporal Datasets*. L. Lins, J. Klosowski, C. Scheidegger. IEEE Transactions on Visualization and Computer Graphics, 19(12):2456–2465, 2013 (Proceedings of IEEE VIS 2013). **Honorable mention for Best Paper award**.
- [4] *Verifying Volume Rendering Using Discretization Error Analysis*. T. Etienne, D. Jonsson, T. Ropinski, C. Scheidegger, J. Comba, L. Nonato, M. Kirby, A. Ynnerman, C. Silva. IEEE Transactions on Visualization and Computer Graphics, 20(1):140–154, 2014.
- [5] *Vector Field k-Means: Clustering Trajectories by Fitting Multiple Vector Fields*. N. Ferreira, J. Klosowski, C. Scheidegger, C. Silva. Computer Graphics Forum, 32(3):201–210, 2013. **Honorable mention for Best Paper award**.
- [6] *Drawing Large Graphs by Low-Rank Stress Majorization*. M. Khoury, Y. Hu, S. Krishnan, C. Scheidegger. Computer Graphics Forum, 31(3):975–984, 2012.
- [7] *Topology Verification for Isosurface Extraction*. T. Etienne, L. G. Nonato, C. Scheidegger, J. Tierny, T. J. Peters, V. Pascucci, R. M. Kirby, C. Silva, IEEE Transactions on Visualization and Computer Graphics, 18(6):952–965, 2012.
- [8] *Combining Predictors for Recommending Music: the False Positives’ approach to KDD Cup track 2*. S. Balakrishnan, R. Wang, C. Scheidegger, A. MacLellan, Y. Hu, A. Archer, S. Krishnan, D. Applegate, G. Ma, S. Au. JMLR: Workshop and Conference Proceedings, 18:1–15, 2012.
- [9] *Verifiable Visualization for Isosurface Extraction*. T. Etienne, C. Scheidegger, L. G. Nonato, M. Kirby, C. Silva. IEEE Transactions on Visualization and Computer Graphics. 15(6):1227–1234, 2009.
- [10] *Bandwidth Selection and Reconstruction Quality in Point-Based Surfaces*. H. Wang, C. Scheidegger, C. Silva. IEEE Transactions on Visualization and Computer Graphics. 15(4):572–582, 2009.
- [11] *Edge Transformations for Improving Quality of Marching Methods*. C. Dietrich, C. Scheidegger, J. Schreiner, J. Comba, L. Nedel, C. Silva. IEEE Transactions on Visualization and Computer Graphics, 15(1):150–159, 2009.
- [12] *Revisiting Histograms and Isosurface Statistics*. C. Scheidegger, J. Schreiner, B. Duffy, H. Carr, C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1659–1666, 2008.
- [13] *Edge Groups: an Approach for Understanding the Mesh Quality of Marching Methods*. C. Dietrich. C. Scheidegger, J. Comba, L. Nedel, C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1651–1658, 2008.
- [14] *VisComplete: Automating Suggestions for Visualization Pipelines*. D. Koop, C. Scheidegger, S. Callahan, J. Freire, C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1691–1698, 2008.

- [15] *Querying and Creating Visualizations by Analogy*. C. Scheidegger, H. Vo, D. Koop, J. Freire, C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2007), 13(6):1560–1567, 2007. **Best paper award**.
- [16] *Tackling the Provenance Challenge One Layer at a Time*, C. Scheidegger, D. Koop, E. Santos, H. Vo, S. Callahan, J. Freire, C. Silva, Concurrency and Computation: Practice and Experience, 20(5):473–483, 2008.
- [17] *High Quality Extraction of Isosurfaces from Regular and Irregular Grids*. J. Schreiner, C. Scheidegger, C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2006), 12(5):1205–1212, 2006.
- [18] *Direct (Re)Meshing for Efficient Surface Processing*. J. Schreiner, C. Scheidegger, S. Fleishman, C. Silva. Computer Graphics Forum (Proceedings of Eurographics 2006), 25(3):527–536, 2006.
- [19] *Practical CFD simulations on the GPU using SMAC*. C. Scheidegger, J. Comba, R. Cunha. Computer Graphics Forum, 24(4):715–728, 2005.
- [20] *Computation on GPUs: from a programmable pipeline to an efficient stream processor*. J. Comba, C. Dietrich, C. Pagot, C. Scheidegger. Revista de Informática Teórica e Aplicada, 10(1):41–70, 2003.

## Conference Publications

- [21] *Multilevel Agglomerative Edge Bundling for Visualizing Large Graphs*. E. Gansner, Y. Hu, S. North, C. Scheidegger. IEEE Pacific Visualization Symposium, 2011.
- [22] *The Provenance of Workflow Upgrades*. D. Koop, C. Scheidegger, J. Freire, C. Silva. Internal Provenance and Annotation Workshop, 2010.
- [23] *End-to-End eScience: Integrating Workflow, Query, Visualization, and Provenance at an Ocean Observatory*, B. Howe, P. Lawson, R. Bellinger, E. Anderson, E. Santos, J. Freire, C. Scheidegger, A. Baptista, C. Silva. IEEE International Conference on e-Science 2008.
- [24] *Toward Provenance-Enabling ParaView*, S. P. Callahan, J. Freire, C. Scheidegger, C. Silva, H. Vo. Second International Provenance and Annotation Workshop (IPAW 2008).
- [25] *Optimal Bandwidth Selection for MLS Surfaces*, H. Wang, C. Scheidegger, C. Silva. Proceedings of Shape Modelling International (SMI), 2008. **Best paper award**.
- [26] *Examining Statistics of Workflow Evolution Provenance: A First Study*, L. Lins, D. Koop, E. Anderson, S. P. Callahan, E. Santos, C. Scheidegger, J. Freire, C. Silva. Proceedings of the 20th International Conference on Scientific and Statistical Database Management (SSDBM), 2008.
- [27] *Querying and Re-Using Workflows with VisTrails* C. E. Scheidegger, H. T. Vo, D. Koop, J. Freire, C. Silva. Demo, ACM SIGMOD 2008.
- [28] *Hardware-Assisted Point-Based Volume Rendering of Tetrahedral Meshes*, E. Anderson, S. Callahan, C. Scheidegger, J. Schreiner, C. Silva. Proceedings of the Brazilian Symposium on Computer Graphics and Image Processing (SIBGRAPI 2007).
- [29] *Managing Rapidly-Evolving Scientific Workflows*. J. Freire, C. Silva, S. Callahan, E. Santos, C. Scheidegger, H. Vo. Proceedings of the International Provenance and Annotation Workshop (IPAW), 2006. Invited paper.

- [30] *Managing the evolution of dataflows with VisTrails*. S. Callahan, J. Freire, E. Santos, C. Scheidegger, C. Silva, H. Vo. Proceedings of the IEEE Workshop on Workflow and Data Flow for Scientific Applications (SciFlow), 2006.
- [31] *VisTrails: Visualization Meets Data Management*. S. Callahan, J. Freire, E. Santos, C. Scheidegger, C. Silva, H. Vo. Demo, ACM SIGMOD 2006.
- [32] *VisTrails: Enabling Interactive Multiple-View Visualizations*. L. Bavoil, S. Callahan, P. Crossno, J. Freire, C. Scheidegger, C. Silva, H. Vo, Proceedings of IEEE Visualization, pages 135-142, 2005.
- [33] *Triangulating Point-Set Surfaces With Bounded Error*. C. Scheidegger, S. Fleishman, C. Silva. Proceedings of the third Eurographics/ACM Symposium on Geometry Processing, pages 63-72, 2005.
- [34] *Boolean Operations on Surfel-Bounded Solids Using CBSP-Trees*. M. Farias, C. Scheidegger, J. Comba, L. Velho. Proceedings of SIBGRAPI 2005 (XVIII Brazilian Symposium on Computer Graphics and Image Processing).
- [35] *Navier-Stokes on Programmable Graphics Hardware using SMAC*. C. Scheidegger, J. Comba, R. Cunha, Proceedings of XVII SIBGRAPI – II SIACG 2004, pages 208-315, 2004.

## Other

- [36] *VisTrails*. Juliana Freire, David Koop, Emanuele Santos, Carlos Scheidegger, Claudio Silva, and Huy T. Vo. Book chapter, in *Architecture of Open Source Applications, Vol. 1*. A. Brown, G. Wilson (eds.). 2011.
- [37] *Provenance of Exploratory Tasks in Scientific Visualization: Management and Applications*. C. Scheidegger. Thesis. 2009.
- [38] *Direct Volume Rendering: A 3D Plotting Technique for Scientific Data*. S. Callahan, J. Callahan, C. Scheidegger, C. Silva. IEEE/AIP Computing in Science and Engineering, 10(1):88–92, 2008.
- [39] *A Unified Projection Operator for MLS Surfaces*. T. Ochotta, C. Scheidegger, J. Schreiner, Y. Lima, R. M. Kirby, C. Silva. SCI Institute Tech Report UUSCI-2007-006.
- [40] *Visualization in Radiation Oncology: Towards Replacing the Laboratory Notebook*. E. Anderson, S. Callahan, G. T. Y. Chen, J. Freire, E. Santos, C. Scheidegger, C. Silva, H. Vo. *Manuscript*.
- [41] *Using Provenance to Streamline Data Exploration through Visualization*. S. Callahan, J. Freire, E. Santos, C. Scheidegger, C. Silva, H. Vo. *Manuscript*.
- [42] *GPUs como processadores de propósito geral*. (In portuguese: GPUs as general purpose processors) C. Scheidegger. B.Sc. thesis. Advisor: Prof. Dr. J. Comba. December 2003.

## Software contributions

- *Nanocubes*. One of the developers of nanocubes, an in-memory data-structure for fast spatiotemporal aggregation queries. Available at <http://github.com/cscheid/nanocube>.
- *RCloud*. One of lead designers and developers of Rcloud, an open-source environment for writing and sharing exploratory data analysis scripts in R over a web browser. Available at <http://github.com/att/rcloud>.

- *Lux*. Lead designer and developer of Lux, an open-source domain-specific language for writing WebGL programs. Available at <http://github.com/cscheid/lux>.
- *VisTrails*. Until 2009, one of the lead designers and developers of VisTrails, an open source provenance-aware system for exploratory scientific workflows and visualization. Available at <http://www.vistrails.org>.
- *Afront*. One of the developers of Afront, a program to generate well-shaped triangle meshes out of many different types of input data. Available at <http://afront.sourceforge.net>.
- *Macet*. One of the developers of Macet, a variant of Marching Cubes geared towards generation of high-quality meshes. Available at [http://www.sci.utah.edu/~cscheid/vis2008/edge\\_groups](http://www.sci.utah.edu/~cscheid/vis2008/edge_groups).
- *PGHFlow*. Lead designer and developer for PGHFlow, a system for solving the incompressible Navier-Stokes equations on programmable graphics hardware. Available at <http://www.sci.utah.edu/~cscheid/smac>.

## Service

**Journal Reviewer** ACM Transactions on Graphics, IEEE Transactions on Visualization and Computer Graphics, Computer Graphics Forum, IEEE Computer Graphics and Applications, International Journal of Computational Geometry and Applications.

**Conference Reviewer** ACM SIGGRAPH, EG Geometry Processing, Eurographics conference, IEEE Visualization, IEEE Information Visualization, ACM Conference on Information and Knowledge Management, IEEE Big Data.

**Program Committees** ACM Conference on Information and Knowledge Management, 2012 and 2013. IEEE Big Data, 2013 and 2014, VPA 2014.

**NSF** Panel participant for grant reviews.

## Invited Talks

- *Exploratory Visualization for Big Data*. Colloquium at University of Chicago, Apr. 2nd 2014
- *Exploratory Visualization for Big Data*. Colloquium at University of Arizona, Jan. 28th 2014
- *Verifying Isosurface Extraction*. Keynote at Graduate Student Research Day, SUNY Stony Brook, Apr. 29th 2011
- *Provenance in Scientific Visualization*. Colloquium at Rutgers University, Apr. 23rd 2009
- *Provenance in Scientific Visualization*. Colloquium at Washington University in St. Louis, Apr. 10th 2009
- *Provenance in Scientific Visualization*. Invited talk at the Computation Institute at the University of Chicago, Apr. 8th 2009
- *Provenance in Scientific Visualization*. Invited talk at AT&T Research, Florham Park, NJ, Feb. 26th 2009
- *Provenance in Scientific Visualization*. Colloquium at Brown University, Feb. 23rd 2009

## Detailed Professional Experience

- *Assistant Professor, Department of Computer Science, University of Arizona.* August 2014 – present.
- *Senior Member of Technical Staff at AT&T Labs – Research.* October 2009 – August 2014.
- *Intern at VisTrails Inc.* Supervisor: Dr. Steven Callahan. Summer 2008.
- *Research Intern at the IBM Watson Research Center.* Supervisor: Dr. Wagner T. Correa. Summer 2006.
- *Research Intern at Lawrence Livermore National Laboratories.* Research topics: Point-based graphics and computational topology. Supervisor: Dr. Valerio Pascucci. Summer 2005.
- *Teaching Assistant for CS3510: Algorithms and Data Structures.* Supervisor: Prof. Cláudio Silva. Jan 2005 – May 2005.
- *Research Intern at the University of Utah.* Topics: Point-based graphics and algorithms. Supervisor: Prof. Cláudio Silva. May 2004 – Aug 2004.
- *Undergraduate Research Assistant.* Research topics: Applied computational geometry and GPU-based algorithms. Supervisor: Prof. João Comba. Department of Computer Science, Federal University of Rio Grande do Sul. Aug 2002 – Dec 2004.
- *Undergraduate Research Assistant.* Research topics: Computer-Aided Design, Geographical Information Systems. Supervisor: Prof. Benamy Turkienicz. Department of Architecture, Federal University of Rio Grande do Sul. Feb 2001 – Jul 2002.

## Language Skills

- English: fluent
- Brazilian Portuguese: native