

# DANIEL RITCHIE

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## EDUCATION

### Stanford University

PhD, Computer Science

Dissertation: *Probabilistic Programming for Procedural Modeling and Design*

Advisors: Pat Hanrahan, Noah Goodman

Conferred September 2016

### Stanford University

MS, Computer Science

Conferred April 2013

### University of California Berkeley

BA, Computer Science

Conferred May 2010

## EMPLOYMENT

### Eliot Horowitz Assistant Professor

Brown University Computer Science Department

Providence, RI

2021 – Present

### Assistant Professor

Brown University Computer Science Department

Providence, RI

2017 – 2021

### Postdoctoral Researcher

Stanford University Computer Science Department

Stanford, CA

2016 – 2017

### Research Intern

Adobe Creative Technologies Lab

San Francisco, CA

Summer 2011

### Graduate Research Assistant

Stanford University Computer Science Department

Stanford, CA

2010 – 2016

### Technical Director Intern

Pixar Animation Studios

Emeryville, CA

Summer 2009

### Software Intern

Hewlett-Packard

Roseville, CA

Summer 2008

## REFEREED

## PUBLICATIONS

All publications listed below follow the author order conventions for visual computing (e.g. graphics, vision, machine learning): the first author is the primary implementer (typically a PhD student), and the last author is typically the direct supervisor of the first author and the principal investigator on the project. Middle authors vary in role, with students and interns typically listed before faculty and senior research scientists.

Annotation scheme for publications started while employed at Brown University (July 2017 onwards):

- **Blue bold text**: PhD student in Daniel's lab.
- **Purple bold text**: undergraduate or masters student in Daniel's lab.
- **Green bold text**: external PhD student whom Daniel closely mentored.
- **Orange bold text**: external undergraduate or masters student whom Daniel closely mentored.

**Roominoes: Generating Novel 3D Floor Plans From Existing 3D Rooms.** Kai Wang, Xianghao Xu, Leon Lei, Natalie Lindsay, Selena Ling, Angel X. Chang, Manolis Savva, Daniel Ritchie. *Symposium on Geometry Processing (SGP) 2021*.

**ShapeMOD: Macro Operation Discovery for 3D Shape Programs.** R. Kenny Jones, David Charatan, Paul Guerrero, Niloy Mitra, Daniel Ritchie. *ACM Transactions on Graphics (Proceedings of SIGGRAPH) 2021*.

**Inferring CAD Modeling Sequences using Zone Graphs.** Xianghao Xu, Wenzhe Peng, Chin-Yi Cheng, Karl D. D. Willis, Daniel Ritchie. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2021*.

**Motion Annotation Programs: A Scalable Approach to Annotating Kinematic Articulations in Large 3D Shape Collections.** Xianghao Xu, David Charatan, Sonia Raychaudhuri, Hanxiao Jiang, Mae Heitmann, Vladimir Kim, Siddhartha Chaudhuri, Manolis Savva, Angel X. Chang, Daniel Ritchie. *International Conference on 3D Vision (3DV) 2020*.

**Shape from Tracing: Towards Reconstructing 3D Object Geometry and SVBRDF Material from Images via Differentiable Path Tracing.** Purvi Goel, Loudon Cohen, James Guesman, Vikas Thamizharasan, James Tompkin, Daniel Ritchie. *International Conference on 3D Vision (3DV) 2020*.

**ShapeAssembly: Learning to Generate Programs for 3D Shape Structure Synthesis.** R. Kenny Jones, Theresa Barton, Xianghao Xu, Kai Wang, Ellen Jiang, Paul Guerrero, Niloy Mitra, Daniel Ritchie. *ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia) 2020*.

**GANHopper: Multi-Hop GAN for Unsupervised Image-to-Image Translation.** Wallace Lira, Johannes Merz, Daniel Ritchie, Daniel Cohen-Or, Hao Zhang. *European Conference on Computer Vision (ECCV) 2020*.

**Learning Generative Models of 3D Structures.** Siddhartha Chaudhuri, Daniel Ritchie, Jiajun Wu, Kai Xu, Hao Zhang. *Eurographics 2020 State-of-the-Art Report*.

**Learning Style Compatibility Between Objects in a Real-World 3D Asset Database.** Yifan Liu, Ruolan Tang, Daniel Ritchie. *Pacific Graphics 2019*.

**PlanIT: Planning and Instantiating Indoor Scenes with Relation Graph and Spatial Prior Networks.** Kai Wang, Yu-an Lin, Ben Weissmann, Manolis Savva, Angel X. Chang, Daniel Ritchie. *ACM Transactions on Graphics (Proceedings of SIGGRAPH) 2019*.

**Fast and Flexible Indoor Scene Synthesis via Deep Convolutional Generative Models.** Daniel Ritchie, Kai Wang, Yu-an Lin. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2019*.

**Learning to Describe Scenes with Programs.** Yunchao Liu, Zheng Wu, Daniel Ritchie, William T. Freeman, Joshua B. Tenenbaum, Jiajun Wu. *International Conference on Learning Representations (ICLR) 2019*.

**Learning to Infer Graphics Programs from Hand-Drawn Images.** Kevin Ellis, Daniel Ritchie, Armando Solar-Lezama, Joshua B. Tenenbaum. *Conference on*

*Neural Information Processing Systems (NeurIPS) 2018. SPOTLIGHT PRESENTATION.*

**Improving Shape Deformation in Unsupervised Image-to-Image Translation** Aaron Gokaslan, Vivek Ramanujan, Daniel Ritchie, Kwang In Kim, James Tompkin. *European Conference on Computer Vision (ECCV) 2018.*

**Deep Convolutional Priors for Indoor Scene Synthesis** Kai Wang, Manolis Savva, Angel X. Chang, Daniel Ritchie. *ACM Transactions on Graphics (Proceedings of SIGGRAPH) 2018.*

**ScanComplete: Large-Scale Scene Completion and Semantic Segmentation for 3D Scans** Angela Dai, Daniel Ritchie, Martin Bokeloh, Scott Reed, Jürgen Sturm, Matthias Nießner. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2018.*

**Example-based Authoring of Procedural Modeling Programs with Structural and Continuous Variability** Daniel Ritchie, Sarah Jobalia, Anna Thomas *Proceedings of Eurographics 2018.*

**An Improved Training Procedure for Neural Autoregressive Data Completion.** Maxime Voisin, Daniel Ritchie. *NIPS 2017 Bayesian Deep Learning Workshop.*

**Neurally-Guided Procedural Models: Amortized Inference for Procedural Graphics Programs using Neural Networks.** Daniel Ritchie, Anna Thomas, Pat Hanrahan, Noah D. Goodman. *Conference on Neural Information Processing Systems (NIPS) 2016.*

**C3: Lightweight Incrementalized MCMC for Probabilistic Programs using Continuations and Callsite Caching.** Daniel Ritchie, Andreas Stuhlmüller, Noah D. Goodman. *International Conference on Artificial Intelligence and Statistics (AISTATS) 2016.*

**Controlling Procedural Modeling Programs with Stochastically-Ordered Sequential Monte Carlo.** Daniel Ritchie, Ben Mildenhall, Noah D. Goodman, and Pat Hanrahan. *ACM Transactions on Graphics (Proceedings of SIGGRAPH) 2015.*

**Generating Design Suggestions under Tight Constraints with Gradient-based Probabilistic Programming.** Daniel Ritchie, Sharon Lin, Noah D. Goodman, and Pat Hanrahan. *Proceedings of Eurographics 2015. BEST PAPER HONORABLE MENTION.*

**Quicksand: A Lightweight Embedding of Probabilistic Programming for Procedural Modeling and Design.** Daniel Ritchie. *The 3rd NIPS Workshop on Probabilistic Programming, 2014.*

**First-class Runtime Generation of High-performance Types using Exotypes.** Zach Devito, Daniel Ritchie, Matthew Fisher, Alex Aiken, and Pat Hanrahan. *Programming Language Design and Implementation (PLDI) 2014.*

**Probabilistic Color-by-Numbers: Suggesting Pattern Colorizations Using Factor Graphs.** Sharon Lin, Daniel Ritchie, Matthew Fisher, and Pat Hanrahan. *ACM Transactions on Graphics (Proceedings of SIGGRAPH) 2013.*

**Example-based Synthesis of 3D Object Arrangements.** Matthew Fisher, Daniel Ritchie, Manolis Savva, Thomas Funkhouser, and Pat Hanrahan. *ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia)* 2012.

**d.tour: Style-based Exploration of Design Example Galleries.** Daniel Ritchie, Ankita Arvind Kejriwal, and Scott R. Klemmer. *ACM Symposium on User Interface Software and Technology (UIST)* 2011.

**Dynamic Local Remeshing for Elastoplastic Simulation.** Martin Wicke, Daniel Ritchie, Bryan M. Klingner, Sebastian Burke, Jonathan R. Shewchuk, and James F. O'Brien. *ACM Transactions on Graphics (Proceedings of SIGGRAPH)* 2010.

**Interactive Simulation of Surgical Needle Insertion and Steering.** Nuttapon Chentanez, Ron Alterovitz, Daniel Ritchie, Lita Cho, Kris K. Hauser, Ken Goldberg, Jonathan R. Shewchuk, and James F. O'Brien. *ACM Transactions on Graphics (Proceedings of SIGGRAPH)* 2009.

## TECHNICAL REPORTS

**Learning to Infer Shape Programs Using Latent Execution Self Training.** Homer Walke, R. Kenny Jones, Daniel Ritchie. *arXiv:2011.13045*, 2020.

**Deep Amortized Inference for Probabilistic Programs.** Daniel Ritchie, Paul Horsfall, Noah D. Goodman. *arXiv:1610.05735*, 2016.

## INVITED TALKS

**Neurosymbolic Generative Models for Structured 3D Content**  
3DGV, *3D Geometry and Vision Seminar* February 2021

**Learning Neurosymbolic 3D Models**  
PROBPROG, *International Conference on Probabilistic Programming* March 2020

**Everything You Need to Know About Deep Fakes**  
Full Stack at Brown, *Hack@Home* October 2020

**Neurosymbolic 3D Models: Learning to Generate 3D Shape Programs**  
GAMES, *Graphics and Mixed Environment Seminar* August 2020

**Toward Synthesizing Training Data for 3D Scene Understanding**  
CVPR, *3D Scene Understanding Workshop* June 2020

**From Neural to Neurosymbolic 3D Modeling**  
CVPR, *Neurosymbolic Visual Learning & Program Induction Workshop* June 2020

**Neurosymbolic 3D Models**  
MIT, *Vision Seminar* March 2020

**Learning to Generate 3D Structures**  
Brown Department of Biostatistics, *Deep Learning Seminar* February 2020

**Deep Learning for Graph(ic)s**  
Simon Fraser University, *Visual Computing Group* December 2019

**Learning to Generate Visual Structures**  
Carney Institute for Brain Science, *Lunch Seminar* October 2019

	<b>Indoor Scene Synthesis: Past, Present, and Future</b> Shenzhen University, <i>Visual Computing Summer School</i>	July 2019
	<b>Probabilistic Programming</b> Brown ICERM, <i>Computer Vision Semester Program</i>	February 2019
	<b>Virtual Indoor Scene Synthesis: Past, Present, and Future</b> MIT, <i>Graphics Lunch</i>	December 2018
	<b>Toward Style-Aware Generative Models of Virtual Indoor Scenes</b> Wayfair LLC, <i>Computer Vision / Data Science Team</i>	December 2018
	<b>Visual Program Induction</b> Brown Applied Math, <i>Pattern Theory Seminar</i>	November 2018
	<b>Probabilistic Programming for Computer Graphics</b> MIT, <i>PROBPROG 2018</i>	October 2018
	<b>Learning Procedural Modeling Programs from Examples</b> MIT, <i>New England Symposium on Graphics</i>	April 2018
	Microsoft Research Cambridge, <i>New England Machine Learning Day</i>	May 2018
	<b>Learning from Large-Scale Synthetic 3D Scene Data</b> Brown University Data Science Initiative, <i>Datathon</i>	March 2018
	<b>Inferring Graphics Programs</b> University of Washington, <i>ML+PL Workshop</i>	February 2018
	<b>Learning and Inferring Graphics Programs</b> MIT, <i>Vision Seminar</i>	September 2017
	<b>Creative AI for Computer Graphics (It's More Than Just Style Transfer)</b> Google Brain, <i>Magenta Group</i>	January 2017
	<b>Probabilistic Programming for Procedural Modeling and Design</b> Adobe Systems, <i>Creative Technologies Lab</i>	March 2016
	Brown University, <i>Computer Science Department</i>	February 2016
	Harvey Mudd College, <i>Computer Science Department</i>	February 2016
	Yale University, <i>Computer Science Department</i>	February 2016
<b>PANELIST</b>	Advances in Software for Approximate Bayesian Inference. <i>NIPS 2016 Workshop on Advances in Approximate Bayesian Inference.</i>	
<b>TUTORIALS &amp; WORKSHOPS</b>	<b>Learning to Generate 3D Shapes and Scenes</b>	June 2021
	Manyi Li, Zhenpei Yang, Angel X. Chang, Siddhartha Chaudhuri, Daniel Ritchie, Manolis Savva	
	CVPR 2021 Workshop	
	<b>Synthetic 3D Scene Datasets: Needs &amp; Opportunities</b>	August 2020
	Daniel Ritchie, Angel Chang, Manolis Savva	
	SIGGRAPH 2020 Birds of a Feather	

**Learning 3D Generative Models** June 2020  
Daniel Ritchie, Florian Golemo, Angel Chang, Siddhartha Chaudhuri, Aaron Courville,  
Qixing Huang, Derek Nowrouzezahrai, Pedro O. Pinheiro, Sai Rajeswar, Manolis Savva,  
David Vasquez, Kai Xu, Hao Zhang  
CVPR 2020 Workshop

**3D Scene Generation** June 2019  
Angel Chang, Qixing Huang, Daniel Ritchie, Manolis Savva  
CVPR 2019 Workshop

**Learning Generative Models of 3D Structures** May 2019  
Siddhartha Chaudhuri, Daniel Ritchie, Kai Xu, Hao Zhang  
Eurographics 2019 Tutorial

## TEACHING

**Instructor** Fall 2021  
Brown CSCI 1230: Introduction to Computer Graphics

**Instructor** Fall 2018 – 2020  
Brown CSCI 1470/2470: Deep Learning

**Instructor** Spring 2018 – 2020  
Brown CSCI 2240: Interactive Computer Graphics

**Instructor** Fall 2017  
Brown CSCI 2951-W: Creative Artificial Intelligence for Computer Graphics

**Instructor** Summer 2016  
DARPA Probabilistic Programming for Advanced Machine Learning Summer School

**Course Assistant** Spring 2014  
Stanford CS 348b: Image Synthesis Techniques

**Course Assistant** Fall 2011  
Stanford CS 148: Introduction to Computer Graphics and Imaging

**Graduate Student Instructor** Fall 2009, Spring 2010  
UC Berkeley CS 184: Foundations of Computer Graphics

**Student Facilitator** Spring 2009 – Spring 2010  
UC Berkeley Undergraduate Graphics Group

**Tutor** Fall 2008  
UC Berkeley Self-Paced Center

## RESEARCH MENTORING

**Current Students**

Kai Wang	Brown CS PhD
Russell (Kenny) Jones	Brown CS PhD
Xianghao Xu	Brown CS PhD
Aditya Ganeshan	Brown CS PhD

Arman Maesumi	Brown CS PhD
Bryce Blinn	Brown CS ScB + ScM (expected 2022)
Yuchen Zhou	Brown CS ScM (expected 2022)
Zhouqi Gong	Brown CS ScM (expected 2022)
Vikas Thamizharasan	Brown CS ScM (expected 2022)
Joshua Pierce	Brown CS ScM (expected 2022)
Caleb Trotz	Brown Math-CS ScB (expected 2022)
Aalia Habib	Brown CS ScB (expected 2022)
Yifan Ruan	Brown Math-CS ScB (expected 2023)
David Han	Brown CS ScB (expected 2023)
Adam Wang	Brown CS + Applied Math ScB (expected 2023)
Sean Zhan	Brown CS + Applied Math + Econ ScB (expected 2023)
Alex Ding	Brown CS ScB (expected 2024)

### Alumni

David Charatan <i>Next position: Common Sense Machines</i>	Brown Computer Engineering ScB 2021
Andrew Peterson <i>Next position: Disney Animation</i>	Brown CS + Applied Math ScB, CS ScM 2021
Maggie Wu <i>Next position: Microsoft</i>	Brown CS + Econ ScB 2021
Homer Walke <i>Next position: PhD Student, UC Berkeley</i>	Brown CS ScB 2021
Theresa Barton <i>Next position: The New York Times</i>	Brown CS ScM 2021
Naveen Srinivasan <i>Next position: Amazon Lab126</i>	Brown CS ScB + ScM 2020
Brian Oppenheim <i>Next position: Google</i>	Brown CS ScB 2020
Brad Guesman <i>Next position: NVIDIA</i>	Brown CS AB + Physics AB 2020

Miles Freeman <i>Next position: Winnie</i>	Brown CS + Applied Math ScB 2020
Siqi Wang <i>Next position: PhD Student, Boston University</i>	Brown CS ScM 2020
Loudon Cohen <i>Next position: NVIDIA</i>	Brown CS ScB + ScM 2020
Purvi Goel <i>Next position: PhD Student, Stanford University</i>	Brown CS ScB + ScM 2020
Natalie Lindsay <i>Next position: Apple</i>	Brown CS ScB + ScM 2020
Leon Lei <i>Next position: Amazon</i>	Brown CS ScB + ScM 2020
Ellen Jiang <i>Next position: Google Brain, Big Picture Group</i>	Brown CS ScB 2020
Ruolan Tang <i>Next position: Two Sigma</i>	Brown CS ScM 2019
Ben Weissmann <i>Next position: Down Dog</i>	Brown CS ScB 2019
Mae Heitmann <i>Next position: AirBnB</i>	Brown Math+CS ScB 2019
Montana Fowler <i>Next position: PhD Student, UC Santa Cruz</i>	Brown CS AB + Visual Art AB 2019
Yu-An (Andy) Lin <i>Next position: Microsoft</i>	Brown ECE ScM 2018
Yifan Liu <i>Next position: Google</i>	Brown CS ScM 2018
Shreya Shankar <i>Next position: Machine Learning Engineer, Viaduct</i>	Stanford CS BS 2019
Maxime Voisin <i>Next position: Research Assistant, Stanford University</i>	Stanford MS&E MS 2018
Anna Thomas <i>Next position: Masters Student, University of Cambridge (Churchill Scholar)</i>	Stanford CS BS 2018
Sarah Jobalia <i>Next position: Microsoft</i>	Stanford CS MS 2018
Ben Mildenhall <i>Next position: PhD Student, UC Berkeley</i>	Stanford CS BS 2015



## Visitors

Hameed Abdul-Rashid Visiting Researcher Summer 2019  
*Home institution: University of Southern Mississippi*

## FUNDING

**Google exploreCSR** 2020

Unrestricted Gift

Co-PIs: James Tompkin, Jeff Huang, Amy Greenwald. \$18,000

**Adobe Inc.**

2020 – 2021

Unrestricted Gifts

Sole PI. \$54,000

**Autodesk Inc.**

2020 – 2021

Unrestricted Gift

Sole PI. \$60,000

**NSF CCRI Planning #2016532**

2020

A Community-Standard, Large-Scale Synthetic 3D Scene Dataset for Scene Analysis and Synthesis

Sole PI. \$50,000

**NSF CAREER #1941808**

2020

Learning Neurosymbolic 3D Models

Sole PI. \$549,999

**NSF CHS Small #1907547**

2019

Learning to Automatically Design Interior Spaces

Sole PI. \$498,333

**DARPA GAILA HR00111990064**

2019

Cognitively-Motivated Word Learning in Embodied Virtual Agents

Co-PIs: Ellie Pavlick, Roman Fieinan, Stefanie Tellex, Carsten Eickhoff. \$954,509

**Brown University OVRP Research Seed Fund Award**

2019

Building a Large Dataset of Articulated 3D Object Models

Sole PI. \$42,500

**NSF CRII #1753684**

2018

Learning Procedural Modeling Programs for Computer Graphics from Examples

Sole PI. \$175,000

## AWARDS & HONORS

Eliot Horowitz Assistant Professorship

2021

NSF CAREER Award

2020

Eurographics Best Paper Honorable Mention

2015

Stanford Graduate Fellowship

2010

UC Berkeley EECS Departmental Citation

2010

UC Berkeley Computer Science Highest Achievement Award

2010

CRA Outstanding Undergraduate Researcher Honorable Mention

2010

UC Berkeley Edward Frank Kraft Scholarship

2007

**PROFESSIONAL SERVICE** Program Committee Member / Area Chair  
SIGGRAPH: 2021

SIGGRAPH Asia: 2018, 2019  
SIGGRAPH Asia Courses: 2020  
NeurIPS: 2019  
ICLR: 2021  
Eurographics: 2020, 2021

**Conflict of Interest Coordinator**  
SIGGRAPH Asia: 2020

**Conference Proceedings Reviewer**  
SIGGRAPH: 2016 – 2021  
SIGGRAPH Asia: 2016 – 2021  
CVPR: 2019, 2020  
UIST: 2016  
NeurIPS: 2016, 2018, 2019  
Eurographics: 2017, 2018, 2019  
Graphics Interface: 2019  
ICCV: 2019, 2021  
ECCV: 2020  
ICML: 2018  
ICLR: 2018

**Journal Editor**  
Computer Graphics Forum (Associate Editor): 2021 – 2024

**Journal Reviewer**  
ACM TOG: 2019  
TVCG: 2016, 2019, 2021  
Computer Graphics Forum: 2017, 2020  
Pattern Recognition: 2019  
Computer Aided Design: 2016  
Transactions on Games: 2020

**Grant Reviewer**  
NSF Proposal Reviewer: 2018, 2020, 2021

<b>DEPARTMENT SERVICE</b>	PhD Admissions Committee Member	2017 – 2021
	Diversity & Inclusion Committee Chair	2021 – 2022
<b>PATENTS</b>	<b>Methods and Apparatus for Comic Creation</b> (US 20130073952 A1)	
<b>FILM CREDITS</b>	<b>Day &amp; Night</b>	2010
	Pixar Animation Studios	
	<i>Shading Technical Director</i>	