

# Curriculum Vitae

## Robert Glenn Scharein

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## 1 Academic information

**Ph.D. (Computer Science)**, The University of British Columbia, 1998

Research areas: topological drawing, computer graphics and art, virtual reality, graphical user interface design, mathematical and scientific visualization, computational knot theory, biomedical imaging, computer vision  
Dissertation *Interactive Topological Drawing* available at [knotplot.com/thesis](http://knotplot.com/thesis)

**M.Sc. (Astronomy)**, The University of British Columbia, 1985

Research areas: automated image analysis, theoretical and observational cosmology, general relativity, radio astronomy  
Scholarships: 1984–1986 N.S.E.R.C. Postgraduate Scholarship, 1981–1983 N.S.E.R.C. 1967 Science Scholarship

**B.Sc. (Honours Physics)**, The University of Manitoba, 1981

Research areas: physics of low temperature metals, nuclear and atomic physics, general relativity  
Awarded the Allen Medal for highest standing in Honours Physics graduating class

## 2 Skills & Experience

**generative art and design** — During Ph.D. research, created an innovative method of interactive computer aided design, called *topological drawing*, that has been useful in generating new architectural and sculptural forms.

**experimental mathematics and biology** — Active in collaborations with mathematicians, biologists, and physicists in problems related to polymer physics and molecular biology.

**real time computer graphics** — Implemented many simulation and animation applications using OpenGL and other graphics libraries. These tools were designed to work consistently across different computer architectures (SGI, Linux, Microsoft Windows and MacOSX).

**virtual environments** — Developer of several sophisticated applications to work in 3D virtual environments, either “fishtank” virtual reality, or immersive virtual reality (such as a CAVE). Excellent knowledge of CAVELib and other VR toolkits.

**visualization** — Thorough knowledge of visualization techniques, especially of mathematical objects in three and four dimensions. Developer of the software KnotPlot ([knotplot.com](http://knotplot.com)), widely used by knot theorists, knot enthusiasts, teachers, and others to simulate, interact with, and visualize mathematical knots. Also developed other software to create and visualize polyhedra, planar tilings, mazes and labyrinths, and 3D architectural models.

**image processing / computer vision** — Developed and implemented algorithms for automated image analysis of 3D confocal microscope imagery. Experience implementing computer vision (high & low level) algorithms.

**document processing** — Created software packages for automated document classification and analysis.

**computer human interaction** — Developed graphical user interfaces for both the standard desktop and 3D virtual environments. The latter also involved gestural input with the use of a six degree of freedom input device.

**software development** — Expert knowledge of Adobe Creative Suite, Unity 3D, OpenGL, OpenAL, OpenCV, C/C++, C#, Objective-C, iOS/macOS App Development, PostScript,  $\text{\TeX}$ / $\text{\LaTeX}$ , and METAFONT.

### 3 Work Experience

**Graphics and Visualization Specialist** — Hypnagogic Software, February 2005 to present. Worked on various projects including statistical analysis of textual documents. Continued research in experimental knot theory and topological problems in molecular biology.

**Game Developer** — Worked on a small team developing a Unity / C# game, August 2015 to May 2017.

**Research Fellow** — Department of Mathematics, San Francisco State University, December 2007 to June 2011. Developed software tools for topological problems in biomathematics.

**Visiting Scholar** — Department of Mathematics, The University of Iowa, July/August 2006, Obermann Center for Advanced Studies, The University of Iowa, May/June 2005.

Project *Computer visualization and identification of DNA knots and links*, collaboration with Isabel K. Darcy ([www.math.uiowa.edu/~idarcy](http://www.math.uiowa.edu/~idarcy)) and Stephen D. Levene ([www.utdallas.edu/biology/faculty/research/levene.html](http://www.utdallas.edu/biology/faculty/research/levene.html))

Obermann Center: [obermann.uiowa.edu](http://obermann.uiowa.edu) [news-releases.uiowa.edu/2005/june/060305obermann-awards.html](http://news-releases.uiowa.edu/2005/june/060305obermann-awards.html)

**Collaboration and Visualization Researcher** — WestGrid ([westgrid.ca](http://westgrid.ca)), December 2003 – September 2004.

Duties included developing distributed visualization tools as well as integrating these tools into WestGrid's Access Grid ([www.accessgrid.org](http://www.accessgrid.org)) environment. Implemented a collaborative version of KnotPlot, coKnotPlot.

**Research Scientist** — New Media Innovation Centre (NewMIC), January 2003 – November 2003.

Developed the Advanced Visualization Suite (AVS) for the Immersive Media Lab at NewMIC, including an immersive virtual reality version of KnotPlot, caveKnotPlot. Also conducted extensive research on astronomical virtual observatories and mentored a group of students in developing a low cost 3D input device for KnotPlot. caveKnotPlot: [www.youtube.com/watch?v=RXHxTIPPAEo](http://www.youtube.com/watch?v=RXHxTIPPAEo) [www.youtube.com/watch?v=IVBdq-fZAcY](http://www.youtube.com/watch?v=IVBdq-fZAcY)

**Sessional Lecturer** — Department of Electrical and Computer Engineering, The University of British Columbia, January 2002 – April 2002.

Project-based final year computer graphics course.

**Research Associate** — Centre for Experimental and Constructive Mathematics (CECM), Simon Fraser University, April 2001 – present (currently adjunct).

On going research in computational knot theory and mathematical visualization.

**Chief Scientist** — Xing Xing Computer Graphics Inc, May 2000 – June 2001.

Worked on a computer game based on the history of the Yuan Ming Yuan garden (the Old Summer Palace) in Beijing.

**Sessional Lecturer and/or Lab Instructor** — Department of Computer Science, The University of British Columbia, January 2001 – December 2001, January 1999 – December 1999.

Fourth year computer graphics course.

### 4 Exhibits and Artistic Projects

Video projections for *Day of the Dead*, a live performance at the Museum of Anthropology, University of British Columbia, 2 November 2017.

Video projections for *I Missed You*, Richmond Multicultural Festival, 2 September 2016 and Museum of Anthropology, UBC, 26 November 2016.

Developed an iPhone app for use as a prop in the motion picture *Fifty Shades Darker* directed by James Foley, February – April 2016.

Artwork for *What Lies Tangled* episode of *Lewis*, directed by David Drury, ITV Studios, UK, August 2015.

*Fireflies (Faeries)*, outdoor generative video projection for *Oscillations* curated by Laura Lee Coles, August 2015 [isea2015.sched.org/event/3hMG/oscillations-art-and-sound-walks](http://isea2015.sched.org/event/3hMG/oscillations-art-and-sound-walks)

Large scale video projections for *BC Buddhist Festival 2015*, artistic director Kalsang Dawa, May 2015.

3D live computer animation for musical *The Road Forward* directed by Marie Clements, PuSh Festival 2015, February 2015 in Vancouver (collaborator: Jamie Griffiths).

Developed one iPad and two iPhone apps for use as props in the motion picture *Night at the Museum: Secret of the Tomb* directed by Shawn Levy, January – May 2014.

*PoSSeSSiONz* — Interactive audio-video installation, 22 April 2014 – 26 April 2014, in collaboration with Laura Lee Coles and Dave Leith as part of the *Thru the Trapdoor* exhibition (artistic director Paul Wong)

Thru the Trapdoor website: [vivomediaarts.com/through-the-trap-door](http://vivomediaarts.com/through-the-trap-door)

Reviews: [blogs.vancouversun.com/2014/04/24/thru-the-trapdoor-paul-wongs-journey-through-art](http://blogs.vancouversun.com/2014/04/24/thru-the-trapdoor-paul-wongs-journey-through-art)

Three installations (one with interactive stereoscopic 3D display and custom iOS app) for the *EcoCentrix* exhibition, London Southbank UK, 25 October – 10 November 2013, in collaboration with Jamie Griffiths.

*White Lies* — Interactive video installation as part of exhibition in St. Leonard's, UK, September 2013, in collaboration with Jamie Griffiths.

*La Wefan Manigua* — Interactive audio-video installation at Camley Street Natural Park in London UK, 15 September – 30 October 2012 and 12 January – 13 April, 2013 at SFU Gallery, in collaboration with Jamie Griffiths and Diego Samper as part of the *Wild New Territories* group exhibition.

3D live computer animation for the musical *The Road Forward* directed by Marie Clements, February 2013, PuSh Festival 2013 in Vancouver (collaborator: Jamie Griffiths)

*MystiQ* — a 3D video installation. Rob Scharein & Jamie Griffiths, 11 July 2009 – 7 August 2009, Vivarium Gallery, Vancouver.

Part of team that created a labyrinth for Christ Church Cathedral in Vancouver, Canada, September 2006.

Labyrinth: [healingvoices.net/cc](http://healingvoices.net/cc) timelapse of construction: [www.youtube.com/watch?v=\\_ORs6zyFnjo](http://www.youtube.com/watch?v=_ORs6zyFnjo)

Computer animation for the PBS series *Life by the Numbers* as well cover art and other illustrations for the companion book of the same name by Keith Devlin, John Wiley & Sons, 1998

## 5 Selected Publications

S. M. Giovan, R. G. Scharein, A. Hanke and S. D. Levene. Free-energy calculations for semi-flexible macromolecules: Applications to DNA knotting and looping *Journal of Chemical Physics* 141, 174902, 2014.

K. Ishihara, R. Scharein, Y. Diao, J. Arsuaga, M. Vazquez and K. Shimokawa. Bounds for the minimum step number of knots confined to slabs in the simple cubic lattice *Journal of Physics A: Math and Theor.* 45(6), 65003, 2012.

J. Portillo, Y. Diao, R. Scharein, J. Arsuaga and M. Vazquez. On the mean and the variance of the writhe *Journal of Physics A: Math and Theor.* 44, 275004, 2011.

Trevor Blackstone, Robert G. Scharein, Rocco Varela, Yuanan Diao and Javier Arsuaga. Modeling Chromosome Intermingling Using Overlapping Uniform Random Polygons *Journal of Mathematical Biology* 62(3), 371–389, 2011.

R. Scharein, K. Ishihara, J. Arsuaga, Y. Diao, K. Shimokawa and M. Vazquez. Bounds for the minimum step number of knots in the simple cubic lattice *J. Phys. A: Math. Theor.*, 42, 475006, November 2009.

D. DeWoskin, R. Scharein and J. Arsuaga. A Computational Homology Analysis of CGH Data Finds Recurrent Genomic Instability in Older Breast Cancer Patients *Fuel and Energy Abstracts* 75(3), 2009.

Javier Arsuaga, Ben Borgo, Yuanan Diao and Robert G. Scharein. The Average Crossing Number of Equilateral Random Polygons in Confined Volumes. *J. Phys. A: Math. Theor.* 42, 465202, 2009.

Isabel K. Darcy, Robert G. Scharein and Andrzej Stasiak. 3D visualization software to analyze topological outcomes of topoisomerase reactions. *Nucleic Acids Research*, 36(11):3515–3521, June 2008.

Gregory Buck, Robert G. Scharein, Jeffrey Schnick, and Jonathan Simon. Accessibility and occlusion of biopolymers, ray tracing of radiating tubes, and the temperature of a tangle. *Physical Review E*, 77, 011803, 2008.

Alexandre A. Vetcher, Alexander Y. Lushnikov, Junalyn Navarra-Madsen, Robert G. Scharein, Yuri L. Lyubchenko, Isabel K. Darcy, and Stephen D. Levene. DNA topology and geometry in F1 and Cre recombination. *J Mol Biol.*, 357(4):1089–1104, 2006.

Vsevolod Katritch, Jan Bednar, Didier Michoud, Robert G. Scharein, Jacques Dubochet, and Andrzej Stasiak. Geometry and physics of knots. *Nature*, 384(6605):142–145, 14 November 1996.