

# Susan VanderPlas

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## 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 analysed experiments to understand human perception of statistical graphics and optimised graphics to clearly communicate statistical results.

- Hierarchy of Graphical Features: Which features of statistical graphics dominate the perceptual experience? Do coloured points matter more than trend lines? ([Repository](#))
- Reproducibility of Plots in the 1870 Statistical Atlas ([Working Project](#))
- 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 conducted experiments to understand human perception of statistical graphics and optimised graphics to clearly communicate statistical results.

- The Sine Illusion in Statistical Graphics: How does this common illusion effect the information we take in from graphs?. Won the ASA Student Paper Award (2014) for the Graphics Section ([Paper](#))
- Statistical Graphics and Visual Aptitude: How are spatial reasoning abilities related to the ability to read statistical graphics? ([Paper](#))
- Hierarchy of Graphical Features: Which features of statistical graphics dominate the perceptual experience? Do coloured points matter more than trend lines? ([Paper](#))

2013  
2015

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

- Analysed 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 parentage 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 non-parametric 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.

## 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.

## Bibliography

### Publications

- Budrus, Sarah, Susan VanderPlas, and Dianne Cook (2013). "In tennis, do smashes win matches?" In: *Significance* 10.3, pp. 35–38.
- Hull, Rachel, Heather Bortfeld, and Susan Koons (2009). "Near-infrared spectroscopy and cortical responses to speech production". In: *The open neuroimaging journal* 3, p. 26.
- Towfic, Fadi et al. (2010). "Detection of gene orthology from gene co-expression and protein interaction networks". In: *BMC bioinformatics* 11.Suppl 3, S7.
- VanderPlas, Susan and Heike Hofmann (2016a). "Clusters beat Trend!? Testing feature hierarchy in statistical graphics". In: *Journal of Computational and Graphical Statistics*.
- (2016b). "Spatial Reasoning and Data Displays". In: *IEEE Transactions on Visualization and Computer Graphics*.
  - (2014). "Signs of the Sine Illusion - why we need to care". In: *Journal of Computational and Graphical Statistics*. DOI: [10.1080/10618600.2014.951547](https://doi.org/10.1080/10618600.2014.951547).

### Presentations

- VanderPlas, Susan (2016). "Clusters beat Trend!? Testing feature hierarchy in statistical graphics". Presentation at JSM. URL: [https://srvanderplas.github.io/Presentations/JSM2016/HierarchyOfVisualFeatures.html#/.](https://srvanderplas.github.io/Presentations/JSM2016/HierarchyOfVisualFeatures.html#/)
- (2015). "Animint: Interactive Web-Based Animations Using Ggplot2's Grammar of Graphics". Presentation at JSM. URL: [https://srvanderplas.github.io/Presentations/JSM2015/Animint.html#/.](https://srvanderplas.github.io/Presentations/JSM2015/Animint.html#/)
  - (2014a). "Animint: Animated, Interactive, Web-ready graphics with R". Presentation at Great Plains R Users Group (Joint work with Toby Hocking). URL: [https://srvanderplas.github.io/Presentations/RUserGroups%20-%20Animint/animint.html#/.](https://srvanderplas.github.io/Presentations/RUserGroups%20-%20Animint/animint.html#/)
  - (2014b). "The curse of three dimensions: Why your brain is lying to you". Presentation at JSM (Computing & Graphics Student Paper Competition). URL: [https://srvanderplas.github.io/Presentations/JSM2014/WhyYourBrainIsLyingToYou/JSM2014.html#/.](https://srvanderplas.github.io/Presentations/JSM2014/WhyYourBrainIsLyingToYou/JSM2014.html#/)
  - (2014c). "Do You See What I See? Using Shiny for User Testing". Panel on Formal Usability Testing and Statistical Graphics at JSM. URL: [https://srvanderplas.github.io/Presentations/JSM2014/UserTesting/UserTesting.html#/.](https://srvanderplas.github.io/Presentations/JSM2014/UserTesting/UserTesting.html#/)
- VanderPlas, Susan and Heike Hofmann (2013). "Signs of the Sine Illusion – why we need to care". Presentation at JSM.

### Other Projects

- Hocking, Toby Dylan, Carson Sievert, and Susan VanderPlas. *Animint: a Grammar for Interactive Animations*. Working Draft. URL: <https://raw.githubusercontent.com/tdhock/animint-paper/master/HOCKING-animint.pdf>.
- Hocking, Toby Dylan, Susan VanderPlas, and Carson Sievert. *animint: Interactive animations*. URL: <https://github.com/tdhock/animint>.

## Teaching

2017

**Data Science Competency Center**, *Nebraska Public Power District*, Columbus, NE.

Designed and conducted workshops to teach R skills to other employees. Led monthly meetings to expand the practice of data science within the company. Helped to identify promising projects and demonstrate the utility of data science in a slow-to-change workplace environment.

2013  
2015

**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 dplyr, tidyr, 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.

## Professional Experience

Fall 2015

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

Analysed power plant business and engineering decisions to increase safety and profitability. Helped to create a data-science competency center and mentored other employees in statistical methods and programming.

- 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 missile 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 Statistical 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 down-power timing and market relationships.

## 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.

## 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 Honours	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