Arvind Satyanarayan

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EDUCATION

2017 **Ph.D. Computer Science**, *Stanford University*
Thesis: Declarative Interaction Design for Data Visualization
Advisor: Jeffrey Heer (University of Washington)

2014 **M.S. Computer Science**, *Stanford University*

2011 **B.S. Computer Science with Honors**, *University of California, San Diego*
Thesis: Using Overlays to Support Collaborative Interaction with Display Walls
Advisor: James D. Hollan

EMPLOYMENT

2018 – **NBX Career Development Assistant Professor**, *MIT EECS/CSAIL*

2017 – 2018 **Postdoctoral Research Scientist**, *Google Brain Team*

2011 – 2017 **Graduate Research Assistant**, *Interactive Data Lab, Stanford University/University of Washington*
With Prof. Jeffrey Heer

2014 – 2016 **Co-Founder and Advisor**, *Apropose, Inc.*

2013 – 2014 **Co-Founder and Chief Architect**, *Apropose, Inc.*
Led initial development of core infrastructure and prototype applications, culminating in a successful $1.9M seed round backed by NEA and Andreessen Horowitz.

AWARDS & HONORS

2021 Seth J. Teller Award for Excellence, Inclusion and Diversity, *MIT EECS*
Google Research Scholar Award
ACM CHI Best Paper Honorable Mention (Viral Visualizations)

2020 NSF CAREER Award
Kavli Fellow, *Kavli Frontiers of Science at the National Academy of Science*
Kolokotrones Education Award, *MIT EECS*

2019 MIT Teaching with Digital Technology Award Nomination (nominated by students)

2016 IEEE InfoVis Best Paper Award (Vega-Lite)

2016 – 2018 Google PhD Fellowship

2015 Kantar Information is Beautiful Awards Shortlist (Lyra)

2013 ACM CHI Best Paper Award (Webzeitgeist)

2011 – 2014 SAP Stanford Graduate Fellowship, *Stanford University*

2011 Outstanding Senior, *UC San Diego Alumni Association*
Phi Beta Kappa, *UC San Diego*

2010 Undergraduate Summer Research Scholar, *Calit2, UC San Diego*

2009, 2010 Ernest Mort Award for Excellence in Leadership, *Revelle College, UC San Diego*

2009 Tau Beta Pi, *UC San Diego*

2008 – 2010 Provost's Honors, *Revelle College, UC San Diego*

PEER-REVIEWED PUBLICATIONS

2021 [1] **Viral Visualizations: How Coronavirus Skeptics Use Orthodox Data Practices to Promote Unorthodox Science Online.** Crystal Lee, Tanya Yang, Gabrielle Inchoco, Graham M Jones, Arvind Satyanarayan. *Proc. ACM Human Factors in Computing Systems (CHI)*, May 2019. 26% Acceptance Rate. Best Paper Honorable Mention (Top 5%).

[2] **Beyond Expertise and Roles: A Framework to Characterize the Stakeholders of Interpretable Machine Learning and Their Needs.** Harini Suresh, Steven R. Gomez, Kevin K. Nam, Arvind Satyanarayan. *Proc. ACM Human Factors in Computing Systems (CHI)*, May 2019. 26% Acceptance Rate.

[3] **Assessing the Impact of Automated Suggestions on Decision Making: Domain Experts Mediate Model Errors but Take Less Initiative.** Ariel Levy, Monica Agrawal, Arvind Satyanarayan, David Sontag. *Proc. ACM Human Factors in Computing Systems (CHI)*, May 2019. 26% Acceptance Rate.

[4] **Lyra 2: Designing Interactive Visualizations by Demonstration.** Jonathan Zong, Dhiraj Barnwal, Ru payan Neogy, Arvind Satyanarayan. *IEEE Trans. Visualization & Computer Graphics (Proc. InfoVis '20)*, February 2021. 26% Acceptance Rate.

2020 [5] **B2: Bridging code and Interactive Visualization in Computational Notebooks.** Yifan Wu, Joseph M. Hellerstein, Arvind Satyanarayan. *Proc. ACM* , October 2020. 21% Acceptance Rate.

[6] **Representing Real-Time Multi-User Collaboration in Visualizations.** Rupayan Neogy, Jonathan Zong, Arvind Satyanarayan. *Proc. IEEE Visualization (VIS)*, October 2020. 36% Acceptance Rate.

[7] **VisuaLint: Sketchy In Situ Annotation of Chart Construction Errors.** Aspen Hopkins, Michael Correll, Arvind Satyanarayan. *Computer Graphics Forum (Proc. EuroVis)*, May 2020. 29% Acceptance Rate.

[8] **Critical Reflections on Visualization Authoring Systems.** Arvind Satyanarayan, Bongshin Lee, Donghao Ren, Jeffrey Heer, John Stasko, John R. Thompson, Matthew Brehmer, Zhicheng Liu. *IEEE Trans. Visualization & Computer Graphics (Proc. InfoVis '19)*, January 2020. 26% Acceptance Rate.

2019 [9] **Sociotechnical Considerations for Accessible Visualization Design.** Alan Lundgard, Crystal Lee, Arvind Satyanarayan. *Proc. IEEE Visualization (VIS)*, October 2019. 32% Acceptance Rate.

[10] **Sherlock: A Deep Learning Approach to Semantic Data Type Detection.** Madelon Hulsebos, Kevin Hu, Michiel Bakker, Emanuel Zgraggen, Arvind Satyanarayan, Tim Kraska, Çağatay Demiralp, César Hidalgo. *Proc. ACM Knowledge Discovery and Data Mining (KDD)*, August 2019. 14% Acceptance Rate.

[11] **VizNet: Towards a Large-Scale Visualization Learning and Benchmarking Repository.** Kevin Hu, Neil Gaikwad, Madelon Hulsebos, Michiel Bakker, Emanuel Zgraggen, César Hidalgo, Tim Kraska, Guoliang Li, Arvind Satyanarayan, Çağatay Demiralp. *Proc. ACM Human Factors in Computing Systems (CHI)*, May 2019. 24% Acceptance Rate.

2018 [12] **Altair: Interactive Statistical Visualizations for Python.** Jacob VanderPlas, Brian E. Granger, Jeffrey Heer, Dominik Moritz, Kanit Wongsuphasawat, Arvind Satyanarayan, Eitan Lees, Ilia Timofeev, Ben Welsh, Scott Sievert. *Journal of Open Source Software 3(32)*, October 2018.

[13] **Augmenting Code with In Situ Visualizations to Aid Program Understanding.** Jane Hoffswell, Arvind Satyanarayan, Jeffrey Heer. *Proc. ACM Human Factors in Computing Systems (CHI)*, April 2018. 26% Acceptance Rate.

[14] **The Building Blocks of Interpretability.** Chris Olah, Arvind Satyanarayan, Ian Johnson, Shan Carter, Ludwig Schubert, Katherine Ye, Alexander Mordvintsev. *Distill 3(3)*, March 2018.

2017 [15] **Vega-Lite: A Grammar of Interactive Graphics.** Arvind Satyanarayan, Dominik Moritz, Kanit Wongsuphasawat, Jeffrey Heer. *IEEE Trans. Visualization & Computer Graphics (Proc. InfoVis '16)*, January 2017. 22% Acceptance Rate. **Best Paper Award (1 Annually).**

2016 [16] **Visual Debugging Techniques for Reactive Data Visualization.** Jane Hoffswell, Arvind Satyanarayan, Jeffrey Heer. *Computer Graphics Forum (Proc. EuroVis)*, June 2016. 27% Acceptance Rate.

[17] **Reactive Vega: A Streaming Dataflow Architecture for Declarative Interactive Visualization.** Arvind Satyanarayan, Ryan Russell, Jane Hoffwell, Jeffrey Heer. *IEEE Trans. Visualization & Computer Graphics (Proc. InfoVis '15)*, January 2016. 22% Acceptance Rate.

2015 [18] **Declarative Interaction Design for Data Visualization.** Arvind Satyanarayan, Kanit Wongsuphasawat, Jeffrey Heer. *Proc. ACM User Interface Software and Technology (UIST)*, October 2014. 22% Acceptance Rate.

[19] **Lyra: An Interactive Visualization Design Environment.** Arvind Satyanarayan, Jeffrey Heer. *Computer Graphics Forum (Proc. EuroVis)*, June 2014. 25% Acceptance Rate.

[20] **Authoring Narrative Visualizations with Ellipsis.** Arvind Satyanarayan, Jeffrey Heer. *Computer Graphics Forum (Proc. EuroVis)*, June 2014. 25% Acceptance Rate.

2013 [21] **Webzeitgeist: Design Mining the Web.** Ranjitha Kumar, Arvind Satyanarayan, Cesar Torres, Maxine Lim, Salman Ahmad, Scott R. Klemmer, Jerry O. Talton. *Proc. ACM Human Factors in Computing Systems (CHI)*, May 2013. 20% Acceptance Rate. **Best Paper Award (Top 1%).**

2012 [22] **Using Overlays to Support Collaborative Interaction with Display Walls.** Arvind Satyanarayan, Nadir Weibel, James D. Hollan. *Proc. ACM Intelligent User Interfaces (IUI)*, February 2012 . 19% Acceptance Rate.

PRE-PRINTS

2021 [23] **Intuitively Assessing ML Model Reliability through Example-Based Explanations and Editing Model Inputs.** Harini Suresh, Kathleen M Lewis, John V Guttag, Arvind Satyanarayan. *arXiv:2102.08540*, February 2021.

2020 [24] **The Effectiveness of Haptic Properties Under Cognitive Load: An Exploratory Study.** Nava Haghighi, Nathalie Vladis, Yuanbo Liu, Arvind Satyanarayan. *arXiv:2006.00372*, May 2020.

2019 [25] **Embedding Comparator: Visualizing Differences in Global Structure and Local Neighborhoods via Small Multiples.** Angie Boggust, Brandon Carter, Arvind Satyanarayan. *arXiv:1912.04853*, Dec. 2019.

WORKSHOP & POSITION PAPERS, POSTERS & REPORTS

2020 [26] **Shared Interest: Human Annotations vs. AI Saliency.** Angie Boggust, Benjamin Hoover, Arvind Satyanarayan, Hendrik Strobelt. *VISxAI*, October 2020.

[27] **Towards a Dynamic Multiscale Personalized Information Space.** James Hollan, Amy Fox, Philip Guo, Clemens Klokmose, Arvind Satyanarayan, Haijun Xia. *Convivial Computing Salon, <Programming>*, May 2020.

[28] **Self-Interfaces: Utilizing Real-Time Biofeedback in the Wild to Elicit Subconscious Behavior Change.** Nava Haghighi, Arvind Satyanarayan. *Work-in-Progress of ACM Tangible and Embodied Interaction (TEI)*, February 2020.

2019 [29] **Visualive: Representing Synchronized Visualization Interactions.** Rupayan Neogy, Emily Hu, Arvind Satyanarayan. *Posters of IEEE Visualization (VIS)*, October 2019.

2018 [30] **Designing Cognitively Convivial Physics for Dynamic Visual Information Substrates.** James D. Hollan, Arvind Satyanarayan. *Rethinking Interaction Workshop, ACM Human Factors in Computing Systems (CHI)*, May 2018.

2013 [31] **The CHI 2013 Interactive Schedule.** Arvind Satyanarayan, Daniel Strazzulla, Clemens Klokmose, Michel Beaudouin-Lafon, Wendy Mackay. *Extended Abstracts, ACM Human Factors in Computing Systems (CHI)*, May 2013.

2012 [32] **Learning Structural Semantics for the Web.** Maxine Lim, Ranjitha Kumar, Arvind Satyanarayan, Cesar Torres, Jerry O. Talton, Scott R. Klemmer. *Stanford CSTR 2012-03*, December 2012.

[33] **A Platform for Large-Scale Machine Learning on Web Design.** Arvind Satyanarayan, Maxine Lim, Scott R. Klemmer. *Extended Abstracts, ACM Human Factors in Computing Systems (CHI)*, May 2012

INVITED TALKS & DEMOS

Visualization for Machine Learning

Jun 2021 AI Seminar, Information Science Institute, University of Southern California
Apr 2021 Daimler/Mercedes-Benz AI

Towards *Effective* Interaction with Data Visualization

Jun 2020 Invited Talk, Symposium on Data Science & Statistics, *American Statistics Association*
Keynote Talk, Workshop on Human-In-the-Loop Data Analytics, *ACM SIGMOD*

Visualization: A Petri Dish for Intelligence Augmentation

Apr 2019 Radcliffe Institute for Advanced Study, Harvard University, *Cambridge, MA*
Oct 2018 MIT CSAIL, *Cambridge, MA*
Sep 2018 Northeastern University, *Boston, MA*

The Building Blocks of Interpretability

May 2018 emlyon business school, *Lyon, France*

Vega-Lite: A Grammar of Interactive Graphics

Apr 2017 OpenVis Conf, *Boston, MA*

Declarative Interaction Design for Data Visualization

Apr 2017 Massachusetts Institute of Technology, *Cambridge, MA*
New York University, *Tandon Computer Science & Center of Data Science, New York City, NY*
University of California, San Diego, *San Diego, CA*
Northwestern University, *Evanston, IL*
Mar 2017 University of British Columbia, *Vancouver, Canada*
University of Toronto, *Toronto, Canada*
University of Michigan, *Ann Arbor, MI*
Feb 2017 University of California, Berkeley, *Berkeley, CA*
University of Illinois Urbana-Champaign, *Urbana, IL*
Cornell University, *Computer Science & Information Science, Ithaca, NY*
University of Wisconsin-Madison, *Madison, WI*

The Vega Ecosystem
Oct 2016 Keynote Talk, Visualization In Practice Workshop, *IEEE VIS, Baltimore, MD*

Reactive Building Blocks: Interactive Visualizations with Vega
Jul 2016 Keynote Talk, DataViz Camp, *United Nations*
Apr 2016 OpenVis Conf, *Boston, MA*

Higher-Level Tools for Interactive Data Visualization
May 2016 INRIA Saclay, *Saclay, France*
Sep 2015 BiD Seminar, *UC Berkeley, Berkeley, CA*

Lowering the Threshold of Visualization Design
Apr 2015 Linfield College, *Science Colloquium, McMinnville, OR*
Dec 2014 Tata Innovation Labs, *Tata Consultancy Services, Delhi, India*

Designing Visualizations with Lyra Tutorial
Apr 2015 I247: Information Visualization & Presentation, *UC Berkeley Information School, Berkeley, CA*
Dec 2014 Tata Innovation Labs, *Tata Consultancy Services, Delhi, India*
J221: Introduction to Data Visualization, *UC Berkeley Journalism School, Berkeley, CA*
Nov 2014 HCDE 511: Information Visualization, *University of Washington, Seattle, WA*

Lyra: An Interactive Visualization Design Environment
Apr 2014 OpenVis Conf, *Boston, MA*
Mar 2014 CAR, *Baltimore, MD*
Feb 2014 Tapestry, *Annapolis, MD*

NewsCamp :: Introduction to D3
Mar 2014 CAR, *Baltimore, MD*

TEACHING

2019 – **6.859: Interactive Data Visualization**, *MIT EECS*
(Numbered 6.894 in 2019 and 2020)

2018 – **6.170: Software Studio**, *MIT EECS*
Co-Instructor with Prof. Daniel Jackson

Winter 2016 **HCID 520: User Interface Software & Technology**, *University of Washington*
Co-Instructor with Prof. Jeffrey Heer

Winter 2013 **CS 247: Human-Computer Interaction Design Studio**, *Stanford University*
Graduate Teaching Assistant for Profs. Jeffrey Heer and Michael Bernstein

Fall 2012 **CS 147: Introduction to Human-Computer Interaction**, *Stanford University*
Graduate Teaching Assistant for Prof. Scott Klemmer

Winter 2012 **HCI Online #001**, *Stanford University* and *Coursera*
Graduate Teaching Assistant for Prof. Scott Klemmer

STUDENT ADVISEES

PhD Angie Boggust *(EECS)*, Aspen Hopkins *(EECS)*, Crystal Lee *(STS*, co-advised w/Graham Jones*)*, Alan Lundgard *(EECS)*, Harini Suresh *(EECS*, co-advised w/John Guttag*)*, Jonathan Zong *(EECS)*

Master's Katherine Bacher (*EECS '21*), Nava Haghighi *(ID&M '20)*, Houssam Kherraz *(EECS '20)*, Rupayan Neogy *(EECS '20)*, Ebenezer Sefah (*EECS '21*), Wonyoung So *(DUSP '20)*

Undergraduate Anna Arpaci-Dusseau (*EECS '23*), Soomin Chun (*EECS & Math '22*), Dhiraj Kumar (*IIT Kharagpur '20*),

Katherine Huang (*CMS & EECS '23*), Allen Lee (*EECS '20*), Anna Meurer (*MechE '23*), Mateo Monterde (*Math & Management '23*), Ethan Nevidomsky (*CMS & EECS '22*), Tanya Yang (*EECS '22*)

Mentoring as a PhD Student
Tianyi "Tina" Lin *(UW CSE '17)*, Matthew Chun *(UW CSE '18)*, Yiyang "Amy" Xu *(UW CSE '18)*, Anjir Hossain *(UW CSE '18)*, Nikhil Khanna *(UW CSE '18)*, Emily Gu *(UW CSE '16)*, Ruijia "Iris" Wang *(UW CSE '17)*, Ryan Russell *(UW CSE '16)*

SERVICE

Reviewing — IEEE VIS 2014–2020, EuroVis 2014–2021, IEEE TVCG 2015–2021, ACM UIST 2014–2020, ACM CHI 2013–2021, ACM IUI 2012–2021, IEEE PacificVis 2016.

Recognition for **exceptional reviews**: UIST 2020, CHI 2019, CHI 2017, VIS 2017 (x2).

Committees — **Diversity & Inclusivity.** MIT EECS 2019–Present. IEEE VIS 2018–2020, Information+ 2018.
Program Committees. ACM IUI 2019–2021, IEEE VIS 2018–2020, OpenVis Conf 2016–2018, ACM CHI 2016 Late-Breaking Work, Information+ 2018, 2021.

2021, 2022 — Publications Co-Chair, *IEEE VIS 2021, 2022*

2018–2020 — Distill (http://distill.pub) Co-Editor.

2019, 2020 — Diversity & Inclusion Co-Chair, *IEEE VIS 2019, 2020*

2018 — Program Co-Chair, *OpenVis Conf*

2013 — Interactive Schedule Chair, *CHI 2013 Organizing Committee*

2008 – 2011 — **Undergraduate Student Leadership**, *UC San Diego*.

2009 – 2011	Resident Advisor, *Revelle College*
2010 – 2011	Student Conduct Code Re-write Workgroup Student Representative
2010 – 2011	Housing, Dining, Hospitality Advisory Committee Student Representative
Summer 2010	Parent Orientation Leader, *Revelle College*
2009 – 2010	Revelle College Senator, *Associated Students*
2008 – 2009	Director of Communications, *Revelle College Council*

PRESS

2021 — **When more Covid-19 data doesn't equal more understanding.**
Daniel Ackerman, MIT News, March 2021
https://news.mit.edu/2021/when-more-covid-data-doesnt-equal-more-understanding-0304

2020 — **3Q: Collaborating with users to develop accessible designs.**
Rob Matheson, MIT News, March 2020
http://news.mit.edu/2020/accessible-designs-data%20visualization-0313

2018 — **Google Researchers Are Learning How Machines Learn.**
Cade Metz, The New York Times, March 2018
https://www.nytimes.com/2018/03/06/technology/google-artificial-intelligence.html

2014 — **Apropose Closes $1.875M Funding Round Led by NEA and Andreessen Horowitz.**
PR Newswire, September 2014
http://www.prnewswire.com/news-releases/apropose-closes-1875m-funding-round-led-by-nea-and-andreessen-horowitz-274728751.html

10 Significant Visualization Developments: January to June 2014.
Andy Kirk, Visualizing Data, August 2014
http://www.visualisingdata.com/index.php/2014/08/10-significant-visualisation-developments-january-to-june-2014/

2008 **Movable Type Experts Team Up on Melody, an Open Source Publishing Platform.**
Techcrunch, June 2009
http://techcrunch.com/2009/06/25/movable-type-experts-team-up-on-melody-an-open-source-publishing-platform/

2007 **Why We Call it a "Community".**
Anil Dash, Six Apart/Movable Type, August 2007
http://www.movabletype.com/blog/2007/02/why-we-call-it-a-community.html