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Susan VanderPlas

Education

2005–2009 **Bachelor of Science**, *Texas A&M University*.
Major: Psychology and Applied Mathematical Sciences (Statistics), Minor: Neuroscience

2009–2011 **Master of Science in Statistics**, *Iowa State University*.
Creative Component: Nonparametric statistical analysis of Atom Probe Tomography spectra
Chair: Dr. Alyson Wilson, Committee Members: Dr. Alicia Carriquiry, Dr. Krishna Rajan

2011–15 **Doctor of Philosophy in Statistics**, *Iowa State University*.

Dissertation

Title *The Perception of Statistical Graphics*

Committee Dr. Heike Hofmann (Chair), Dr. Dianne Cook, Dr. Sarah Nusser, Dr. Max Morris, Dr. Erin McDonald, Dr. Stephen Gilbert

Abstract Research on statistical graphics and visualization generally focuses on new types of graphics, new software to create graphics, interactivity, and usability studies. Our ability to interpret and use statistical graphics hinges on the interface between the graph itself and the brain that perceives and interprets it, and there is substantially less research on the interplay between graph, eye, brain, and mind than is sufficient to understand the nature of these relationships. This dissertation further explores the interplay between a static graph, the translation of that graph from paper to mental representation (the journey from eye to brain), and the mental processes that operate on that graph once it is transferred into memory (mind). Understanding the perception of statistical graphics will allow researchers to create more effective graphs which produce fewer distortions and viewer errors while reducing the cognitive load necessary to understand the information presented in the graph.

Research

2015 **Independent Research**, Auburn, NE.
Designed and analyzed experiments to understand human perception of statistical graphics and optimized graphics to clearly communicate statistical results.

- Hierarchy of Graphical Features: Which features of statistical graphics dominate the perceptual experience? Do colored points matter more than trend lines? (Paper) [1]
- Reproducibility of Plots in the 1870 Statistical Atlas
- Bayesian Analysis of Two-Target Statistical Lineups (Working Project)

Apr - Nov 2015 **Postdoc**, *Iowa State University*, Ames, IA.

Office of the Vice President for Research

- Evaluated faculty funding start-up packages to explore links between start-up funding and future productivity.
- Explored natural variation and underlying trends in grant receipts across Iowa State over a 20 year period.

2012 - Jun 2015 **PhD Research**, *Iowa State University*, Ames, IA.

Designed and analyzed experiments to understand human perception of statistical graphics and optimized graphics to clearly communicate statistical results. [2]

- The Sine Illusion in Statistical Graphics: How does this common illusion effect the information we take in from graphs? [3–5]
  - Won the ASA Student Paper Award (2014) for the Graphics Section (Paper)
  - Created Shiny applets to demonstrate the illusion and test it's effect.
- Statistical Graphics and Visual Aptitude: How are spatial reasoning abilities related to the ability to read statistical graphics? (Paper) [6].
- Hierarchy of Graphical Features: Which features of statistical graphics dominate the perceptual experience? Do colored points matter more than trend lines? (Paper) [1]

2013 2015 **Research Assistant, USDA Soybean Genome Project**, *Iowa State University*, Ames, IA.

- Analyzed large quantities of soybean genetics data to identify inheritance, important genes, single nucleotide polymorphisms, and copy number variation.
- Created interactive applets presenting the data and appropriate graphics designed to encourage exploration of the results by biologists.
- Assembled a database of known soybean parantage to facilitate further research, and created an interactive applet to display the lineage of any variety in the database.

Jan-Aug 2012 **Research Assistant, Iowa Dept. of Transportation**, *Iowa State University*, Ames, IA.

Developed a hierarchical Bayesian model to determine the effectiveness of road interventions on traffic accidents and fatalities. Discovered a previously unknown error in the data used in prior analyses using exploratory techniques, and developed a method to compensate for the missing data.

2010 2011 **M.S. Research**, *Iowa State University*, Ames, IA.

Worked with materials scientists and engineers to develop and implement nonparametric methods for automatic peak detection in mass spectroscopy data. Fit systems of differential equations to spectroscopy data based on theoretical concepts from quantum physics to facilitate inference about the atomic structure of a material.

Fall 2009 **Research Rotations in Bioinformatics**, *Iowa State University*, Ames, IA.

Explored applications of the EM algorithm to next-generation sequencing data error detection and modeled the relationship between age and fertility in reptiles. Each project lasted about 6 weeks; rotations were structured to allow new students to explore several facets of bioinformatics, and included wet-lab and computational experiences.

Summer 2009 **NSF Research Experience for Undergraduates**, *Iowa State University*, Ames, IA.

Worked with biologists and bioinformaticians to compare homologous gene expression in humans, pigs, and mice. [7]

Summer 2008

NSF Research Experience for Undergraduates, *University of Nebraska*, Lincoln, NE.

Created a mathematical model describing electrical impulse transmission and decay along neurons with varying states of myelination.

Teaching

2013

R Course Instructor, *Iowa State University Stat Dept.*, Ames, IA.

Designed and conducted workshops to teach R skills to the members of the university and local business community. Workshop topics included an introduction to R, ggplot2, data management with plyr, reshape2, and stringr, package development, document creation with knitr, linear models, and creating web applets with Shiny.

Spring 2013

Statistical Methods for Research, *Iowa State University Stat Dept.*, Ames, IA.

Held office hours and graded labs and tests for Stat 401, a class composed primarily of graduate engineering students.

2012
2013

Introduction to Business Statistics II, *Iowa State University Stat Dept.*, Ames, IA.

Taught undergraduate business students statistical methods and use of JMP statistical software. Responsibilities included holding office hours and evening help sessions, developing lab materials, managing the course website on Blackboard, and grading labs, homework, and tests.

Fall 2011

Statistical Methods for Research, *Iowa State University Stat Dept.*, Ames, IA.

Taught graduate social science students statistical methods and use of SAS statistical software. Responsibilities included teaching lab sessions, creating lab materials, holding office hours and grading homework and lab materials.

Fall 2011

Empirical Methods for Comp. Sci., *Iowa State University Stat Dept.*, Ames, IA.

Held office hours and graded homework for Stat 430, a class composed of graduate bioinformatics and computer science students.

Software Development

2013
2014

Statistics Teaching Applets, *Iowa State University*, Ames, IA.

Created and redesigned web-based applets to teach statistical techniques interactively. Applets covered topics such as the method of least squares, ANOVA, k-means, regression diagnostics, and t-tests. (Applets)

2013
2015

Animint Developer, *R Project*, Google Summer of Code.

Worked to develop the `animint` package for R to translate `ggplot2` into d3 interactive JavaScript graphics. Participated in the project in 2013, adding support for all ggplot2 geoms as well as most scales and axes. Returned to serve as a mentor for the project in 2014 and 2015. [8–11]

Professional Experience

Fall 2015 **Engineering Statistical Analyst**, *Cooper Nuclear Station*, Nebraska Public Power District.

Analyzed power plant business and engineering decisions to increase safety and profitability.

- Modeled employee turnover to identify individuals likely to retire or resign.
- Established automated statistical monitoring of site conditions, department turnover, and human performance errors.
- Predicted likely direction of tornadoes based on location and topological factors to establish the risk of tornado guided missle debris damaging critical equipment.
- Evaluated the risk of climate fluctuations on operational readiness.
- Identified site conditions statistically associated with water accumulation in radiation detectors.
- Improved engineering margin in thermal limits management in the reactor core.

2015 **Consultant**.

Developed web applications, interactive data displays, and statistical analyses for clients including the Iowa Soybean Association and Iowa State USDA Extension office. Example 1: Nitrogen Deficiency in Corn, Example 2: Crop Yield Forecast

2012–2015 **Informal Consultant**, *Cooper Nuclear Station*, Nebraska Public Power District.

Provided informal statistical recommendations to nuclear engineers on proper methods for bootstrap, k95/95 intervals, probability analysis, and other modeling questions. Helped to estimate capacity factor using block bootstrap, answered questions about probability theory and model assessment, and assessed violations of modeling assumptions. Assembled data sets containing years of hourly power prices to explore downpower timing and market relationships.

2014-2015 **Statistical Web Development**, *Iowa State Extension Service*, Ames, IA.

Designed interactive web tools to assist soybean farmers with making informed decisions on planting and cultivar choices for their geographic location. Created clear, easy-to-read statistical graphics with multiple layers of detail, presented using responsive Shiny web applets. (Announcement, Tool)

Technical Skills

Statistical Software	R (programming, graphics, package development, web scraping) SAS (linear and mixed models) JMP (basic analysis and data mining)
Languages	C and C++, JavaScript, SQL, python (for web scraping)
Web Development	Shiny (library for interactive web applets), d3 interactive graphics, `knitr` and `pandoc` for integration of code, results, and documentation, Apache and MySQL web server configuration and administration
Operating Systems	Ubuntu (system administration) Windows

Awards

ASA	Student Paper Award (Graphics)	*2013*
NSF	IGERT Fellowship	*2009-2011*
Texas A&M	Foundation, University, Liberal Arts, Psychology, and Math Honors	*2009*

Texas A&M	Undergraduate Research Fellow	*2009*
Texas A&M	University Scholar	*2006-2009*
Texas A&M	Astronaut Scholar	*2008-2009*
Texas A&M	President's Endowed Scholarship	*2005-2009*
Texas A&M	Director's Excellence Award	*2005-2009*
Texas A&M	National Merit Award	*2005-2009*
	National Merit Scholar	*2005*

Publications and Presentations

1 **VanderPlas, S.** and Hofmann, H. Clusters beat Trend!? Testing feature hierarchy in statistical graphics. *Journal of Computational and Graphical Statistics*, 2016.

2 **VanderPlas, S.** Do You See What I See? using Shiny for User Testing. Panel on Formal Usability Testing and Statistical Graphics at JSM, August 2014.

3 **VanderPlas, S.** and Hofmann, H. Signs of the sine illusion - why we need to care. *Journal of Computational and Graphical Statistics*, 2014.

4 **VanderPlas, S.** The curse of three dimensions: Why your brain is lying to you. Presentation at JSM (Computing & Graphics Student Paper Competition), August 2014.

5 **VanderPlas, S.** and Hofmann, H. Signs of the sine illusion – why we need to care. Presentation at JSM, August 2013.

6 **VanderPlas, S.** and Hofmann, H. Spatial reasoning and data displays. *IEEE Transactions on Visualization and Computer Graphics*, 2016.

7 Towfic, F., **VanderPlas, S.**, Oliver, C. A., Couture, O., Tuggle, C. K., Greenlee, M. H. W., and Honavar, V. Detection of gene orthology from gene co-expression and protein interaction networks. *BMC bioinformatics*, 11(Suppl 3):S7, 2010.

8 Hocking, T. D., **VanderPlas, S.**, and Sievert, C. *animint: Interactive animations*.

9 Hocking, T. D., Sievert, C., and **VanderPlas, S.** Animint: a grammar for interactive animations. Working Draft.

10 **VanderPlas, S.** Animint: Animated, interactive, web-ready graphics with R. Presentation at Great Plains R Users Group (Joint work with Toby Hocking), May 2014.

11 **VanderPlas, S.** Animint: Interactive web-based animations using ggplot2's grammar of graphics. Presentation at JSM, August 2015.

12 Budrus, S., **VanderPlas, S.**, and Cook, D. In tennis, do smashes win matches? *Significance*, 10(3):35–38, 2013.

13 Hull, R., Bortfeld, H., and **Koons, S.** Near-infrared spectroscopy and cortical responses to speech production. *The open neuroimaging journal*, 3:26, 2009.