Randy Heiland

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Education

- **Arizona State University** — Tempe, AZ
  M.A. Mathematics — *1992*
  Dynamical Systems. Advisor: Prof. Dieter Armbruster
  Thesis: KLTool: A Mathematical Tool to Analyze Spatiotemporal Data
- **University of Utah** — Salt Lake City, UT
  M.S. Computer Science — *1987*
  Computer Graphics, Computer-Aided Geometric Design. Advisor: Prof. Richard Riesenfeld
  Thesis: A Front-End User Interface to a Geometric Modeling System
- **Eastern Illinois University** — Charleston, IL
  B.S. Computational Mathematics — *1979*

Work Experience

- Indiana University (2003-present)
  - Intelligent Systems Engineering, 2017-present
    Research Associate
  - Center for Applied Cybersecurity Research, 2013-2017
    Senior Systems Analyst/Programmer
  - Open Systems Lab (then part of pti.iu.edu; later, became CREST) , 2007-2012
    Research Associate (~50% effort in Biocomplexity Institute)
  - UITS High Performance Applications Group, 2007
    Acting Manager
  - Scientific Data Analysis Lab, Pervasive Technology Labs, 2003-2007
    Associate Director
- Acquired Science, LLC (2005-2010)
  President. Scientific software development and consulting.
- NCSA, University of Illinois (1997-2003)
  Senior Research Scientist. Scientific visualization and data analysis.
- Pacific Northwest National Lab (1993-97). Richland, WA

Computer Scientist. Computational chemistry, image analysis, visualization.

- Los Alamos National Lab (1992). Los Alamos, NM

  Graduate Research Associate. Visualization and analysis software for the CM5 supercomputer.

- Center for Industrial Research (now SINTEF) (1985-87). Oslo, Norway

  Computer Scientist. Computer-aided geometric design software.

- Caterpillar Tractor Co. (1979-82). Peoria, IL

  Computer Scientist. Data analysis and computer-aided design.

Teaching Experience

- **Science Gateways Bootcamp** — Indianapolis
  Instructor — *April 24-28, 2017*
- **Brief Survey of Calculus (MATH 119)** — Indiana University
  Instructor — *Fall 2013*
- **Tutorial: Multi-cell, Multi-scale Modeling** — NIMBioS, UT-Knoxville
  Instructor — *May 18-21, 2011*
- **Outreach: Squeak and Scratch Modeling** — Girl Scouts of Central Indiana
  Instructor — *2007*
- **Computer Graphics I (CSC 231)** — Parkland College
  Instructor — *Fall 2001*

Notable Projects

- PhysiCell (physicell.mathcancer.org): An open source physics-based cell simulator.
- CTSC (trustedci.org): The NSF Cybersecurity Center of Excellence.
- SWIP (cacr.iu.edu/projects/swip): Scientific Workflow Integrity with Pegasus
- CompuCell3D (compucell3d.org): Modeling environment for multi-cell behavior
- LifeScienceWeb: Web services for bioinformatics
- VisBench/VisPort: Remote data visualization and analysis
- ECCE (ecce.emsl.pnl.gov): Extensible Computational Chemistry Environment

Publications

1. R. Heiland, S. Koranda, S. Marru, M. Pierce, and V. Welch. Authentication and authorization considerations for a multi-tenant service. In *Proceedings of the 1st Workshop on The Science of Cyberinfrastructure: Research, Experience, Applications and Models*, SCREAM '15, pages 29–35, New York, NY, USA, 2015. ACM.

2. J.P. Sluka, A. Shirinifard, M. Swat, A. Cosmanescu, R.W. Heiland, and J.A. Glazier. The cell behavior ontology: describing the intrinsic biological behaviors of real and model cells seen as active agents. *Bioinformatics*, 30(16):2367–2374, 15 August 2014.

3. R. Heiland, A. Shirinifard, M. Swat, G.L. Thomas, J. Sluka, A. Lumsdaine, B. Zaitlen, and J.A. Glazier. Visualizing cells and their connectivity graphs for CompuCell3D. In *2012 IEEE Symposium on Biological Data Visualization (BioVis)*, pages 85–90, October 2012.

4. S. Ito, M.E. Hansen, R. Heiland, A. Lumsdaine, A.M. Litke, and J.M. Beggs. Extending transfer entropy improves identification of effective connectivity in a spiking cortical network model. *PLoS One*, 6(11):e27431, 15 November 2011.

5. R. Heiland, M. Swat, B. Zaitlen, J. Glazier, and A. Lumsdaine. Workflows for parameter studies of multi-cell modeling. In *Proceedings of the 2010 Spring Simulation Multiconference*, SpringSim '10, pages 94:1–94:6, San Diego, CA, USA, 2010. Society for Computer Simulation International.

6. M.H. Swat, S.D. Hester, A.I. Balter, R.W. Heiland, B.L. Zaitlen, and J.A. Glazier. Multicell simulations of development and disease using the CompuCell3D simulation environment. *Methods Mol. Biol.*, 500:361–428, 2009.

7. A. Singh, A. Olowoyeye, P.H. Baenziger, J. Dantzer, M.G. Kann, P. Radivojac, R. Heiland, and S.D. Mooney. MutDB: update on development of tools for the biochemical analysis of genetic variation. *Nucleic Acids Res.*, 36(Database issue):D815–9, January 2008.

8. R.D. Wampler, A.J. Moad, C.W. Moad, R. Heiland, and G.J. Simpson. Visual methods for interpreting optical nonlinearity at the molecular level. *Acc. Chem. Res.*, 40(10):953–960, 1 October 2007.

9. X. Dong, K.E. Gilbert, R. Guha, R. Heiland, J. Kim, M.E. Pierce, G.C. Fox, and D.J. Wild. Web service infrastructure for chemoinformatics. *J. Chem. Inf. Model.*, 47(4):1303–1307, July 2007.

10. M.P. Baker, R. Heiland, E. Bachta, and M. Das. VisPort: Web-Based access to Community-Based visualization functionality. In *Proceedings in TeraGrid Conference, Madison WI*, 2007.

11. R. Heiland, M. Swat, A. Balter, S. Mooney, M. Christie, J. Boverhof, K. Jackson, and J. Insley. Python for scientific gateways development. In *International Workshop on Grid Computing Environments*, 2007.

12. B. Peters, C. Moad, E. Youn, K. Buffington, R. Heiland, and S. Mooney. Identification of similar regions of protein structures using integrated sequence and structure analysis tools. *BMC Struct. Biol.*, 6(1):4, 2006.

13. J. Dantzer, C. Moad, R. Heiland, and S. Mooney. MutDB services: interactive structural analysis of mutation data. *Nucleic Acids Res.*, 33(Web Server issue):W311–4, 1 July 2005.

14. R.W. Heiland, M.P. Baker, and D.K. Tafti. VisBench: A framework for remote data visualization and analysis. In *Computational Science - ICCS 2001*, pages 718–727. Springer, Berlin, Heidelberg, 28 May 2001.

15. J. Leigh, A.E. Johnson, T.A. DeFanti, M. Brown, M.D. Ali, S. Bailey, A. Banerjee, P. Benerjee, J. Chen, K. Curry, J. Curtis, F. Dech, B. Dodds, I. Foster, S. Fraser, K. Ganeshan, D. Glen, R. Grossman, R. Heiland, J. Hicks, A.D. Hudson, T. Imai, M. A. Khan, A. Kapoor, R.V. Kenyon, J. Kelso, R. Kriz, C. Lascara, X. Liu, Y. Lin, T. Mason, A. Millman, K. Nobuyuki, K. Park, B. Parod, P.J. Rajlich, M. Rasmussen, M. Rawlings, D.H. Robertson, S. Thongrong, R.J. Stein, K. Swartz, S. Tuecke, H. Wallach, H.Y. Wong, and G.H. Wheless. A review of tele-immersive

applications in the CAVE research network. In *Proceedings IEEE Virtual Reality (Cat. No. 99CB36316)*, pages 180–187, March 1999.

16. E. Stone, D. Armbruster, and R. Heiland. Towards analyzing the dynamics of flames. *Fields Inst. Commun.*, 5:1–17, 1996.

17. R.J. Littlefield, R.W. Heiland, and C.R. Macedonia. Virtual reality volumetric display techniques for three-dimensional medical ultrasound. *Stud. Health Technol. Inform.*, 29:498–510, 1996.

18. D. Armbruster, R. Heiland, and E.J. Kostelich. kltool: A tool to analyze spatiotemporal complexity. *Chaos*, 4(2):421–424, June 1994.

19. D. Armbruster, R. Heiland, E.J. Kostelich, and B. Nicolaenko. Phase-space analysis of bursting behavior in kolmogorov flow. *Physica D*, 58(1):392–401, 15 September 1992.

20. G.M. Nielson and R.W. Heiland. Animated rotations using quaternions and splines on a 4D sphere. *Program. Comput. Softw.*, 18(4):145–154, 1992.

Reports and Presentations

1. R. Heiland. Cybersecurity for Science Gateways. *SGCI Bootcamp.* Indianapolis, IN. April 24-28, 2017. http://hdl.handle.net/2022/21367

2. R. Heiland and V. Welch. Center for Trustworthy Scientific Cyberinfrastructure: The NSF Cybersecurity Center of Excellence. *NSF SI2 PI Meeting: Poster session.* Arlington, VA. Feb 21-22, 2017. http://hdl.handle.net/2022/21258

3. V. Welch, *et al.* Center for Trustworthy Scientific Cyberinfrastructure - The NSF Cybersecurity Center of Excellence: Year One Report. Technical Report, Indiana University, December 2016. http://hdl.handle.net/2022/21163

4. R. Heiland, W.C. Garrison III, Y. Qiao, A.J. Lee, V. Welch. The Web's PKI: An Expository Review and Certificate Validation Cost Simulation. Technical Report, Indiana University, September 2016. http://hdl.handle.net/2022/21038

5. R. Heiland, S. Sons. Secure Software Engineering Best Practices. Presentation at the NSF Cybersecurity Summit. August 16, 2016. http://hdl.handle.net/2022/21322

6. R. Heiland, S. Koranda, V. Welch. SciGaP-CTSC Engagement Summary. Technical Report, Indiana University, May 2016. http://hdl.handle.net/2022/20926

7. R. Heiland, S. Koranda, V. Welch. SciGaP-CTSC Engagement: Final Technical Recommendations. Technical Report, Indiana University, April 2016. http://hdl.handle.net/2022/20927

8. R. Heiland, A. Adams, E. Heymann. perfSONAR-CTSC Code Review Engagement Final Report. Technical Report, Indiana University, January 2016. http://hdl.handle.net/2022/20596

9. V. Welch, *et al.* Year Three Report: Center for Trustworthy Scientific Cyberinfrastructure. Technical Report, Indiana University, Oct 2015. http://hdl.handle.net/2022/20401

10. R. Heiland and V. Welch. Analysis of authentication events and graphs using Python. *SIAM Workshop on Network Science: Poster session.* Snowbird, UT. May 2015. github.com/rheiland/authpy

11. V. Welch, *et al.* Year Two Report: Center for Trustworthy Scientific Cyberinfrastructure. Technical Report, Indiana University, Sept 2014. http://hdl.handle.net/2022/20030

12. J. Marsteller and R. Heiland. IceCube Cybersecurity Improvement Plan. Technical Report, Indiana University, 2014. http://hdl.handle.net/2022/17364

13. R. Heiland, S. Koranda, V. Welch. Globus Data Sharing: Security Assessment. Technical Report, Indiana University, 2014. http://hdl.handle.net/2022/19165

14. R. Heiland and O. Sporns. Comparing Functional Networks of the Brain: An Introductory Tutorial using Python. *BioVis 2014 Data Contest*, Boston, MA, July 2014. github.com/rheiland/biovis2014

15. R. Heiland, S. Marru, M. Pierce, V. Welch. CTSC Recommended Security Practices for Thrift Clients: Case Study - Evernote. Technical Report, Indiana University, May 2014. http://hdl.handle.net/2022/20620

16. V. Welch, *et al.* Year 1 Report: Center for Trustworthy Scientific Cyberinfrastructure. Technical Report, Indiana University, 2013. http://hdl.handle.net/2022/17205

17. R. Heiland, B. Thomas, V. Welch, C. Jackson. Toward a Research Software Security Maturity Model. *Workshop on Sustainable Software for Science*, Nov 2013. arxiv.org/abs/1309.1677

18. R. Heiland, S. Koranda, V. Welch. Pegasus-CTSC Engagement Final Report. Technical Report, Indiana University, 2013. http://hdl.handle.net/2022/15562

19. R. Heiland, J. Champlin, S. Ito, A. Litke, A. Lumsdaine, and J. Beggs. Introduction to Modeling and Computational Neuroscience using Python. *Presentation at Society for Mathematical Biology (SMB) Annual Meeting and Conference*, July 2012.

20. R. Heiland, C. Perry, B. Ream, A. Lumsdaine. Sculpture, Geometry, and Computer Science. *Presentation at SIAM Conference on Computational Science and Engineering*, Feb 2011. fperez.org/events/2011_siam_cse/siam-cse11-IndianaArc.pdf obamawhitehouse.archives.gov/blog/2010/12/10/celebrating-computer-science

21. R. Heiland. Squeak: A Free Computer Application to Enhance Math and Science Learning. *Presentation, HASTI Conference*, Indianapolis, Feb 10, 2006.

22. R. Heiland. XML for Bioinformatics. *Book Review, Briefings in Bioinformatics*, Feb 2006. https://doi.org/10.1093/bib/bbk013

23. C. Moad, R. Heiland, and S.D. Mooney. LifeScienceWeb Services: Integrated Analysis of Protein Structural Data. *Poster presentation at the Pacific Symposium on Biocomputing*, Jan 3-7, 2006. randyheiland.com/docs/lsw-poster.pdf

24. R. Heiland. Introduction to Distributed Computing. *SC05 Education Program*, Nov 2005. randyheiland.com/K-12/DistComp-SC05-Heiland.pdf

25. R. Heiland, D. Milsho, and K. Browning. Using Squeak to graphically model symmetries in nature. *ITAP Teaching and Learning with Technology conference*, Purdue University. Feb 2005. randyheiland.com/K-12/sym-nature.pdf

26. C. Crosetto, K. Dunker, T. Le Gall, R. Heiland, and C. Moad. MolNav: A Tool for Visualizing Protein Disorder. *Poster presentation at the 1st Annual Indiana Bioinformatics Conference*, Indianapolis, May 27, 2004. randyheiland.com/docs/IUPUI-Bioinfo-Poster-May04.pdf

27. R. Heiland, M. P. Baker, and B. D. Semeraro. A Survey of Visualization Tools for High Performance Computing. *Poster presentation at SIAM Parallel Processing for Scientific Computing*, 1999. (Abstract)

28. R. Heiland and M. P. Baker. Coprocessing: Experience with CUMULVS and pV3. *CEWES MSRC/PET TR/99-05*, 1999. randyheiland.com/coproc/cewes_cumulvs_pv3.pdf

29. R. Heiland and M. P. Baker. A Survey of Co-Processing Systems. *CEWES MSRC/PET TR/99-02*, 1999. randyheiland.com/coproc/CoprocSurvey.pdf

30. P. Baker, D. Bock, R. Heiland, and M. Stephens. Visualization of Damaged Structures. *CEWES MSRC PET Annual Technical Report: Year 2*. March 1998.

31. R.W. Heiland. Object-oriented parallel polygon rendering. Technical Report PNL-SA–25031; CONF-9409278–3, Pacific Northwest Lab., Richland, WA (United States), 1 September 1994.

Software Skills

- Good level: C/C++, Python(+numerous pkgs), OpenGL, Jupyter/IPython Notebooks, VTK, CMake, ParaView, MATLAB, git, LaTeX, ImageMagick, gdb, Linux, OSX
- Intermediate: Fortran, Java, R, Qt, OpenMP, ITK, HTML, Bash, Valgrind, OpenCV, VisTrails
- Basic level: Javascript, MySQL, MPI, Boost, Pegasus, CUDA, OpenCL, Django, Mathematica, Maple, Blender, Windows

Professional Society Memberships

Society for Industrial and Applied Mathematics (SIAM)

Mathematical Association of America (MAA)

Society for Mathematical Biology (SMB)

References

Available upon request.