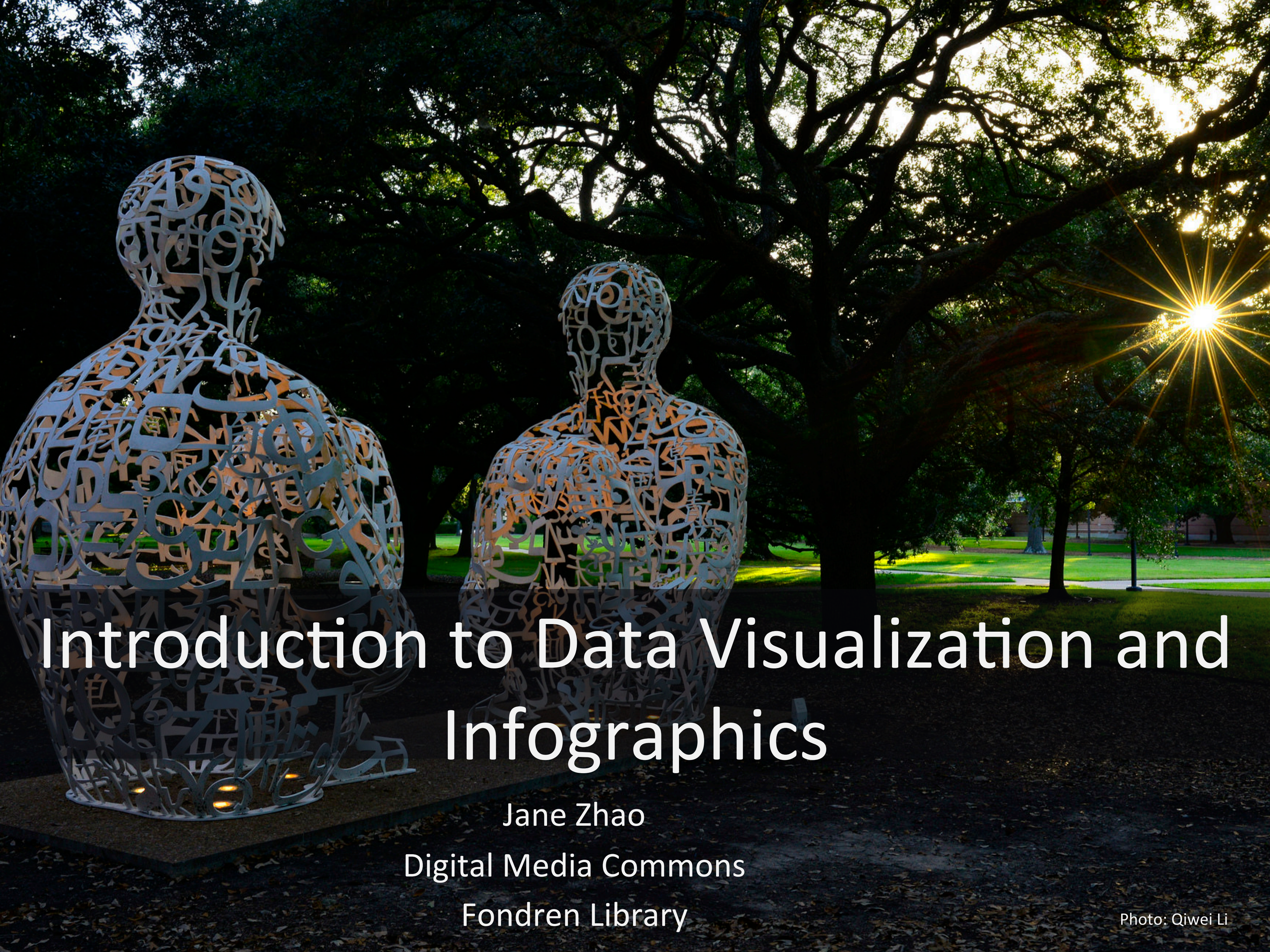


Introduction to Data Visualization and Infographics

Jane Zhao

Digital Media Commons

Fondren Library

Photo: Qiwei Li

Student survey, Spring 2015

Undergraduate

9. Would you be interested in taking a library short course on:

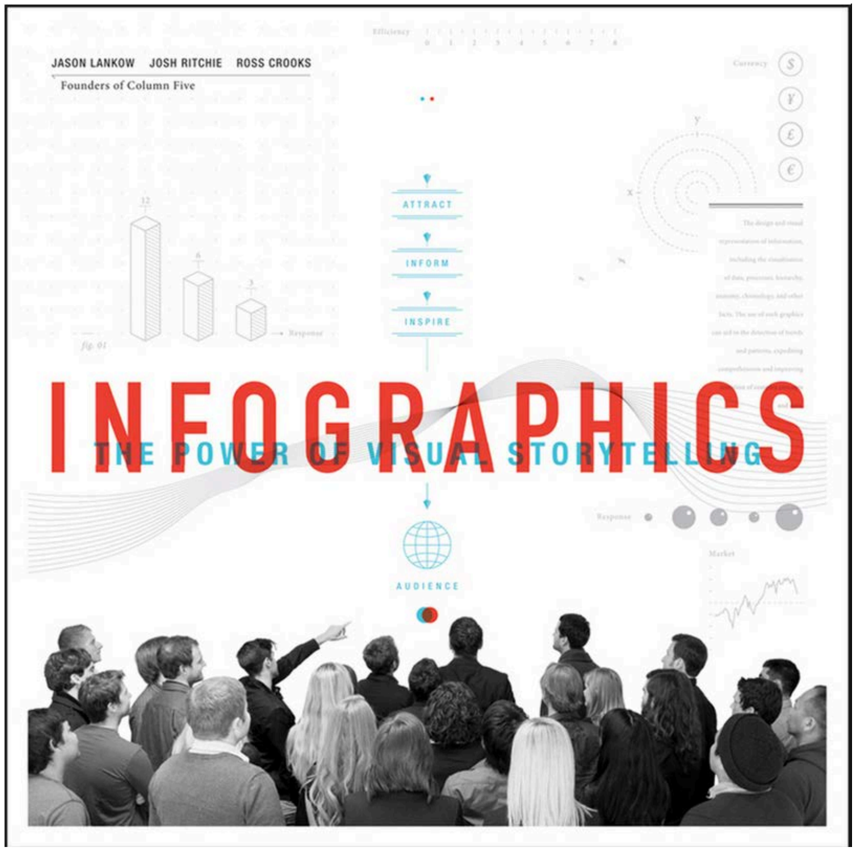
#	Answer	Response	%
1	Zotero	162	21%
2	Mendeley	82	10%
3	EndNote	145	18%
4	GIS	223	28%
5	Visualizing data	270	34%
6	Creating infographics	292	37%
7	Digital storytelling	181	23%
8	Library research methods	232	29%
9	Navigating the library website	115	15%
10	Specific database(s) - (please specify)	16	2%
11	Other (please specify)	19	2%

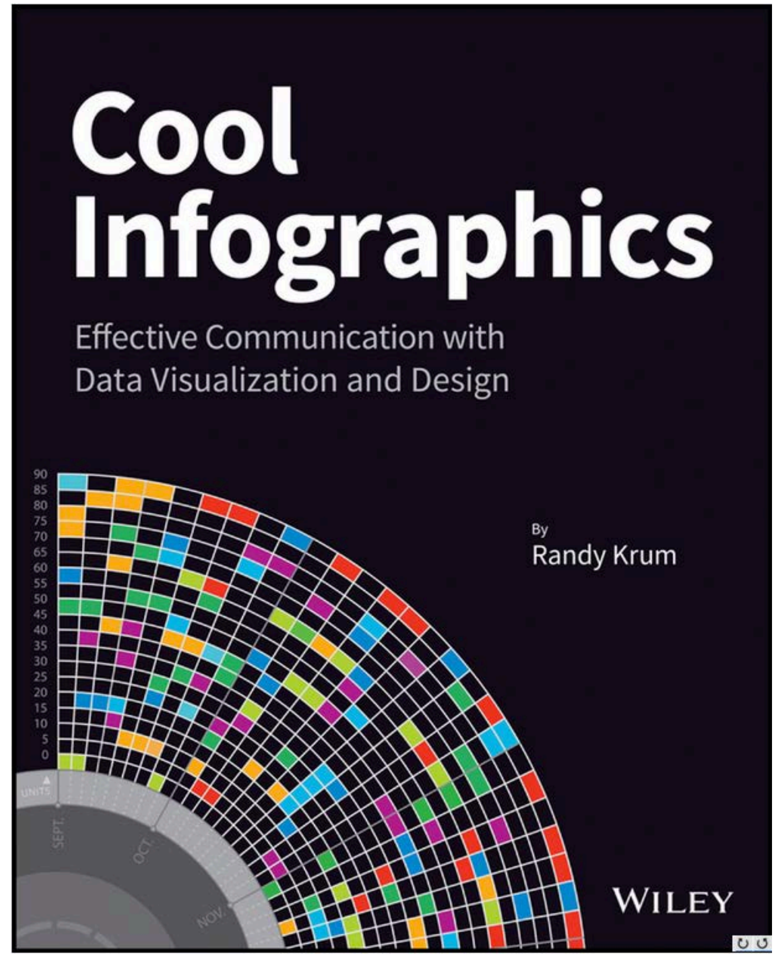
Graduate

9. Would you be interested in taking a library short course on:

#	Answer	Response	%
1	Zotero	178	24%
2	Mendeley	168	23%
3	EndNote	245	34%
4	GIS	166	23%
5	Visualizing data	302	41%
6	Creating infographics	183	25%
7	Digital storytelling	132	18%
8	Library research methods	166	23%
9	Navigating the library website	85	12%
10	Specific database(s) - (please specify)	11	2%
11	Other (please specify)	21	3%

Books used


JASON LANKOW JOSH RITCHIE ROSS CROOKS
Founders of Column Five
ATTRACT
INFORM
INSPIRE
INFOGRAPHICS
THE POWER OF VISUAL STORYTELLING
AUDIENCE


Cool Infographics
Effective Communication with Data Visualization and Design
By
Randy Krum
WILEY

Objectives

- Learn the basic concepts of data visualization and infographics as well as the best practices of information design
- Be aware the handy tools for creating Infographics and Data Visualization

Outline

- What is Infographics? What is Data Visualization?
- Why do they work?
- What makes a good Infographic?
- Information design best practices.
- Tools for creating Infographics and Data Visualization.
- Creating a simple graphics with PowerPoint
- Visualizing a small set of data with Excel and Google Chart

INFOGRAPHICS AND DATA VISULIZATION

Check out some examples…

What is Infographics?

An Example of Infographics

An Example of Infographics

1ST FLOOR CONSTRUCTION

An Example of Infographics

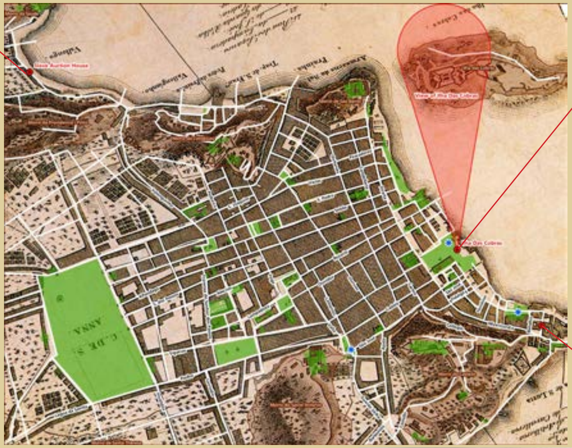
“Life of Outsiders in Rio de Janeiro during the Time of the King”

Ariel Guerrero-Stewart, Ericka Howard, Tracey Franklin
History 251 Rice University
Spring 2012

In the nineteenth century there was a mainstream Brazilian society and then those who were outsiders to it. This map shows some of the places where these outcasts, including gypsies, prisoners, and freed slaves would have visited during their time in Rio. While other groups were confined in one specific area these people were distributed throughout the city.

Debret, Three female gypsies outside a slave auction house

Steinnmann, Ilha das Cobras, an island near the coastland of Rio



Debret, Freed black slaves running a barbershop

Debret, Prisoner begging for alms on the eve of Pentecost

An Example of Infographics

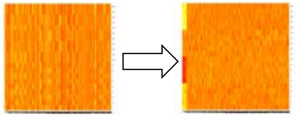
Bayesian Clustering and Variable Selection of High-Dimensional Count Data

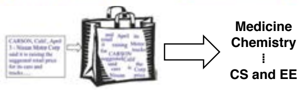
Qiwei Li and Marina Vannucci

Department of Statistics, Rice University, Houston, Texas

INTRODUCTIONS

- An explosion of data for which the dimension p is considerably larger than the sample size n, i.e., $p \gg n$;
- A challenge to uncover the group structure of the observations and to determine the discriminating variables;
- A lot of well studies on continuous and Gaussian-distributed large-scale data, e.g., DNA microarray;
- A call for Bayesian method on non-negative count data, e.g., next-generation sequencing (RNA-Seq) and bag-of-word data;
- Difficulties: the number of groups, normalization, variability modeling.





STATISTICAL MODELS AND MCMC ALGORITHMS

Data and Parameter Specification

- Observable Data
  - X is a set of n p-dimensional observations from K populations;
  - Each element $x_{ij} \in \mathbb{Z}^+$ is an nonnegative count number:

$$X_{n\times p} = \begin{array}{c} \\ X_{1\cdot} \\ X_{2\cdot} \\ \vdots \\ X_{n\cdot} \end{array} \begin{array}{c} \begin{array}{cccc} X_{\cdot 1} & X_{\cdot 2} & \cdots & X_{\cdot p} \end{array} \\ \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{pmatrix} \end{array}.$$

- Parameters for Clustering Observations
  - n samples are from a mixture of K Poisson distributions:

$$f(X_{i\cdot}|W,\Theta) = \sum_{k=1}^{K} w_k f(X_{i\cdot}|\theta_k);$$

  - The size of each component $(n_1 \quad n_2 \quad \cdots \quad n_K)$ follows a multinomial distribution with parameter n and $(w_1 \quad w_2 \quad \cdots \quad w_K)$ with conjugate prior $(\alpha \quad \alpha \quad \cdots \quad \alpha)$;
  - A latent n-vector is introduced to identify the cluster, where $z_i = k$ indicates i-th observation belongs to k-th component:

$$Z = (z_1 \quad z_2 \quad \cdots \quad z_n).$$

- Parameters for Identifying Discriminating Variables
  - Not all the variables provide information about group structure and some even obscure the recovery of the true structure;
  - A latent p-vector is introduced to identify the most discriminating variables, where $\gamma_j = 1$ indicates j-th variable is informative:

$$\Gamma = (\gamma_1 \quad \gamma_2 \quad \cdots \quad \gamma_p);$$

  - Assume γ_js are independent Bernoulli random variables with parameter ω, that is, $|\Gamma| = \sum_{j=1}^{p}\gamma_j \backsim Binomial(p,\omega)$.

- Parameters for Modeling Heterogeneity
  - The variation in the number of counts per sample is very high, e.g., different RNA samples may be sequenced to different depths.
  - A n-vector is introduced to model the unobserved heterogeneity with prior $Gamma(1/\sigma^2, 1/\sigma^2)$[1]:

$$S = (s_1 \quad s_2 \quad \cdots \quad s_n).$$

Hierarchical Framework

- Data Likelihood
  - We assume

$$x_{ij} \backsim \begin{cases} Poisson(s_i\theta_k) & if\ z_i = k, \gamma_j = 1 \\ Poisson(s_i\theta_0) & if\ \gamma_j = 0 \end{cases};$$

  - Data likelihood of each observation:

$$f(X_{i\cdot}|z_i = k, s_i, \Gamma, \theta_k, \theta_0) = \frac{s_i^{h_{i0}+h_{i1}}}{\prod_{j=1}^{p} x_{ij}!} e^{-s_i d_0 (p-|\Gamma|)} {\theta_0}^{h_{i0}} e^{-s_i d_k |\Gamma|} {\theta_k}^{h_{i1}};$$

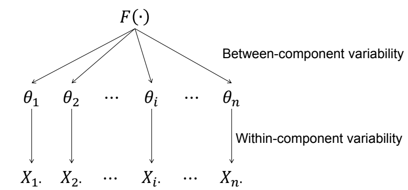
  - Data likelihood of each variable:

$$f(X_{\cdot j}|Z,S,\gamma_j,\Theta,\theta_0) = \begin{cases} \dfrac{\prod_{i=1}^{n} s_i^{x_{ij}}}{\prod_{i=1}^{n} x_{ij}!} e^{-|S|\theta_0} {\theta_0}^{v_j} & if\ \gamma_j = 1 \\ \dfrac{\prod_{i=1}^{n} s_i^{x_{ij}}}{\prod_{i=n} x_{ij}!} \prod_{k=1}^{K} e^{-|S_k|\theta_k} {\theta_k}^{v_{jk}} & if\ \gamma_j = 0 \end{cases};$$

  - $h_{i0} = \sum_{j:\gamma_j=0} x_{ij}$, $h_{i1} = \sum_{j:\gamma_j=1} x_{ij}$, $v_j = \sum_{i=1}^{n} x_{ij}$, $v_{jk} = \sum_{i:z_i=k} x_{ij}$;
  - Full data likelihood:

$$f(X|Z,S,\Gamma,\Theta,\theta_0) = \prod_{i=1}^{n} f(X_{i\cdot}|z_i = k, s_i, \Gamma, \theta_k, \theta_0).$$

- Dirichlet Process Model



  - Motivation:
    - The number of component K is unknown;
    - The prior distribution of θ_k is unknown;
  - Each θ_k shares a common but completely unknown $F(\cdot)$;
  - The prior of $F(\cdot)$ is $DP(F_0, \alpha)$, where α is a weighting factor that characterizes how close $F(\cdot)$ is to the shape of F_0:

$$F_0 = Gamma(a,b);$$

  - Integrating over $F(\cdot)$, we obtain

$$\theta_k|\Theta_{-k} \backsim \frac{1}{K-1+\alpha}\sum_{m=1,m\neq k}\delta(d_m) + \frac{\alpha}{K-1+\alpha}F_0;$$

  - If Θ only takes on K distinctive values, then we have a mixture of the smooth measure F_0 and the K point masses;
  - Any observations θ_k and θ_m that have the same value are defined as being in the same cluster.

- Posterior and Full Conditionals
  - Posterior:

$$\pi(Z,S,\Gamma,\Theta,\theta_0|X) \propto f(X|Z,S,\Gamma,\Theta,\theta_0)\pi(Z)\pi(S)\pi(\Gamma)\pi(\Theta)\pi(\theta_0);$$

  - Full conditionals

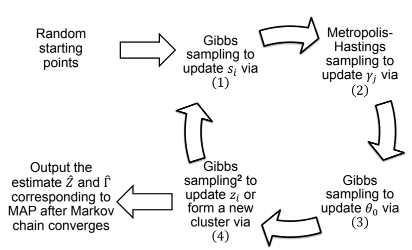
$$s_i|z_i,\Gamma,\theta_k,\theta_0,X_{i\cdot} \backsim Gamma\left(\frac{1}{\sigma^2} + h_i, \frac{1}{\sigma^2} + \theta_0(p-|\Gamma|) + \theta_k|\Gamma|\right); \quad (1)$$

$$\pi(\gamma_j|Z,S,\Theta,\theta_0,X_{\cdot j}) \propto f(X_{\cdot j}|Z,S,\gamma_j,\Theta,\theta_0)\pi(\gamma_j); \quad (2)$$

$$\theta_0|z_i,\Gamma,\theta_k,\theta_0,X_{i\cdot} \backsim Gamma(a + \textstyle\sum_{i:z_i=k} h_{i1}, b + |\Gamma||S_k|); \quad (3)$$

$$\pi(z_i = k|Z_{-i},s_i,\Gamma,\Theta,\theta_0,X_{i\cdot}) \propto f(X_{i\cdot}|z_i = k, s_i,\Gamma,\theta_k,\theta_0)\pi(\theta_k|\Theta_{-k}); \quad (4)$$

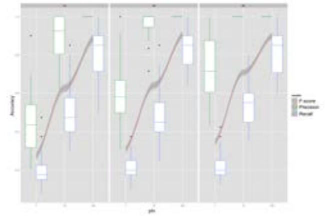
MCMC Algorithms



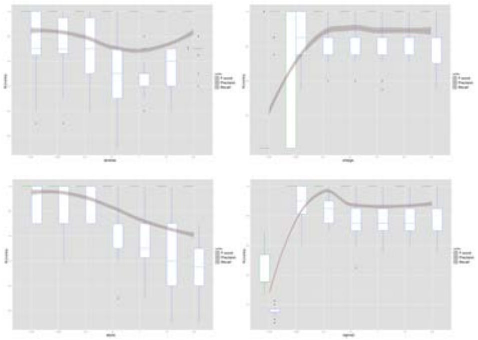
RESULTS AND DISCUSSION

Evaluation with Synthetic Data

- Synthetic Data Generating
  - 20 observations and 1000 variables, of which $|\gamma|$are discriminant: $x_{ij}|\gamma_j = 1 \sim I_{\{1\leq I\leq 5\}}Poisson(s_i\theta_1) + I_{\{6\leq I\leq 10\}}Poisson(s_i\theta_2) + I_{\{11\leq I\leq 15\}}Poisson(s_i\theta_3) + I_{\{16\leq I\leq 20\}}Poisson(s_i\theta_4)$;
  - $\theta_0 = 10$ and to model overdispersion, we set $\theta_k \sim Gamma(\psi, \psi/d_k)$, $d_1 = 80$, $d_2 = 40$, $d_3 = 60$, and $d_4 = 100$.
- Statistical Performance
  - $Precision = \frac{\#\ of\ true\ pairwise\ relationship\ that\ are\ correctly\ estimated}{\#\ of\ all\ pairwise\ in\ estimated\ \hat{Z}}$;
  - $Recall = \frac{\#\ of\ true\ pairwise\ relationship\ that\ are\ correctly\ estimated}{\#\ of\ all\ pairwise\ in\ true\ Z}$;
  - $F\ score = \frac{2\times Precisioin\times Recall}{Precision+Recall}$;
  - Program settings: $a = 0.01$, $b = a/\bar{X}$, $c = 1/\sigma^2$, $\alpha = 1$, $\omega = 0.01$.

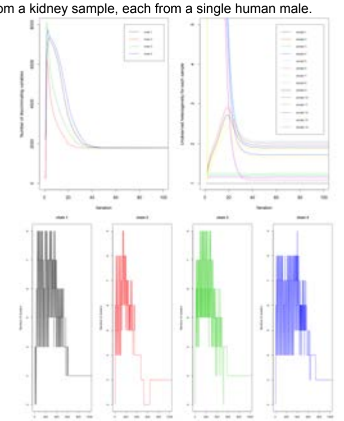


- Sensitivity Analysis
  - We set $|\gamma| = 40$ and $\psi = 10$;
  - Program settings: $a = 0.01$, $b = a/\bar{X}$, $c = 1/\sigma^2$, $\alpha = 1$, $\omega = 0.01$.

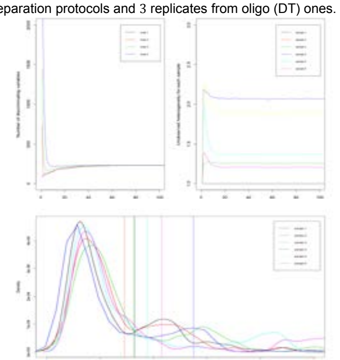


Experiment on Real Data

- Liver and Kidney RNA-Seq Data Set[3]
  - 22,925 genes, 7 replicates from a liver sample and 7 replicates from a kidney sample, each from a single human male.



- Yeast (*Saccharomyces cerevisiae*) RNA-Seq Data Set[4]
  - 6,874 genes, 3 replicates from random hexamer (RH) library preparation protocols and 3 replicates from oligo (DT) ones.



CONCLUSION

- Proposed a fully Bayesian method for simultaneously clustering high-dimensional data and selecting the variables that best discriminate the different groups on Poisson model;
- Formulated the clustering problem in terms of Poisson mixture model via Dirichlet process with unknown K;
- Evaluated the MCMC algorithms on both simulated and real data and provided recommendations for priors;
- To extent Poisson model to negative binomial model and to model variance shrinkage more elaborate.

Reference

[1] J. Li, D. M. W

[2] R. M. Neal,

[3] J. Marioni, C

[4] U. Nagalaks

An Example of Infographics

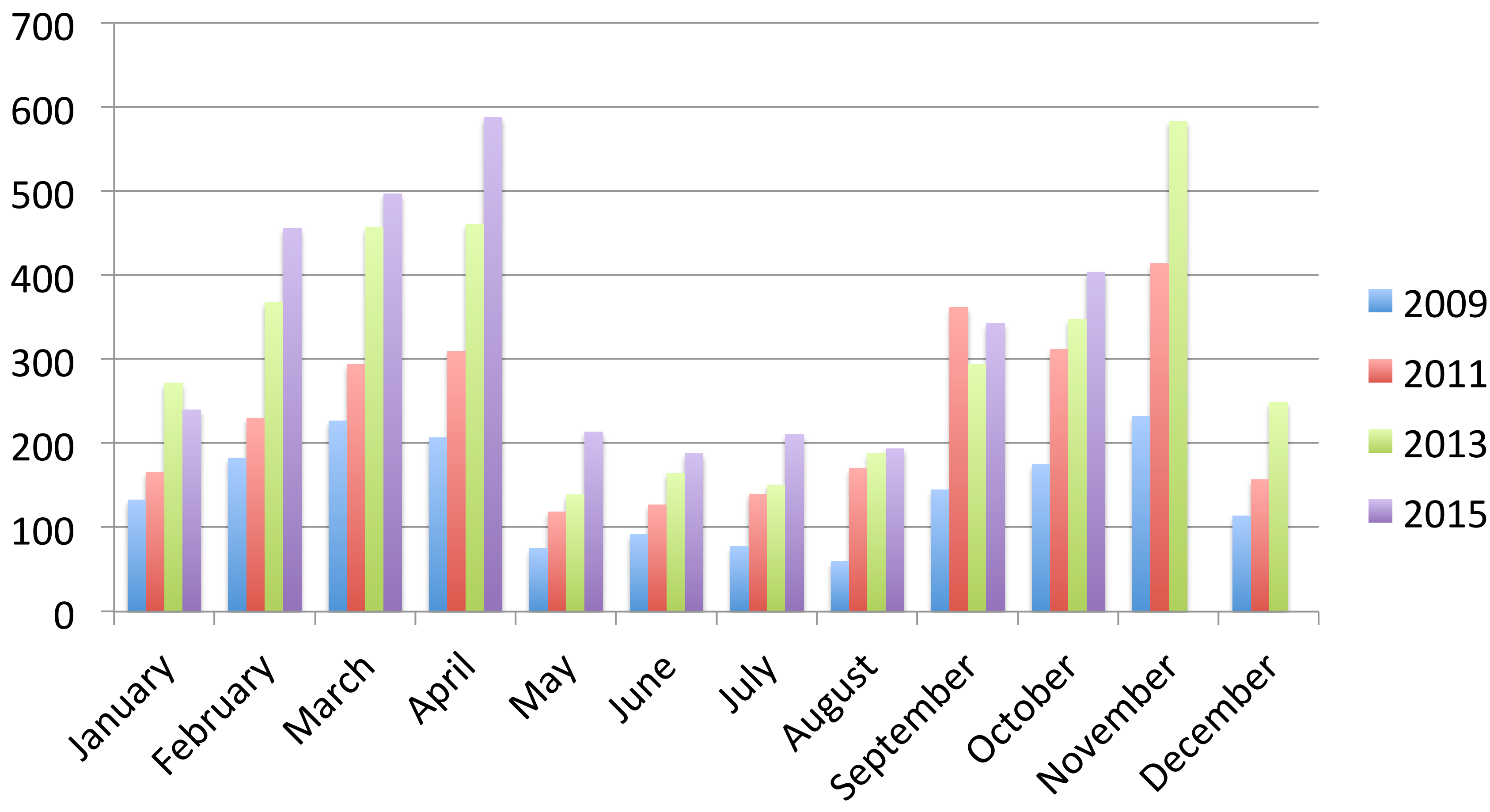
Definition of Infographics

- Infographic is an abbreviation of "information graphic".
- It combines data visualizations, illustrations, text and images together into a format that tells a complete story (Krum, 2014, p. 6).
- It uses visual cues to communicate information.

Check out some examples...

What is Data Visualization?

DMC Equipment Circulation Statistics

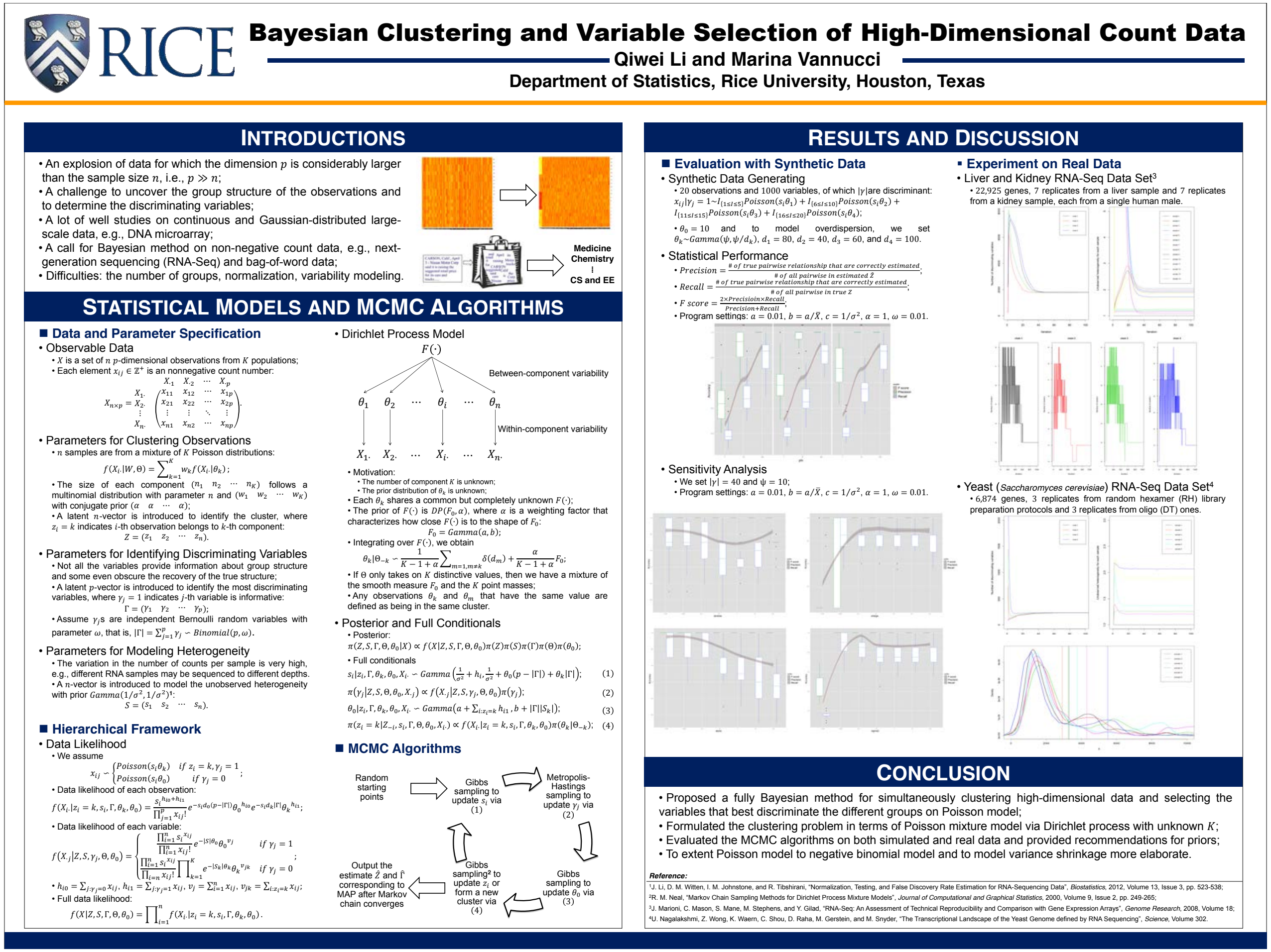


An Example of Data Visualization

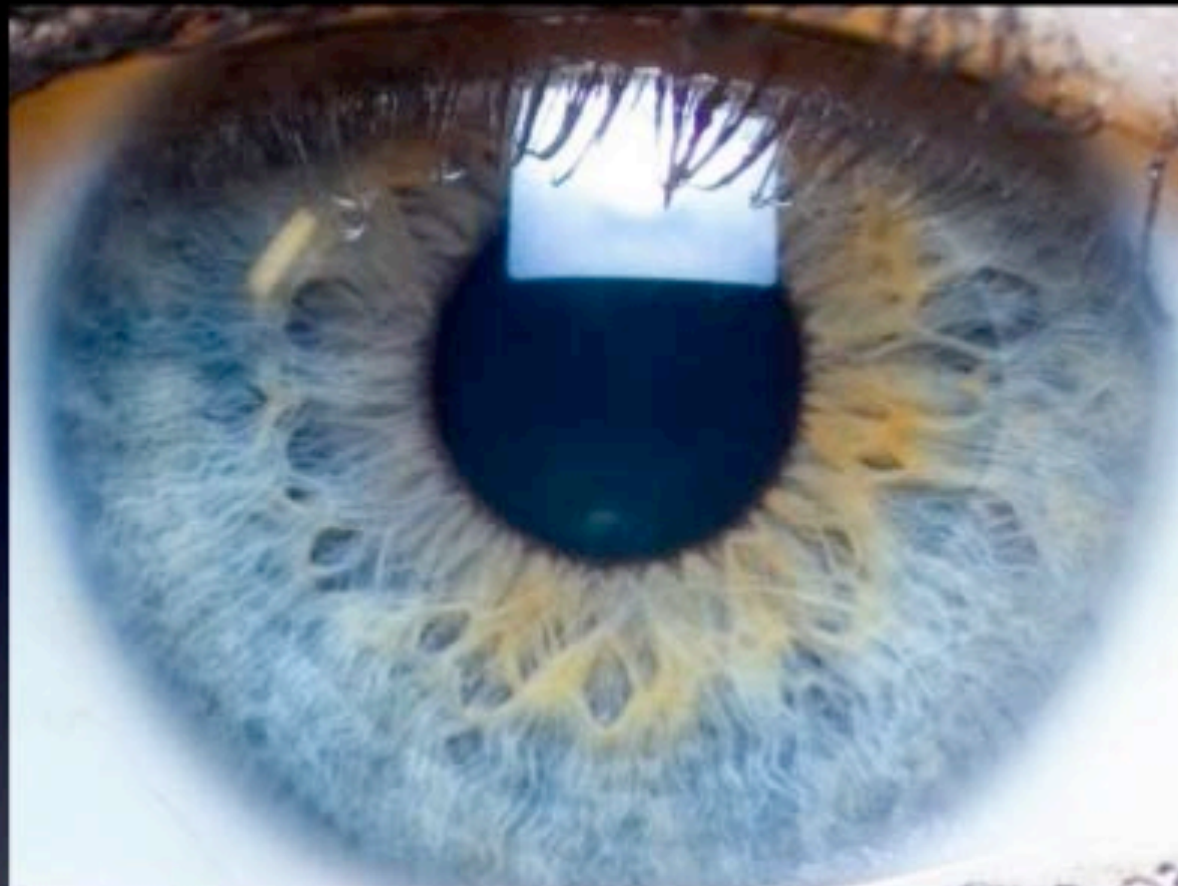
Definition of Data Visualization

- Data visualization is a visual representation of data or the practice of visualizing data.
- Common forms include pie charts, bar graphs, line charts, and so forth.
- It is a powerful tool that designers often use to help tell their story visually in an infographic (Krum, 2014, p. 6).

Data Visualization is a Separate Design Element Used in the Design of Infographics.



WHY INFOGRAPHICS WORK?



80% of the brain is dedicated to visual processing

University of Rochester, 2004

SFIMA (South Florida Interactive Marketing Association) Cool Infograp... (09:52:21 UTC). Retrieved from http://www.slideshare.net/rtkrum/sfima-south-florida-interactive-marketing-association-cool-infographics feb-2014

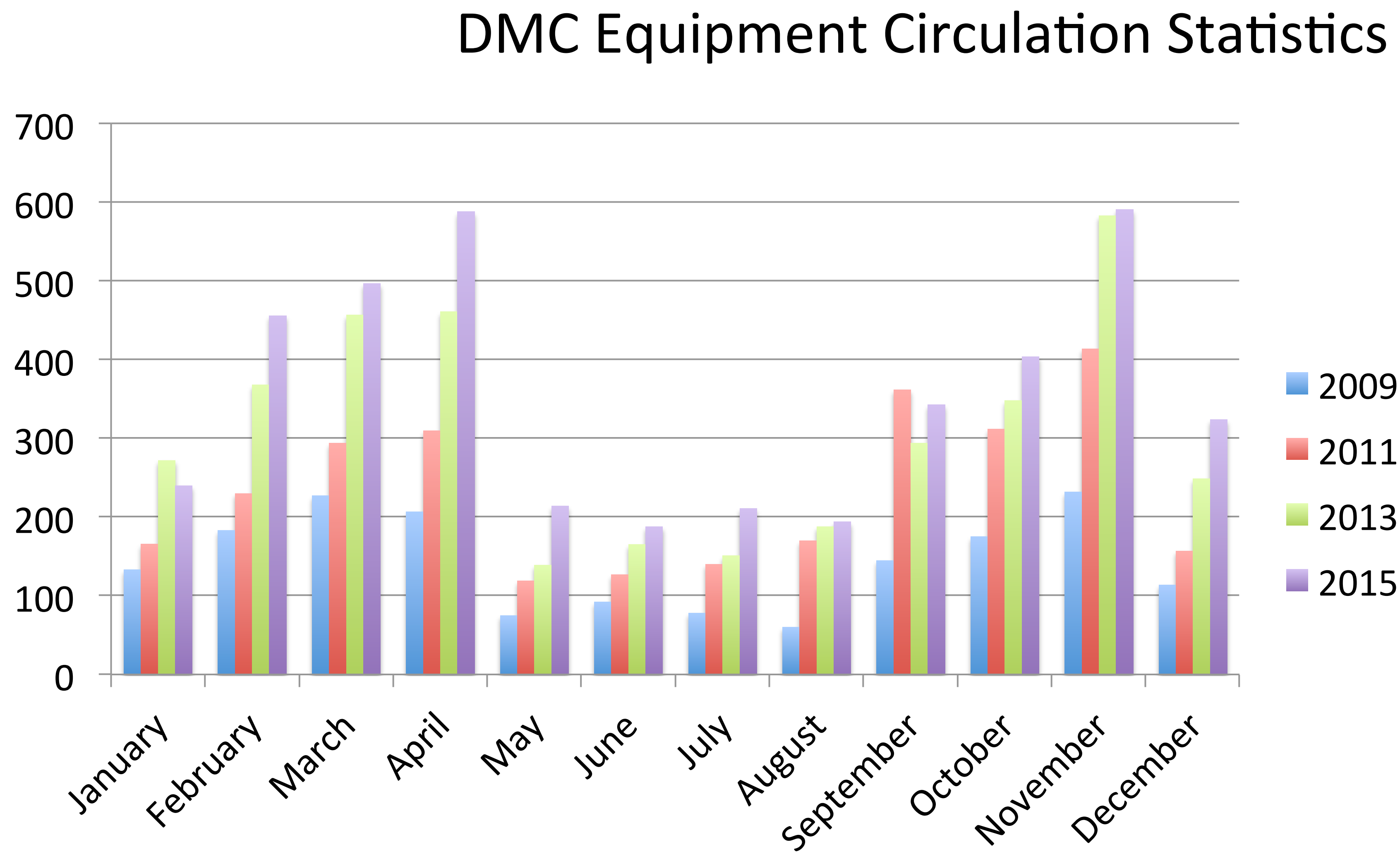
SFIMA (South Florida Interactive Marketing Association) Cool Infograp.... (09:52:21 UTC). Retrieved from http://www.slideshare.net/rtkrum/sfima-south-florida-interactive-marketing-association-cool-infographics-feb-2014

A Table of Data, Hard to See its Pattern and Trend.

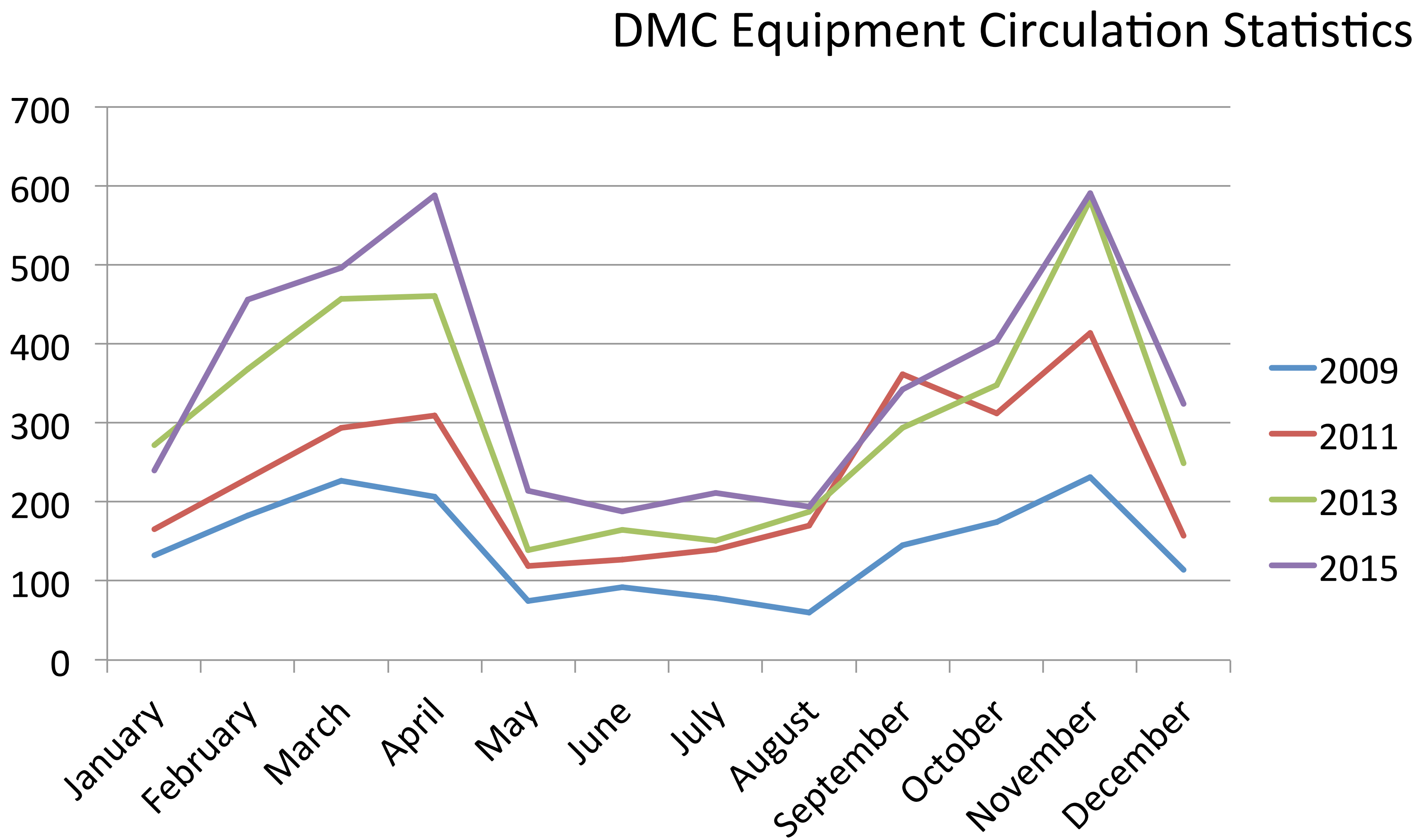
DMC Equipment Circulation Statistics

Month	2009	2011	2013	2015
January	133	166	272	240
February	183	230	368	456
March	227	294	457	497
April	207	310	461	588
May	75	119	139	214
June	92	127	165	188
July	78	140	151	211
August	60	170	188	194
September	145	362	294	343
October	175	312	348	404
November	232	414	583	591
December	114	157	249	324

Convert the Data to a Bar Chart, Easy to See the Pattern.



Convert the Data to a Line Chart, Easy to See the Trend.



Picture Superiority Effect

Memory retention after 3 days

10%

Text or Audio Only

65%

Text + Picture

European Journal of Cognitive Psychology 18(6), 2006

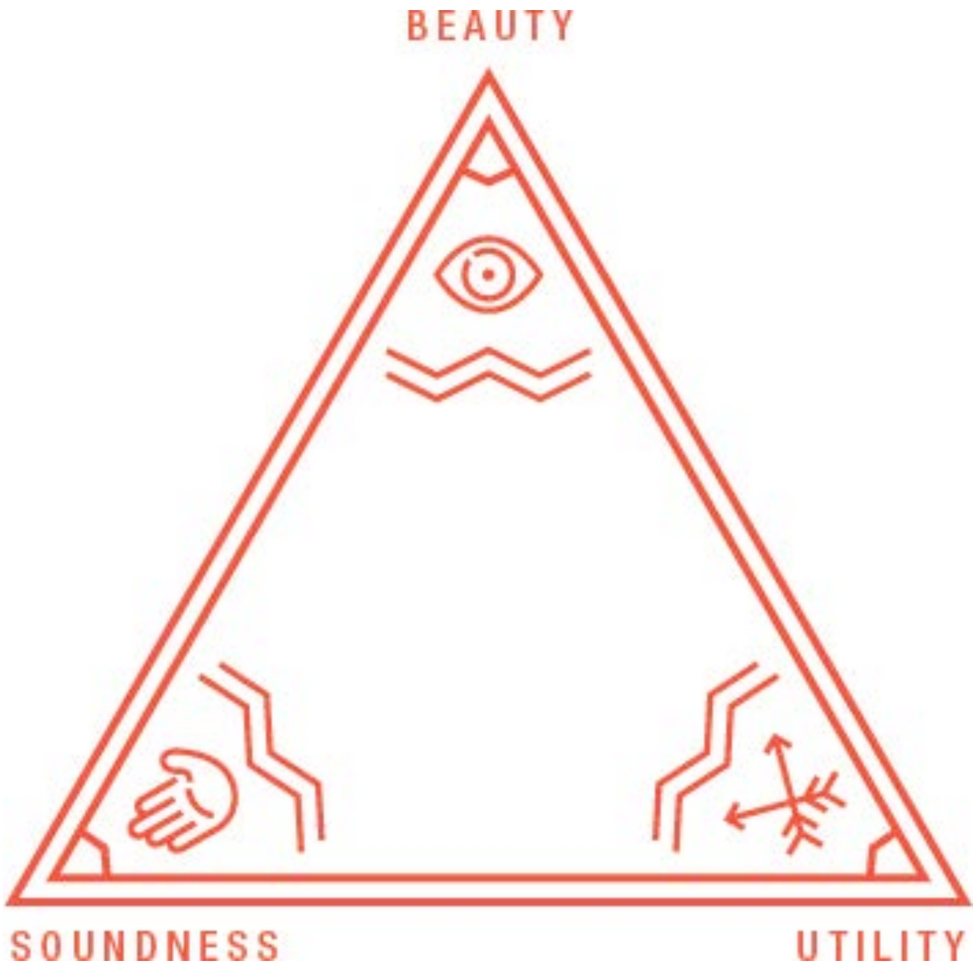
SFIMA (South Florida Interactive Marketing Association) Cool Infograp... (09:52:21 UTC). Retrieved from http://www.slideshare.net/rtkrum/sfima-south-florida-interactive-marketing-association-cool-infographics feb-2014

“Of all methods for analyzing and communicating statistical information, well-designed data graphics are usually the simplest and at the same time the most powerful.”

Eward Tufte, Yale Professor

WHAT MAKES A GOOD INFOGRAPHIC?

A good infographic has all three:



Lankow, J., Ritchie, J., & Crooks, R. (2012). *Infographics [electronic resource]: the power of visual storytelling*. ©2012. P198

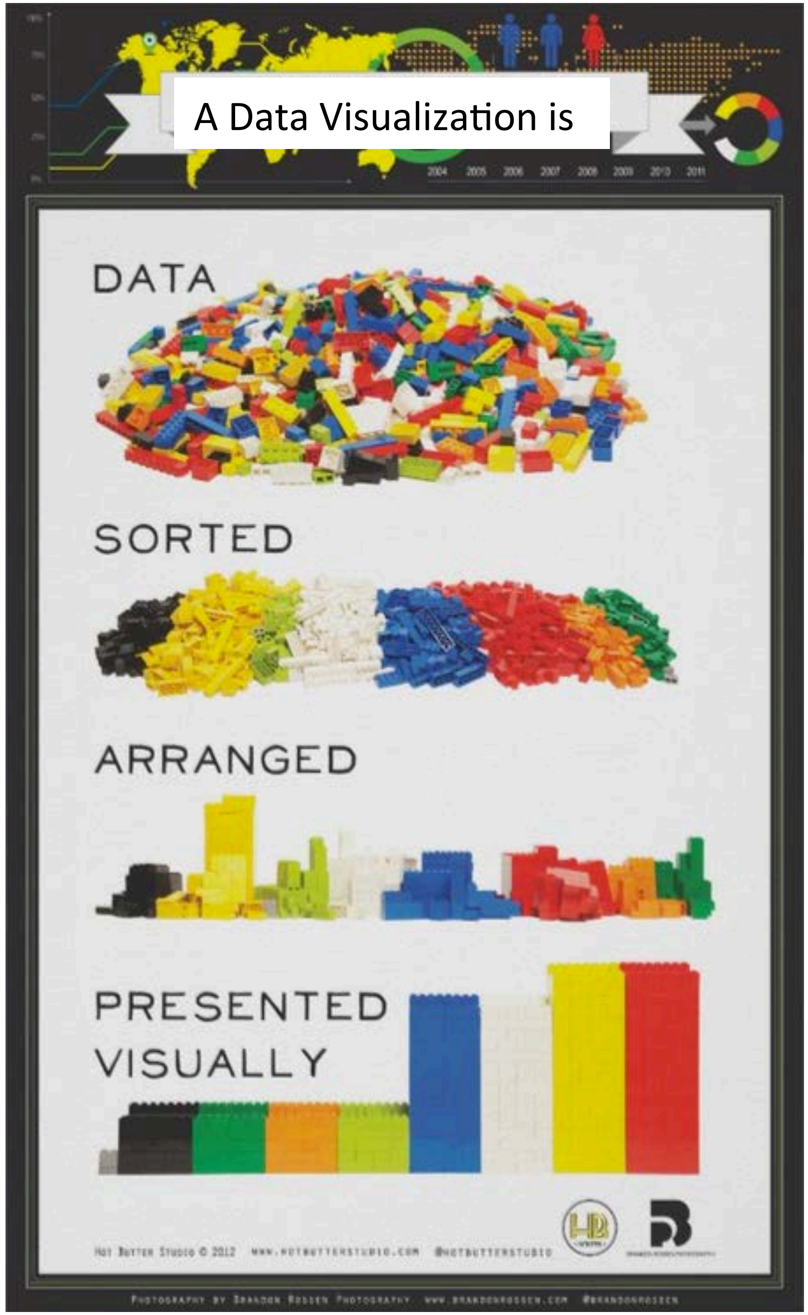
INFORMATION DESIGN
BEST PRACTICES

http://www.slideshare.net/bethanyvsmith/pecha-kucha-presentation-zen?qid=c59c4f27-0731-4a00-98b5-396ec71bd13a&v=&b=&from_search=1

“Simplicity means the achievement of maximum effect with minimum means.”

- Dr. Koichi Kawana – artist, designer, and architect

A Data Visualization is

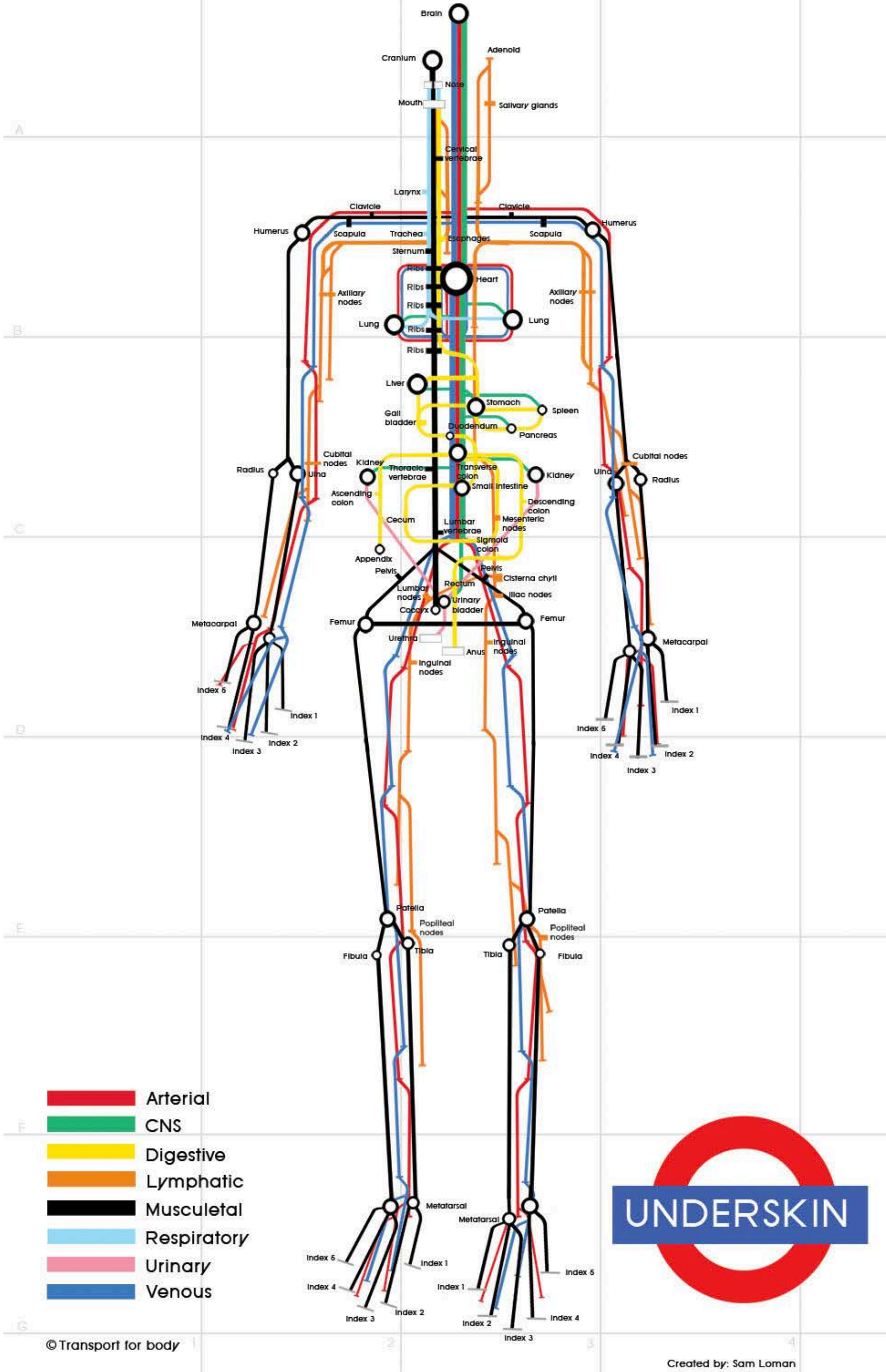


Designed by HotButterStudio, http://www.zazzle.com/poster-228276710365015813

Use a simple text message combined with a relevant image.

http://www.slideshare.net/rtkrum/sfima-south-florida-interactive-marketing-association-cool-infographics-feb-2014?qid=c7d62517-2289-4642-9d64-285cf2579059&v=&b=&from_search=1

Make it unique!



http://www.coolinfographics.com/blog/2010/3/11/underskin-the-human-subway-map.html

A good infographic leaves you feeling informed or delighted.

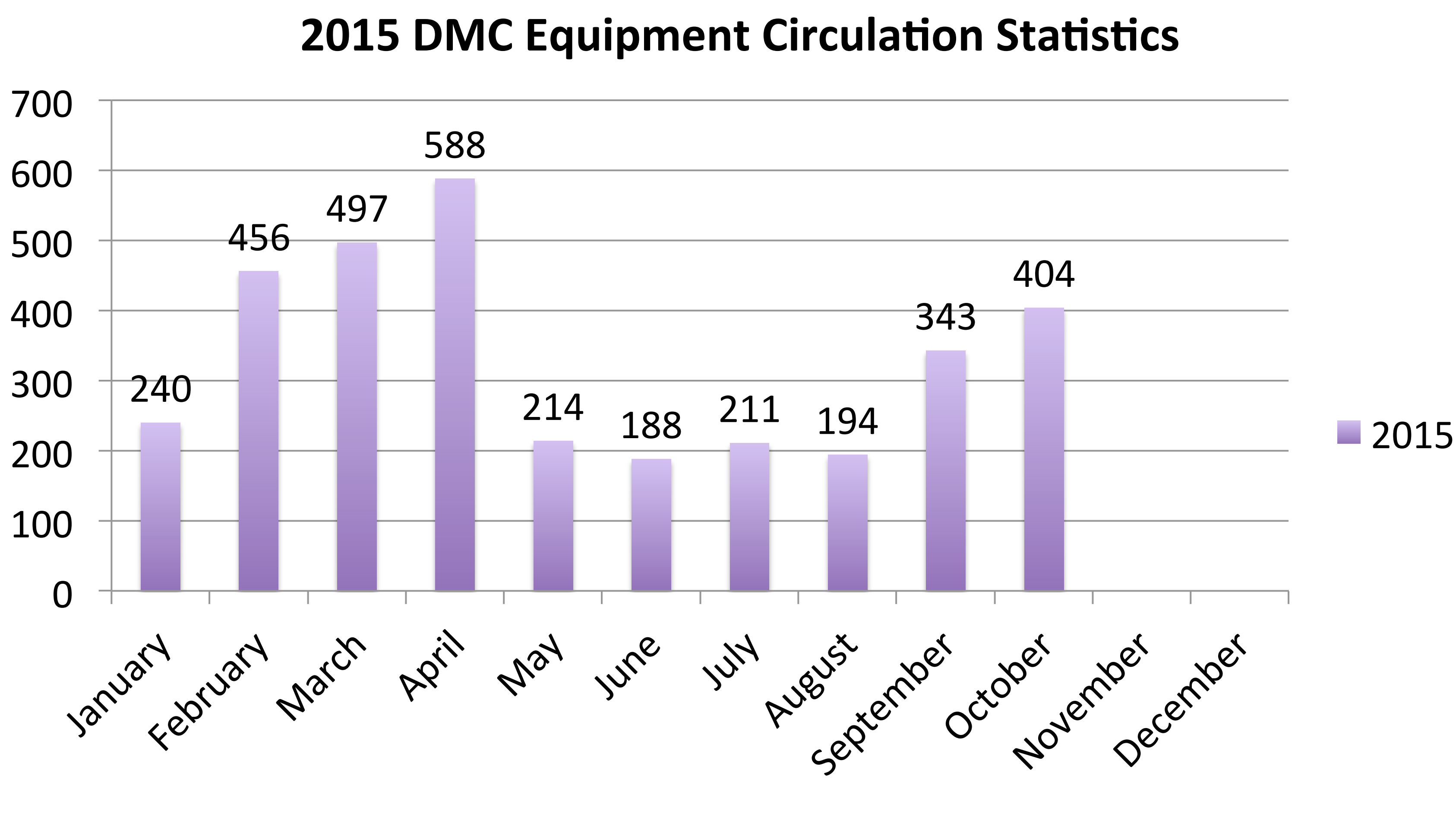
- Krum, Randy, Cool Infographics, P52

DATA VISUALIZATION BEST PRACTICES

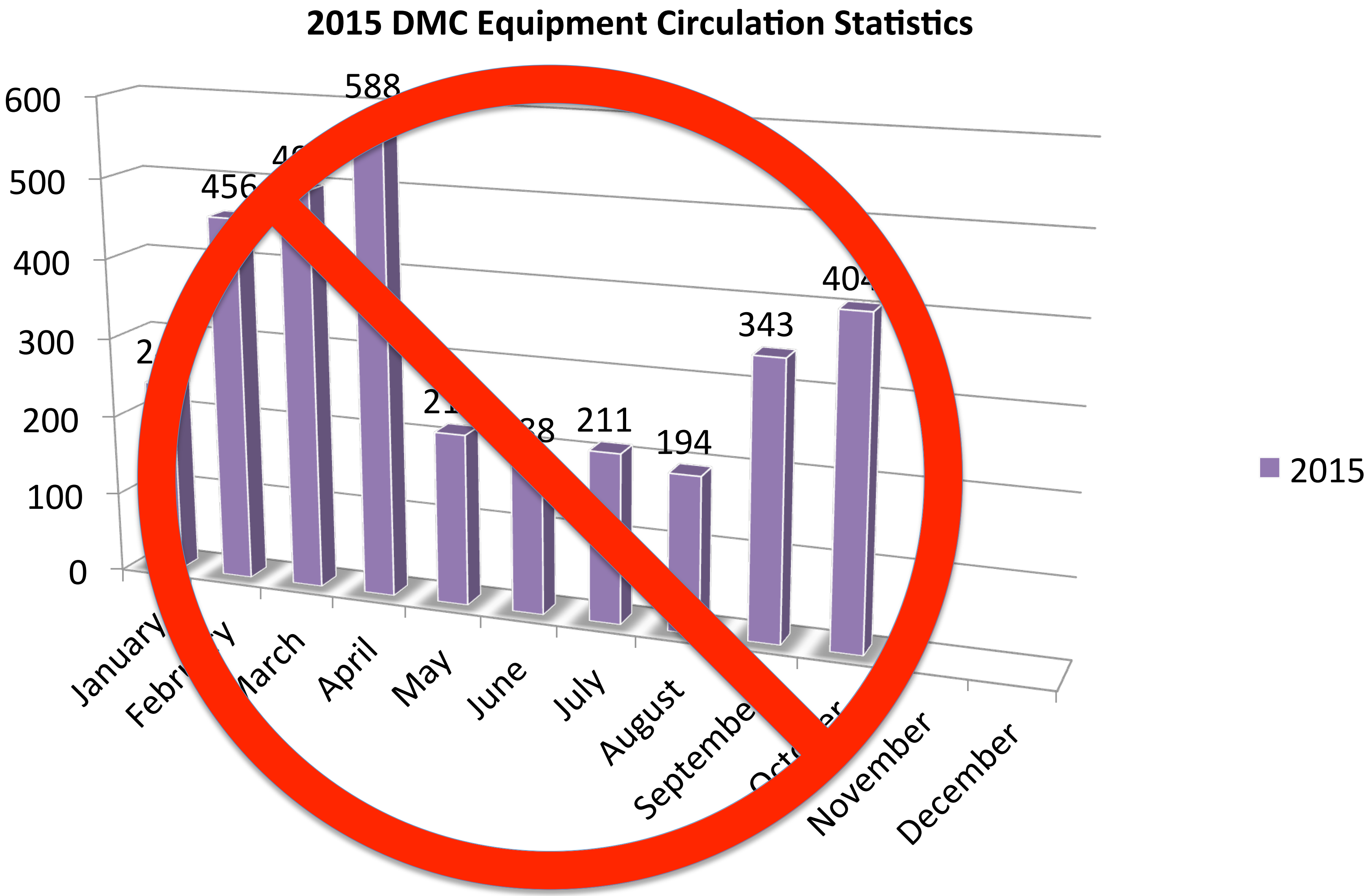
Choose the appropriate graph based on the relationship type!

- Graphs are a representation of the relationships in quantitative information.
- The graph type chosen is based on the type of relationship.
- Different types of graphs can display some types of relationships better than others.
- When there are a number of acceptable options, choose the graph that you think is the best (most effective) way to convey your message to your audience (Lankow et al., 2012, p. 213).

Bar Chart for Ranking or Time Series



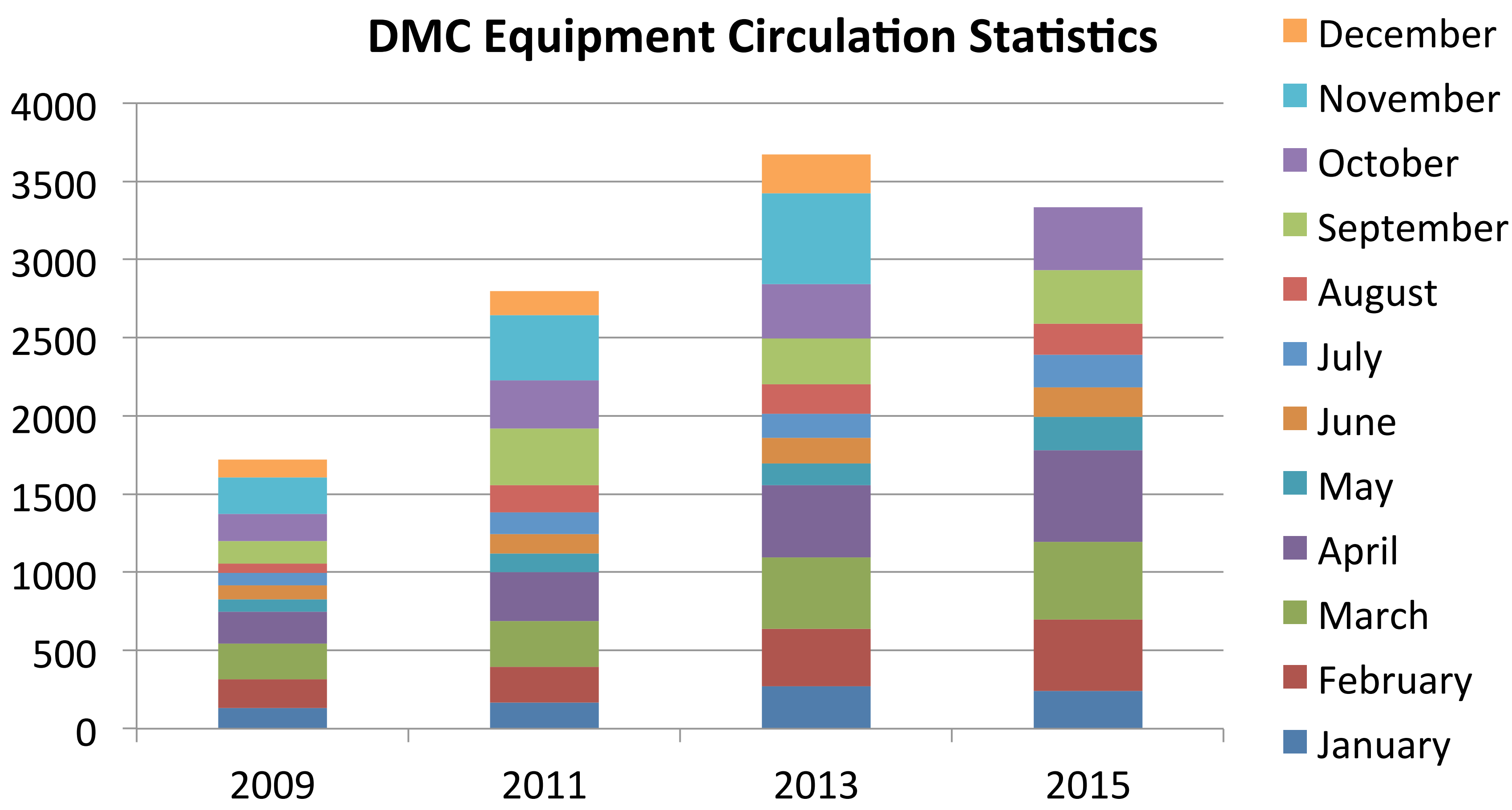
Avoid 3-D Bar Chart



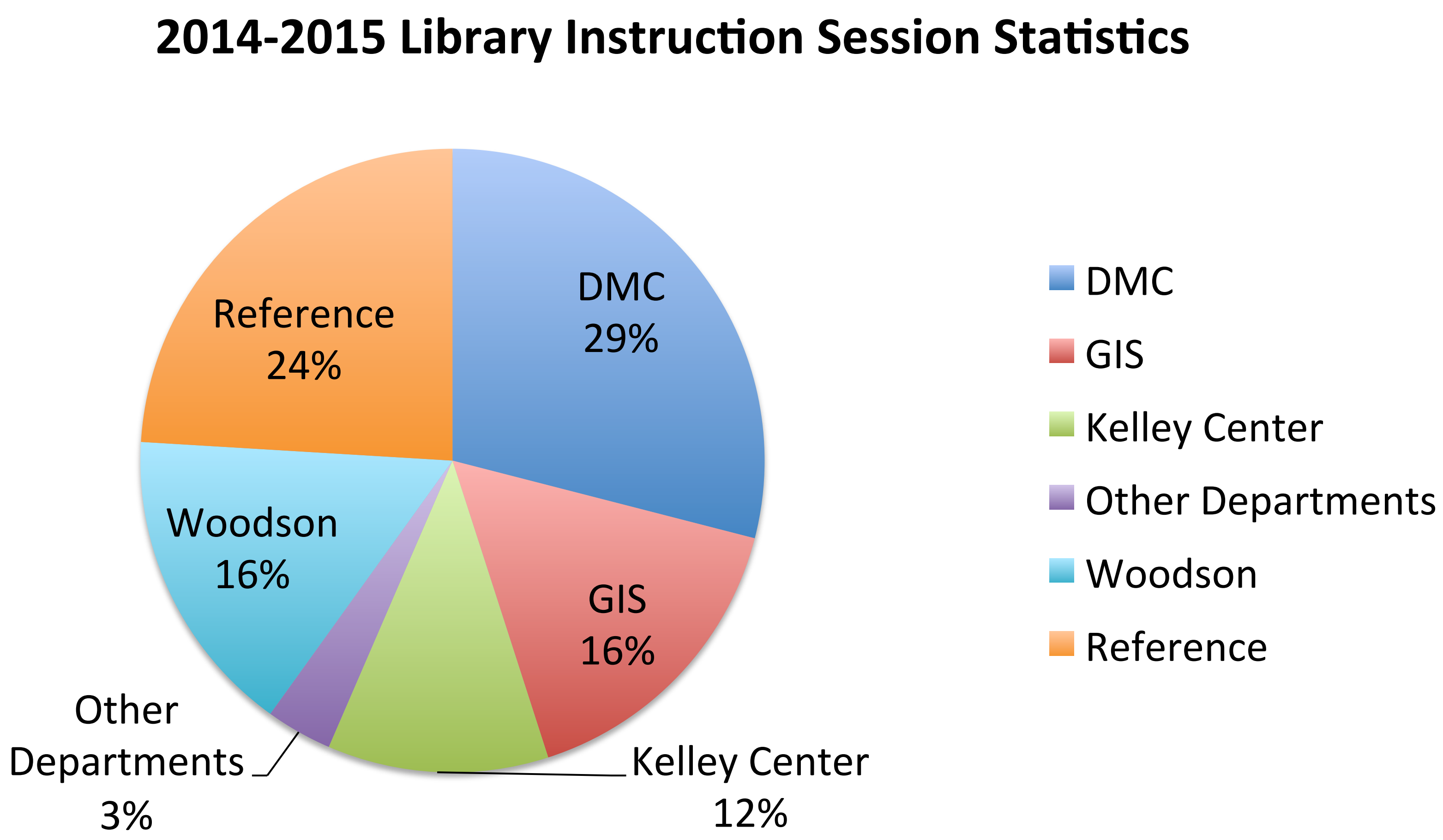
Avoid 3-D Bar Chart

Edward Tufte, Show Me the Numbers, P4

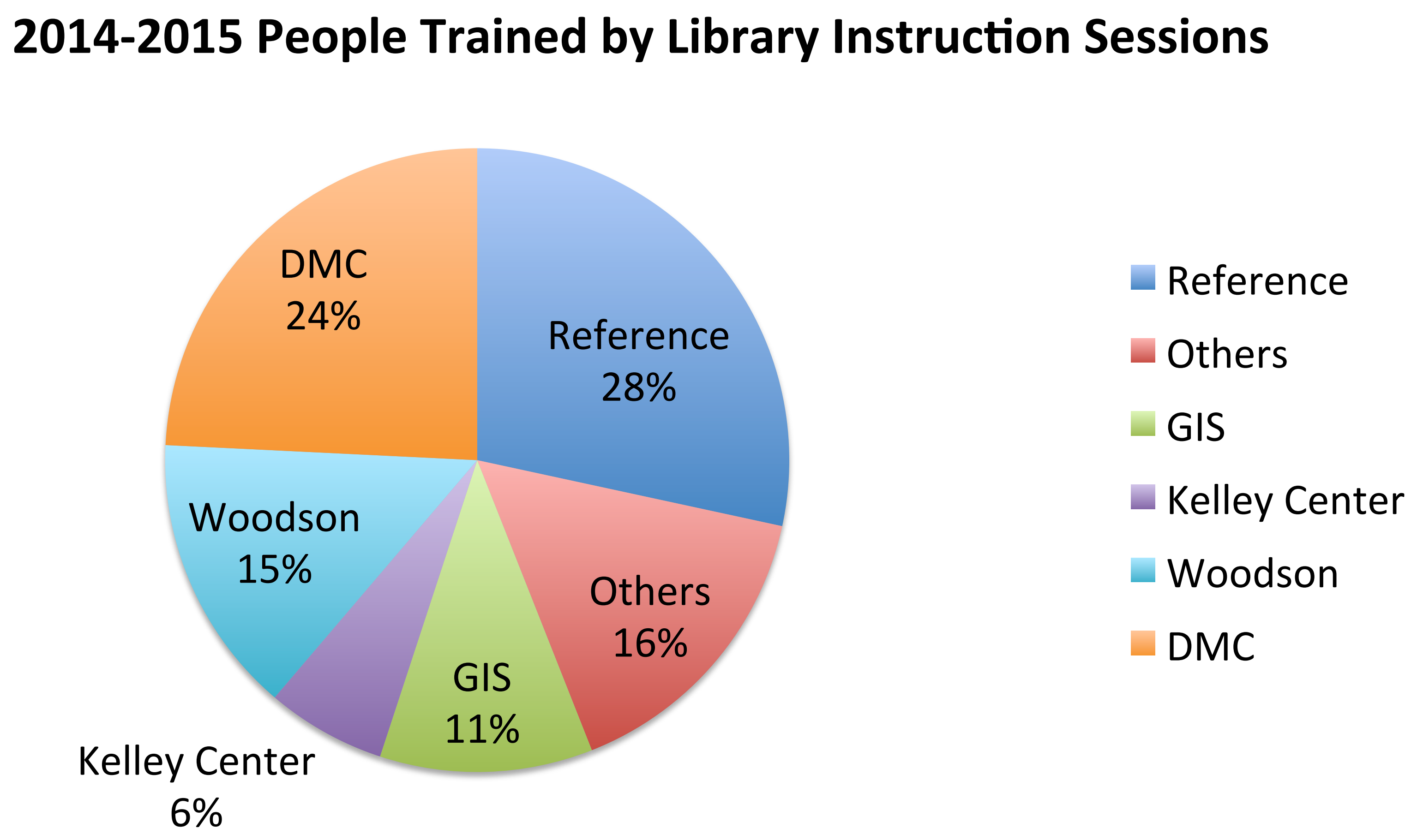
Stacked Bar Chart for Multiple Part-to-Whole Relationships



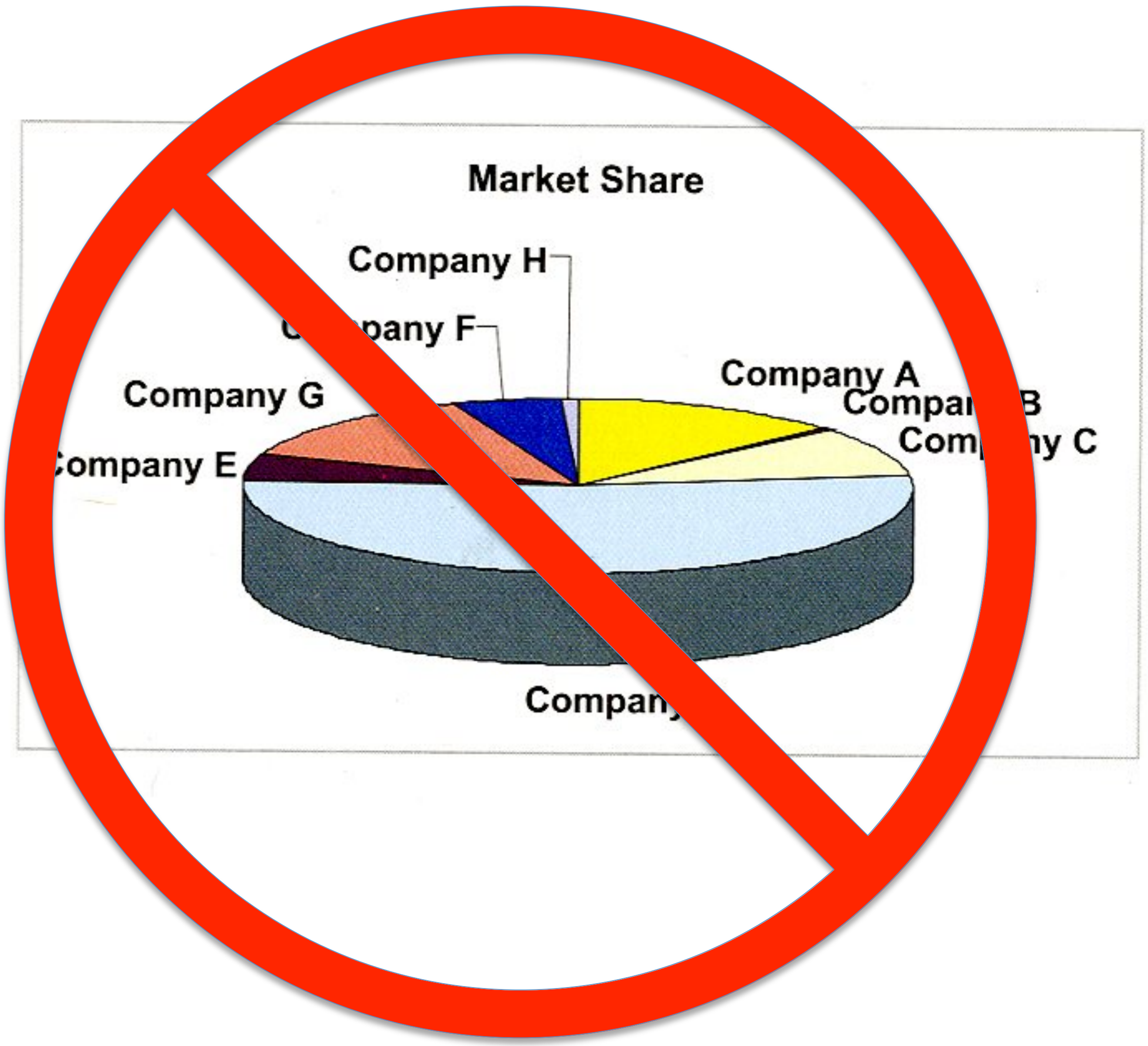
Pie Chart for Part-to-Whole Comparisons



Pie Chart for Part-to-Whole Comparisons

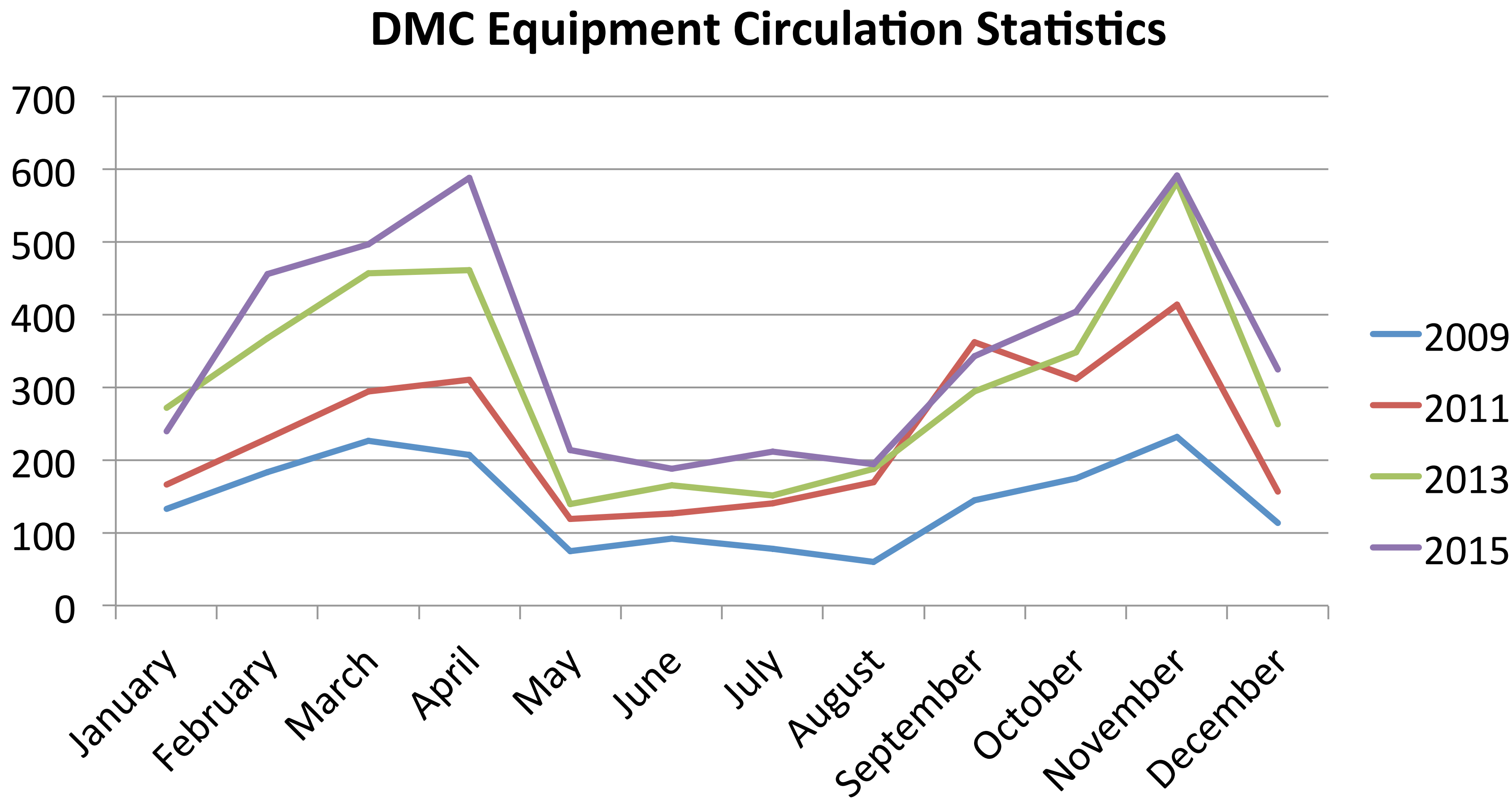


Avoid 3-D Pie Chart

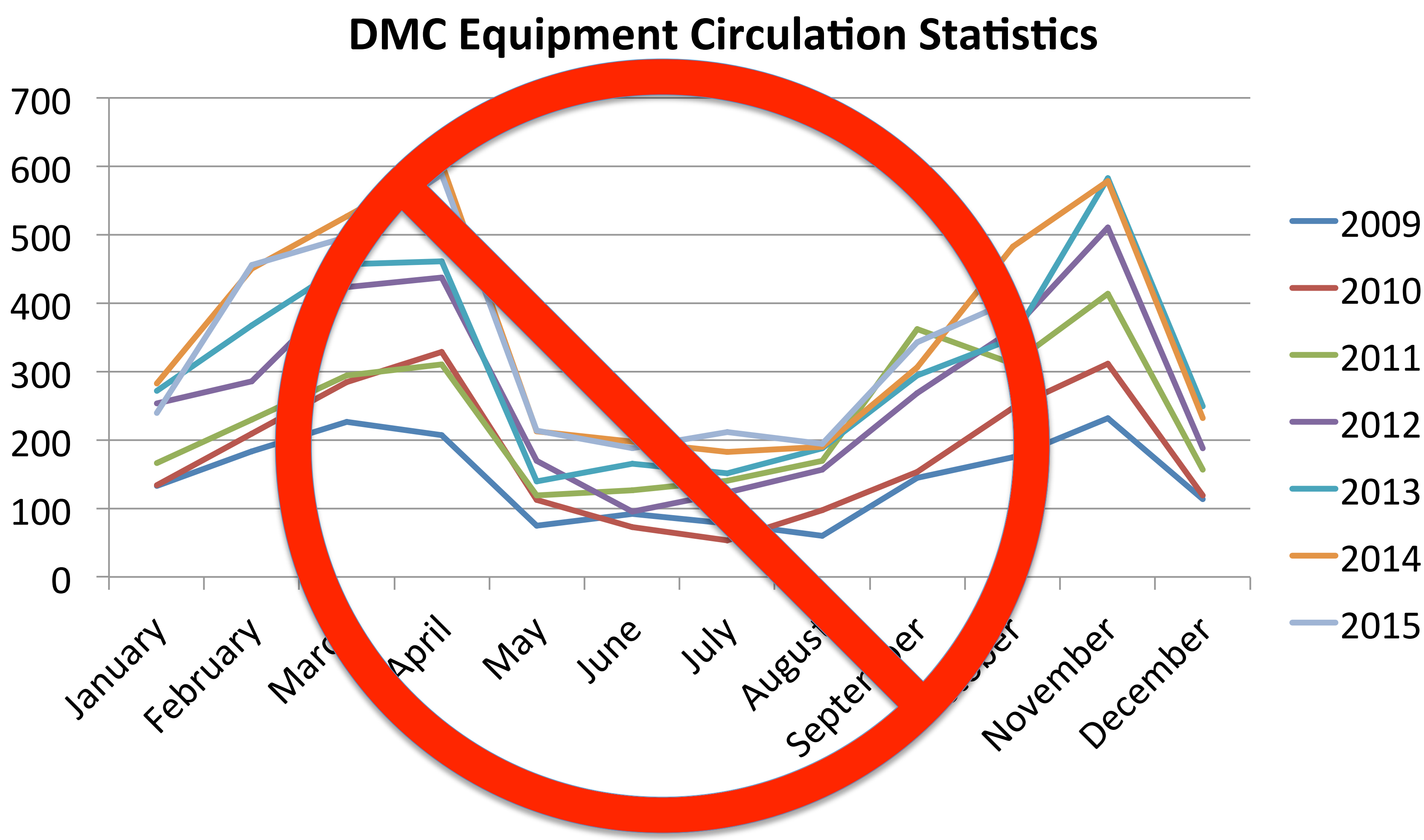


Show Me the Numbers, P8

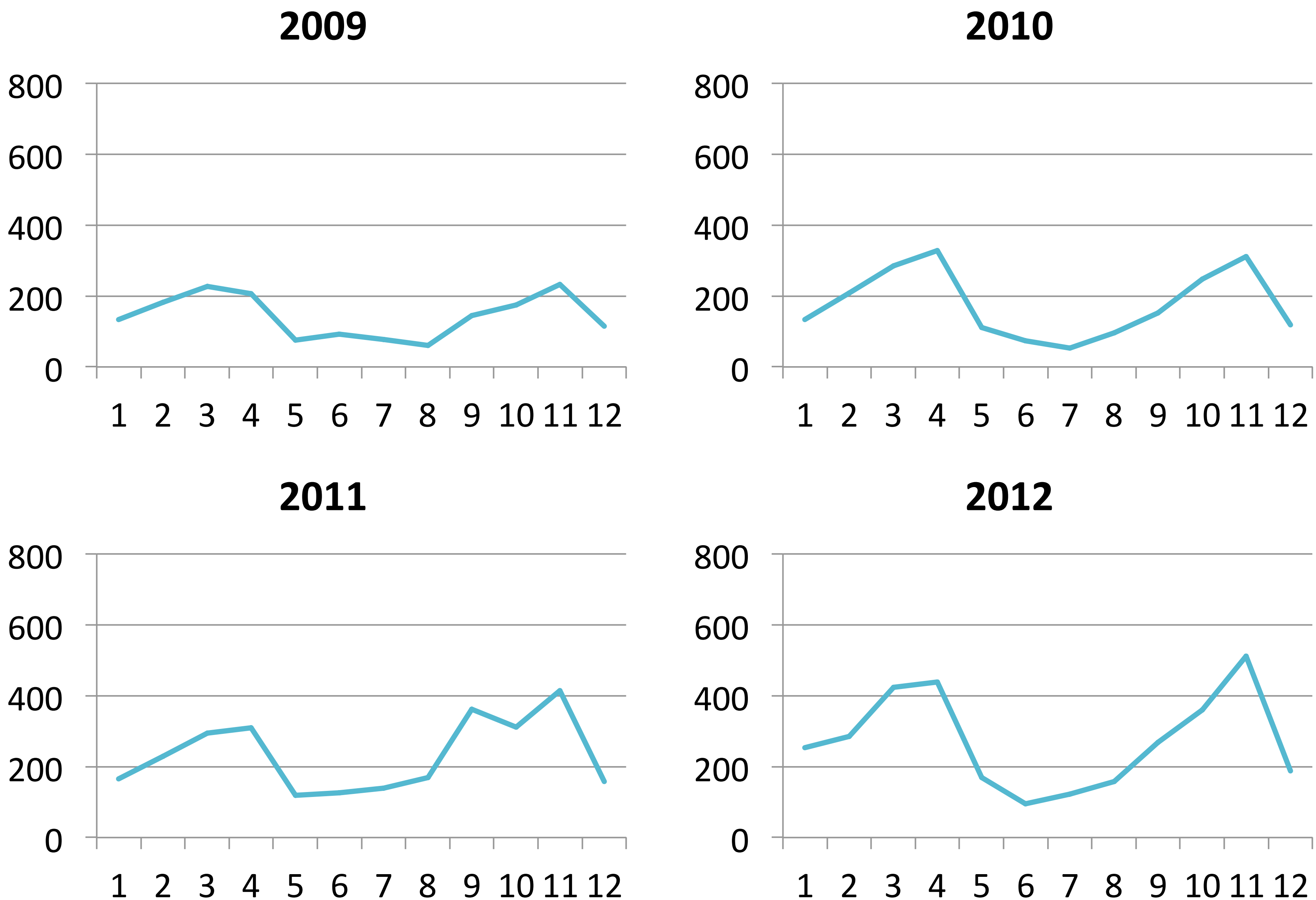
Line Chart for Time Series

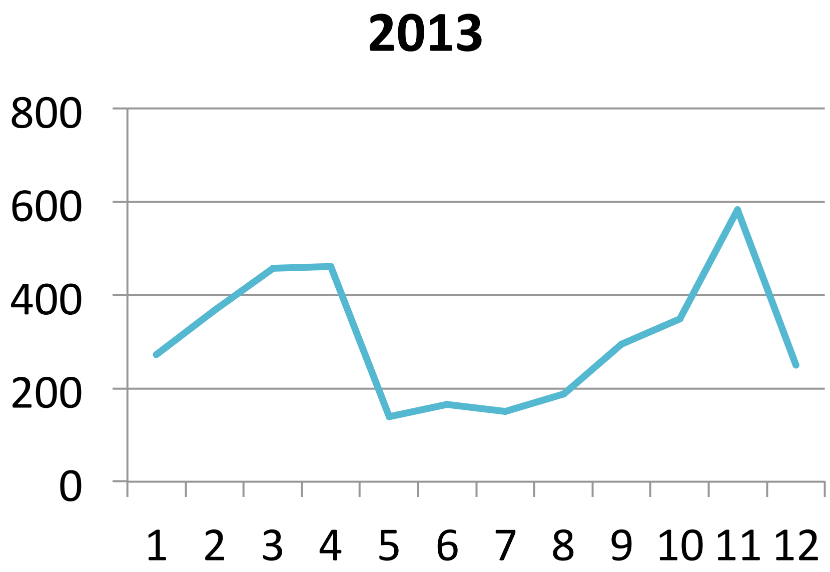


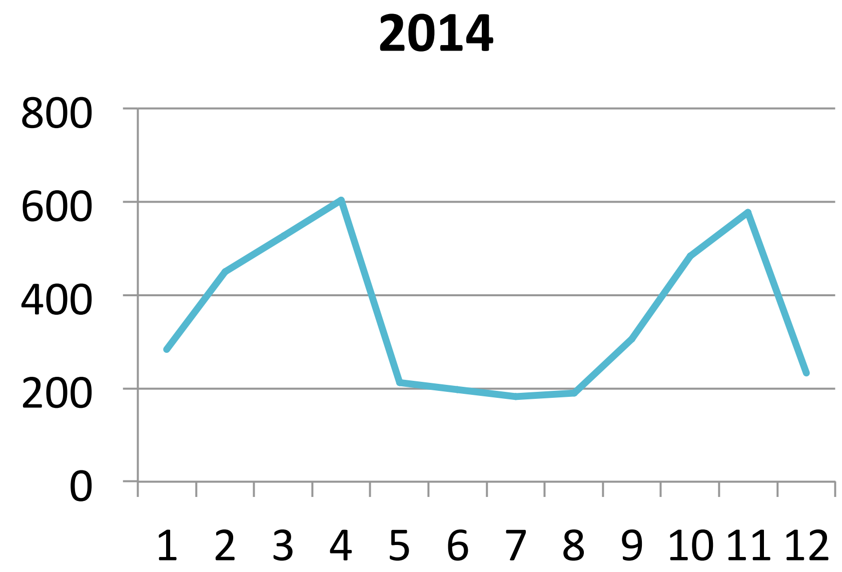
Keep the Line Chart to Four or Fewer. Otherwise the Chart is Too Busy!

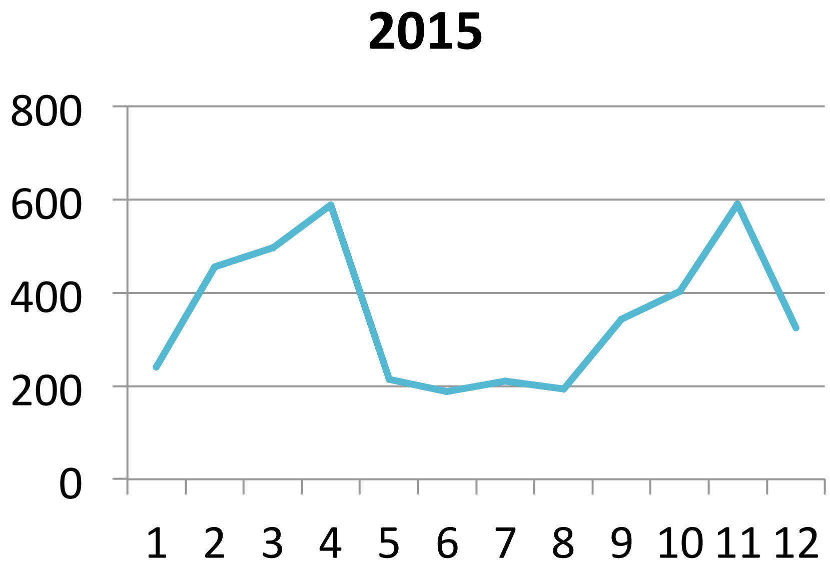


Use the Practice of Paneling and a Constant Scale for Consistency if You have More Than Four Lines.

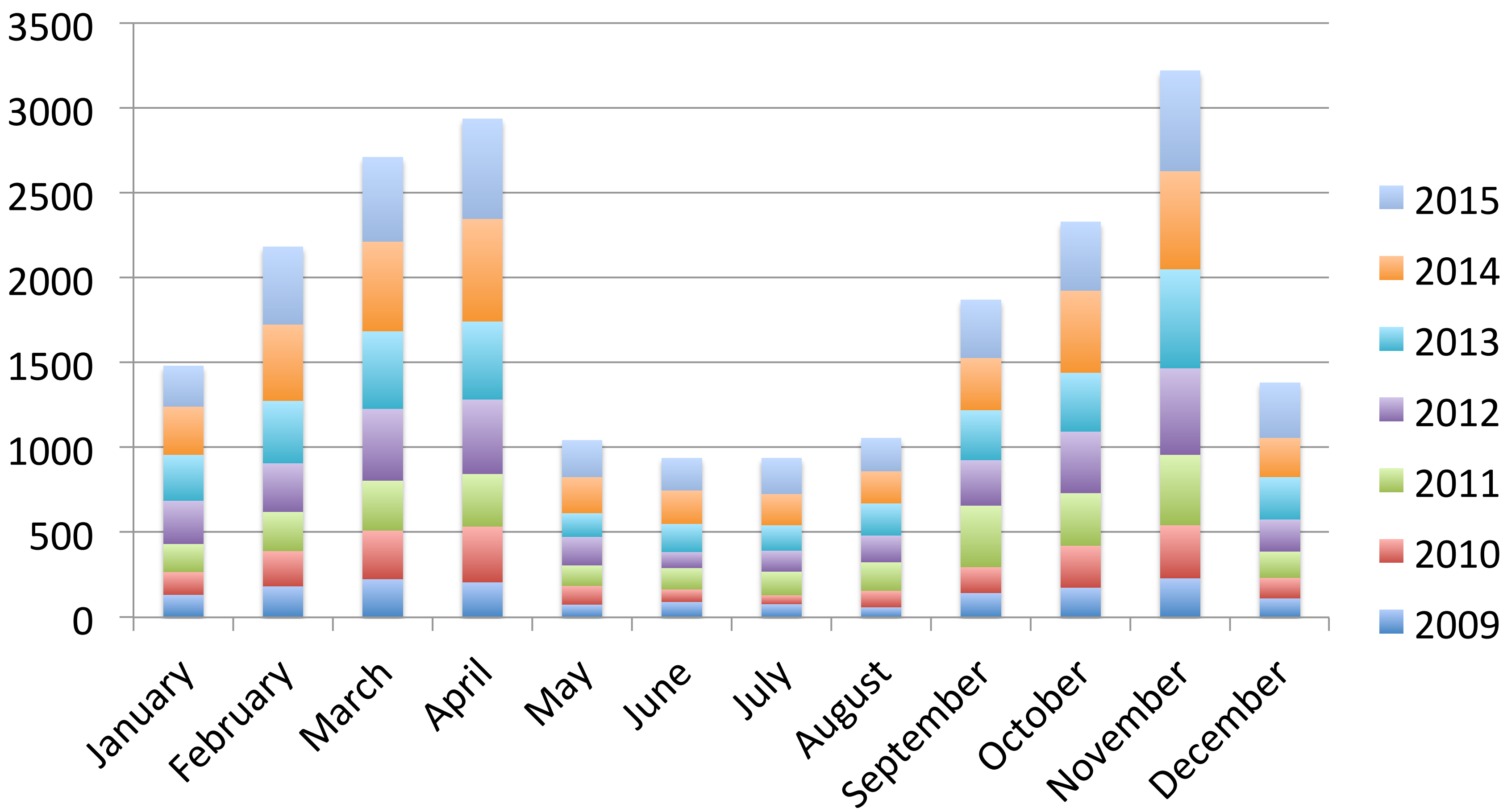



2013
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10 11 12

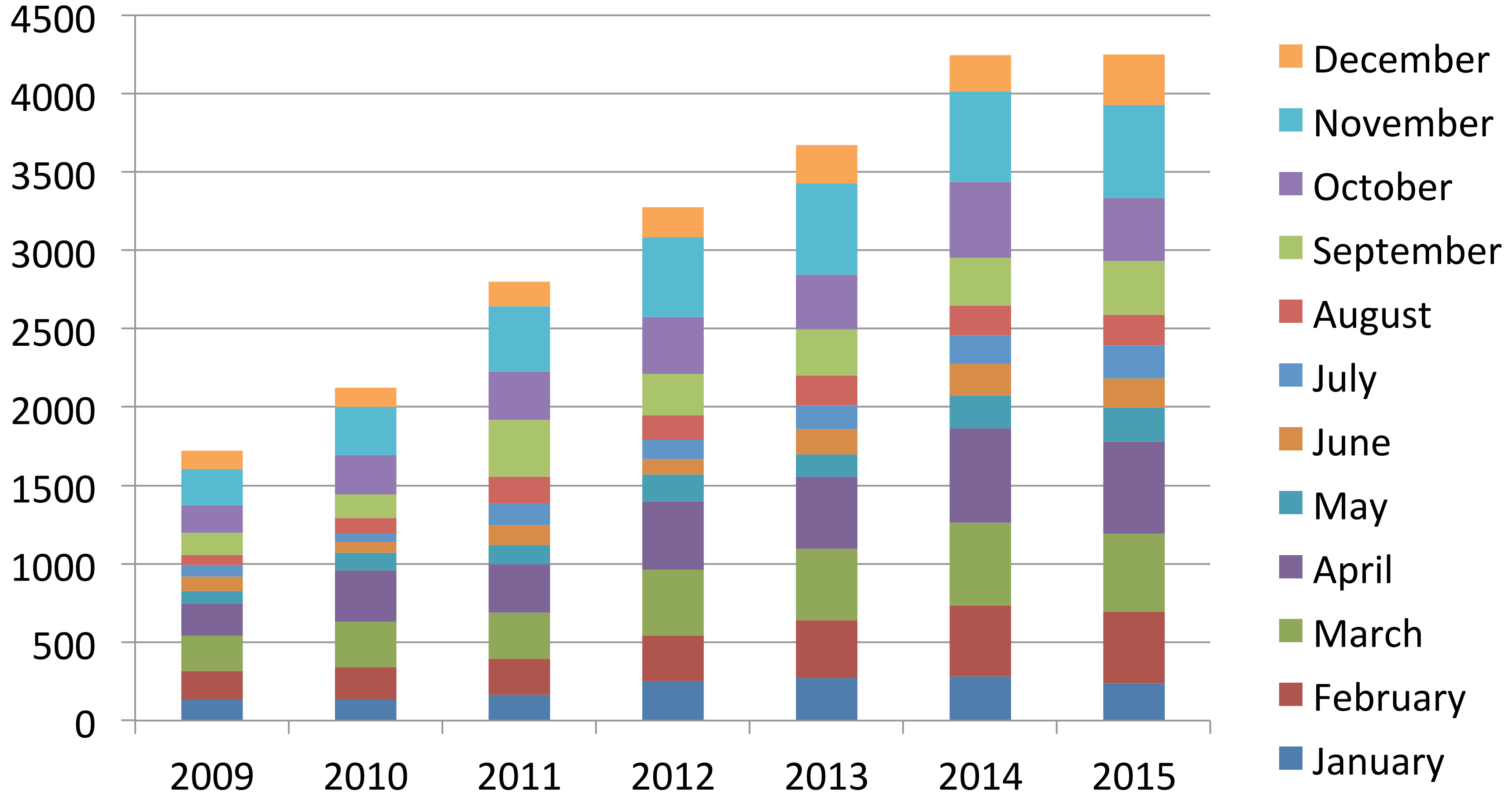

2014
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10 11 12


2015
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10 11 12

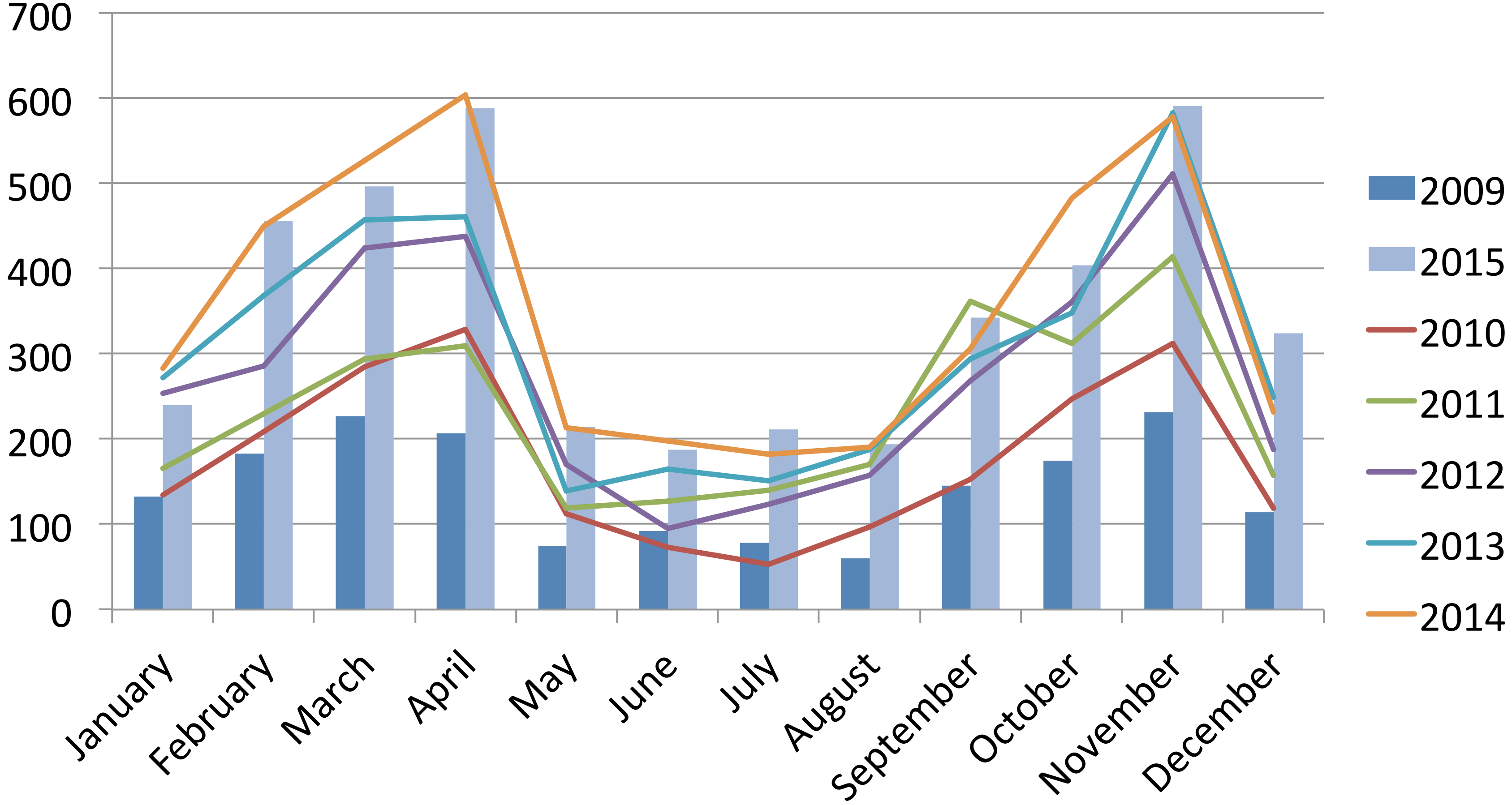
Stacked Bar Chart for Multiple Part-to-whole Relationships



Stacked Bar Chart for Multiple Part-to-whole Relationships



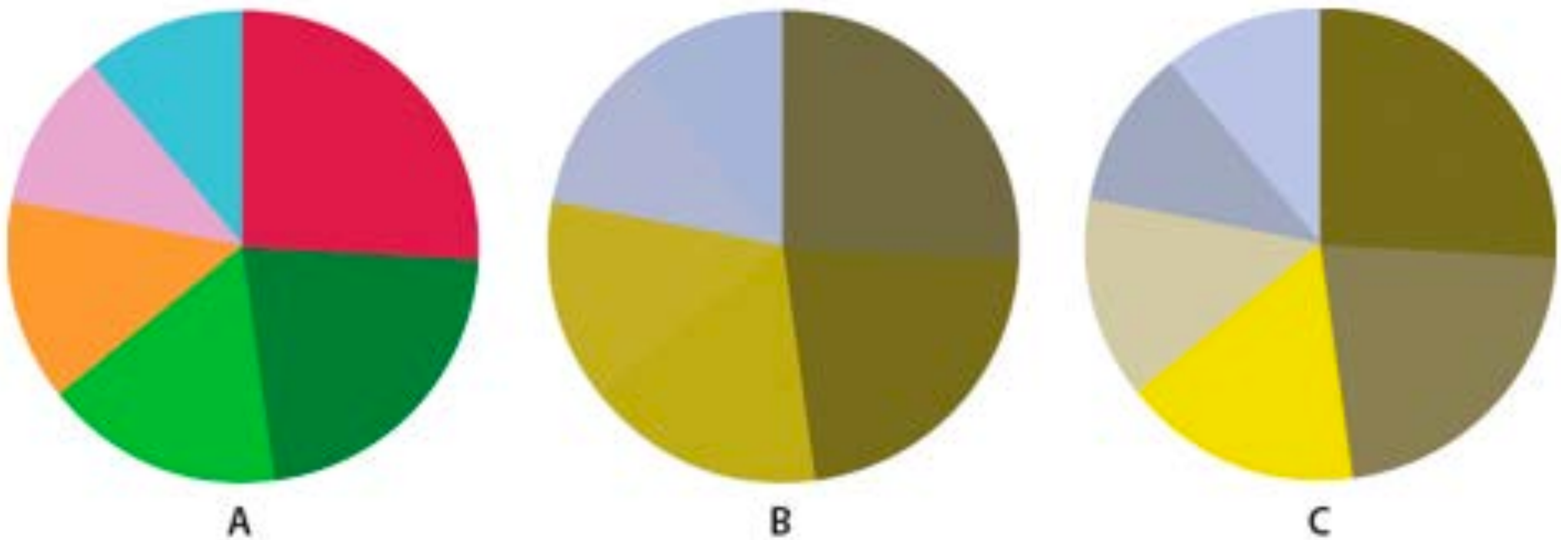
A Mix of Bar Chart and Line Chart



Make sure your infographic is complaint with Color Universal Design (CUG), which means the graphical information is conveyed accurately to people with various types of color vision, including people with color blindness.

Adjust hue or color brightness

to make color-bind friendly color schemes

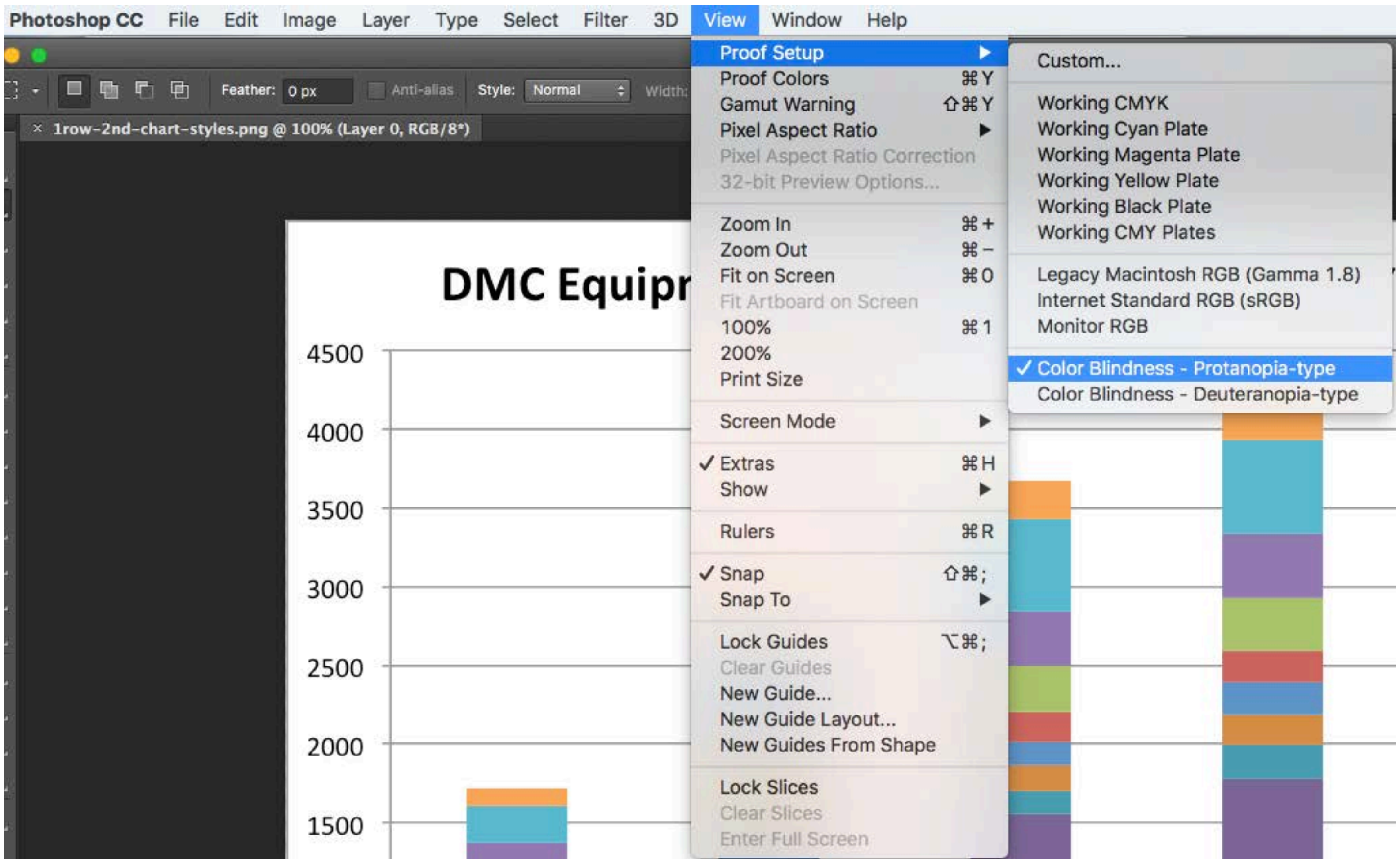


Adjusting design for color blindness

***A.** Original image* ***B.** Color-blind proof* ***C.** Optimized design*

http://help.adobe.com/en_US/creativesuite/cs/using/WS3F71DA01-0962-4b2e-B7FD-C956F8659BB3.html

Use Photoshop/Illustrator to Proof Colors



Choice of colors for color-blind readers - Tips from Edward Tufte website

http://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0000HT

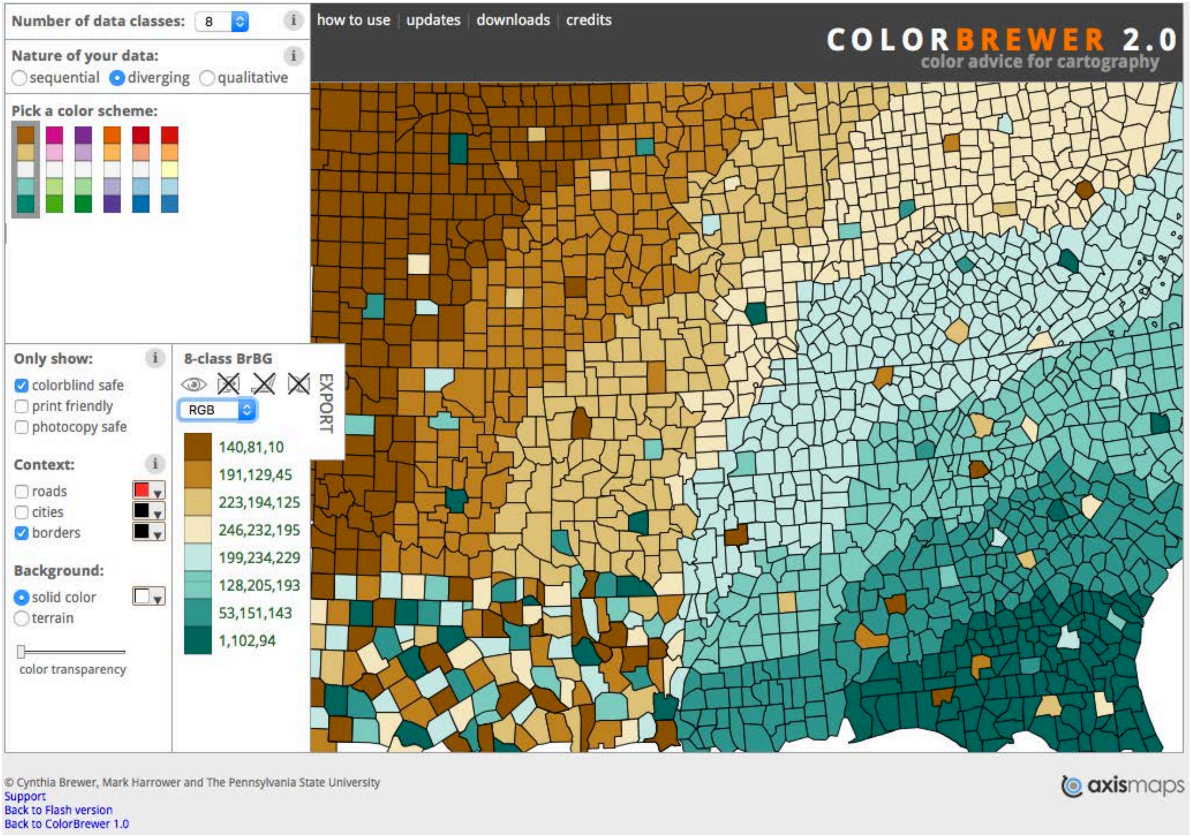
Set of colors that is unambiguous both to colorblinds and non-colorblinds

Original — *Simulation*: Protan, Deutan, Tritan

			for Photoshop, Illustrator, Freehand, etc.		*for Word, Power Point, Canvas, etc.*
		Hue	C,M,Y,K (%)	R,G,B (0-255)	R,G,B (%)
1	Black	–°	(0,0,0,100)	(0,0,0)	(0,0,0)
2	Orange	41°	(0,50,100,0)	(230,159,0)	(90,60,0)
3	Sky Blue	202°	(80,0,0,0)	(86,180,233)	(35,70,90)
4	bluish Green	164°	(97,0,75,0)	(0,158,115)	(0,60,50)
5	Yellow	56°	(10,5,90,0)	(240,228,66)	(95,90,25)
6	Blue	202°	(100,50,0,0)	(0,114,178)	(0,45,70)
7	Vermilion	27°	(0,80,100,0)	(213,94,0)	(80,40,0)
8	reddish Purple	326°	(10,70,0,0)	(204,121,167)	(80,60,70)

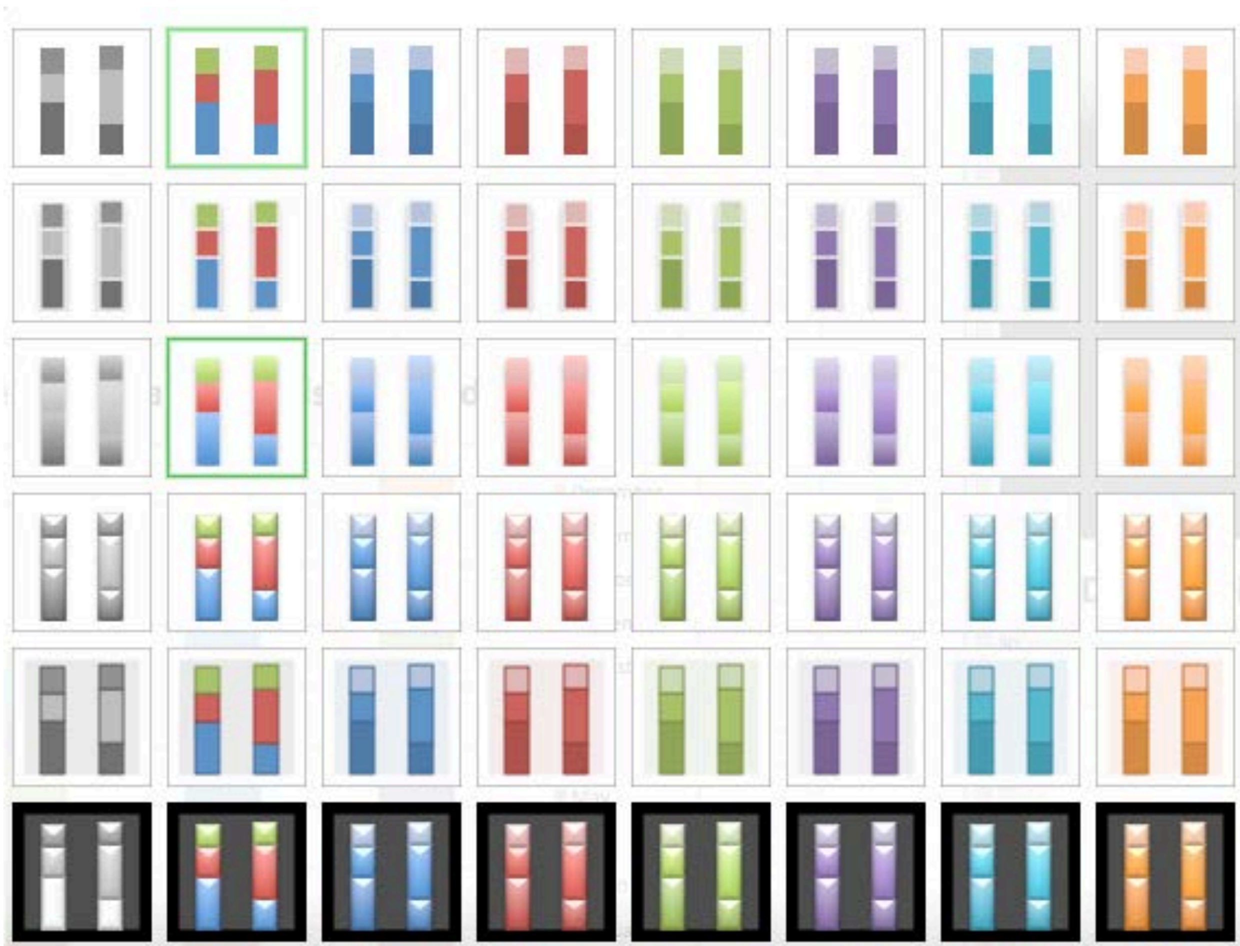
Fig. 16 Colorblind barrier-free color pallet

Use Color Brewer as a Reference to Create Color-blind Friendly Color Scheme



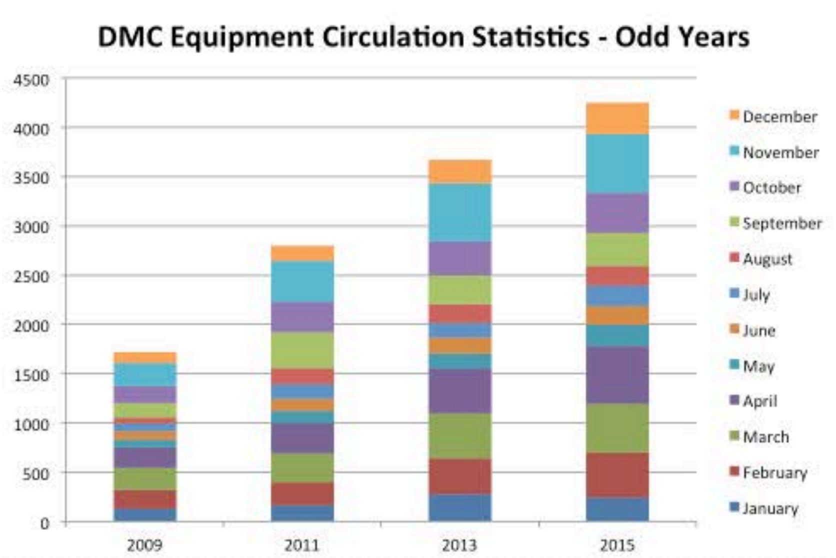
http://colorbrewer2.org/ – Color Advice for Cartography

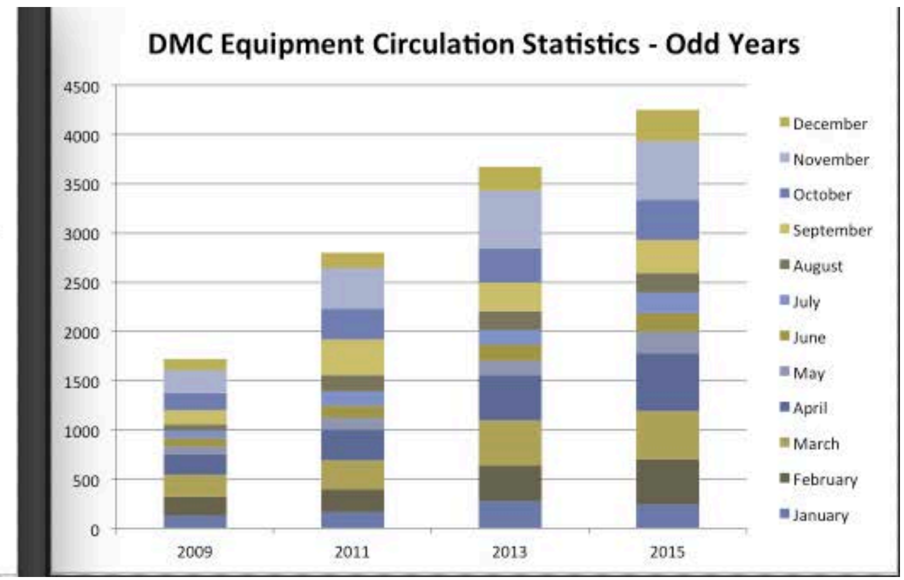
Do Excel's built-in chart styles pass color-blind test?



Left: Excel chart style – 1^{st} row 2^{nd} one

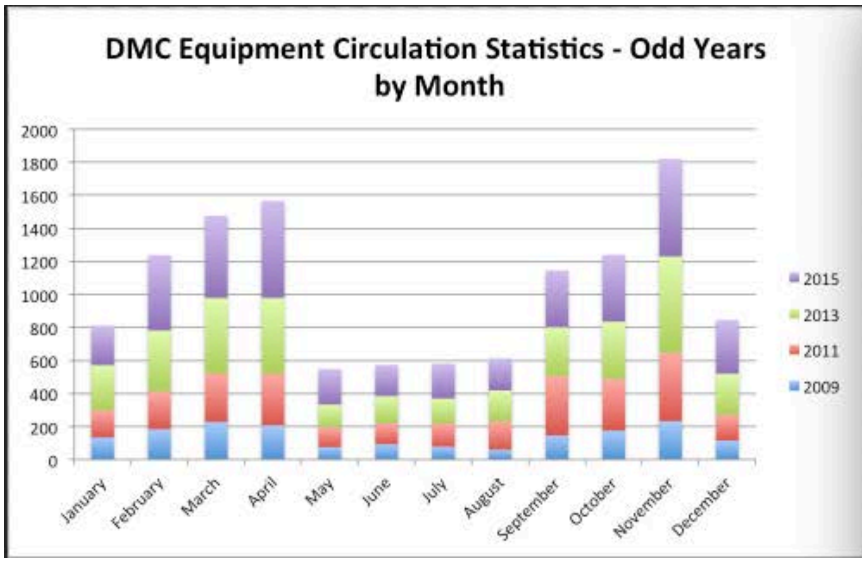
Right: after turning on color-blindness tool in Photoshop

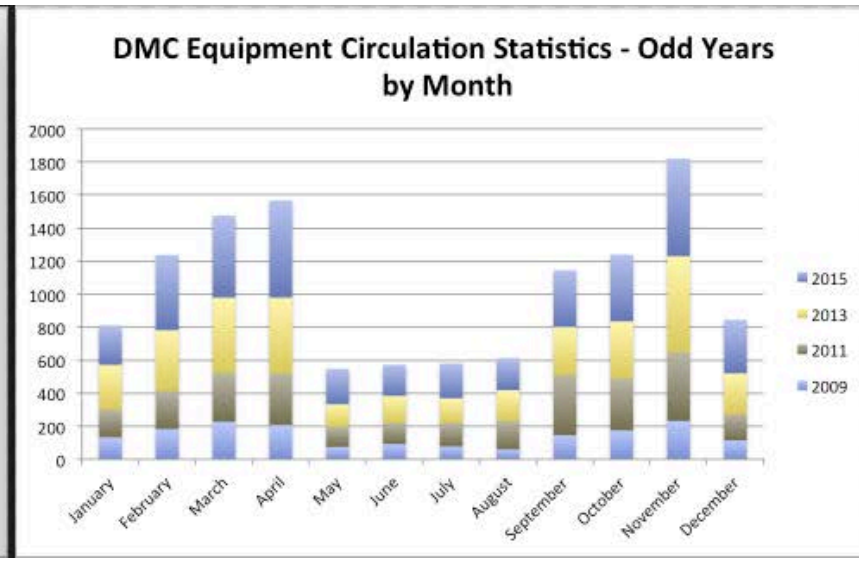




Left: Excel chart style – 3rd row 2nd one

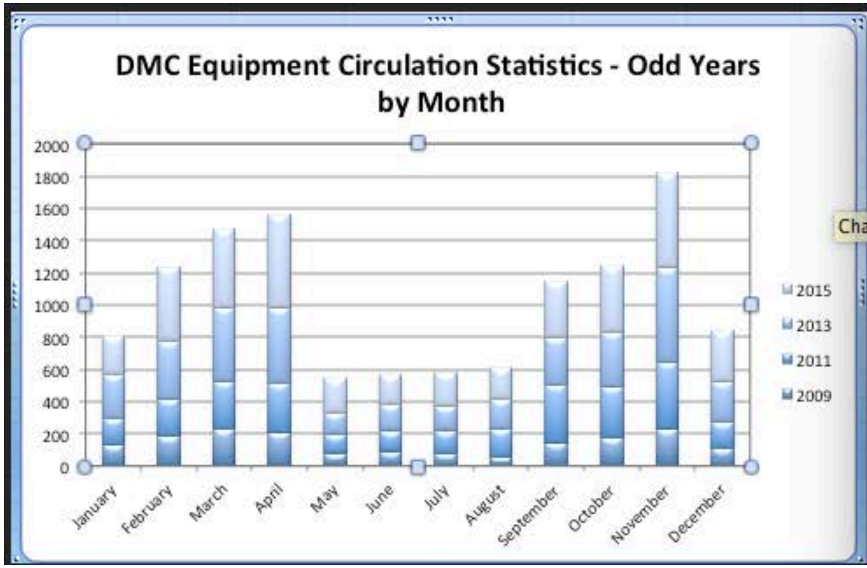
Right: after turning on color-blindness tool in Photoshop

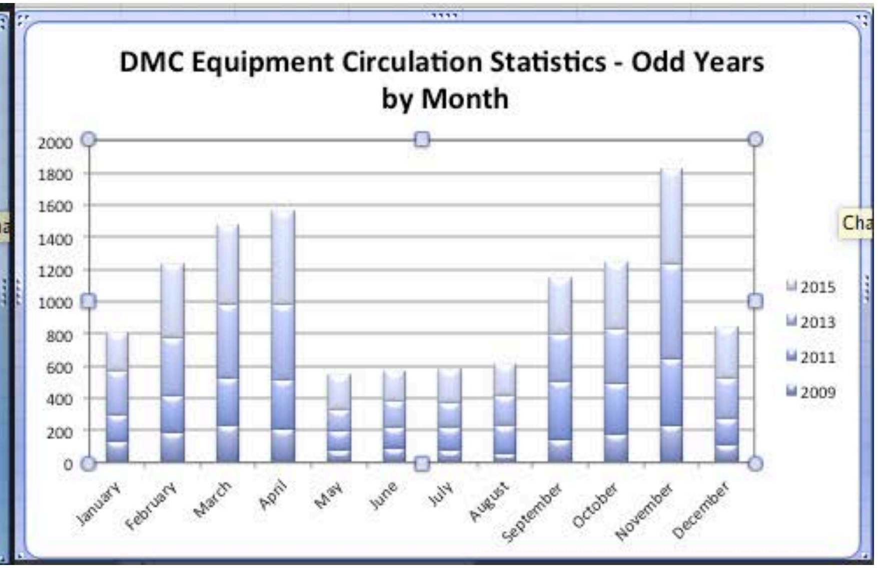




Left: Excel chart style – 4th row 3rd one

Right: after turning on color-blindness tool in Photoshop





My finding: It is safe to use Excel's built-in chart styles to create color-blind friendly color schemes!

TOOLS FOR CREATING INFOGRAPHICS AND DATA VISUALIZATION

Desktop Tools – Vector Graphics

PowerPoint	**Excel**	**Adobe Illustrator**	**Adobe InDesign**
Gephi(free)	OmniGraffle	InkScape(free)	

By InDesign

Digital Media Commons

Will Wang , Jane Zhao

Our Mission

The DMC supports the creation and use of multimedia in education, scholarship, and creative expression. Working toward this end, we provide services that include hands-on training, assistance with digital projects, and access to the essential tools for creating digital resources such as digital video and audio, images and animations, infographics, PowerPoint presentations, web pages, and more.

DMC Offers Hands-on Training on Media Editing and Assistance with Various Digital Projects

1. Help with using DMC equipment
2. Demonstration of DMC equipment
3. Assistance on video/audio editing, and graphics creation
4. Consultation on patron's project
5. Short courses for using digital tools

DMC Provides Access to the Essential Tools and Facilities for Creating Digital Media

1. Poster printing
2. Skyping/Podcasting
3. Equipment available for checking out
4. Lecture/interview recording
5. Photo taking
6. iMovie, Final Cut Pro, Photoshop, Illustrator, InDesign, and more

Your Projects, Our Passion!

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By PowerPoint

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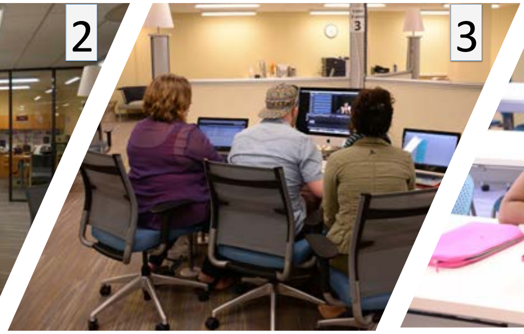
1


2


3


4


5

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1


2


3


4


5

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Desktop Tools – Image Editing

Adobe Photoshop	**Gimp(free)**
Pixelmator	Acorn

Gephi

- https://dhs.stanford.edu/tools/maps-graphs-and-workshops/

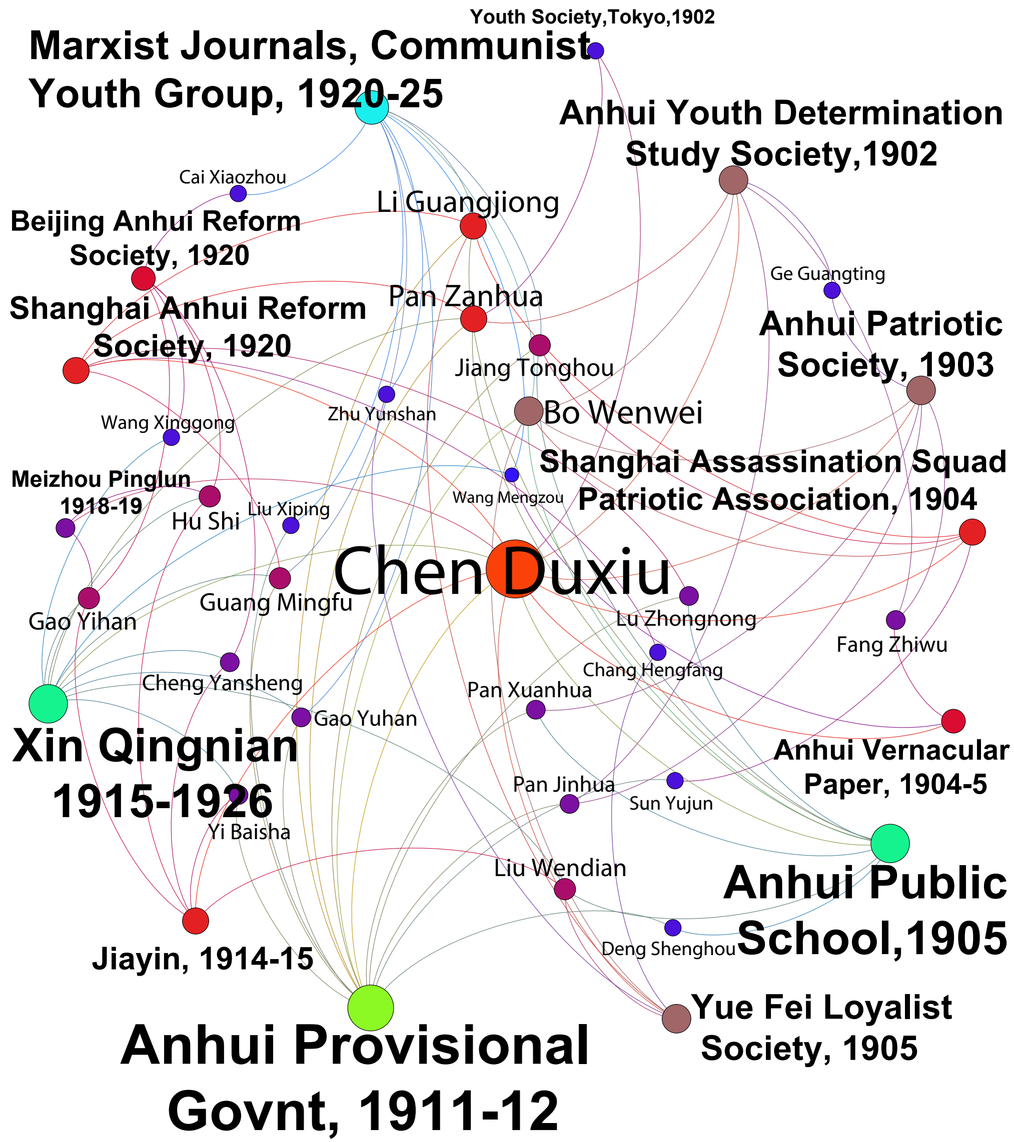


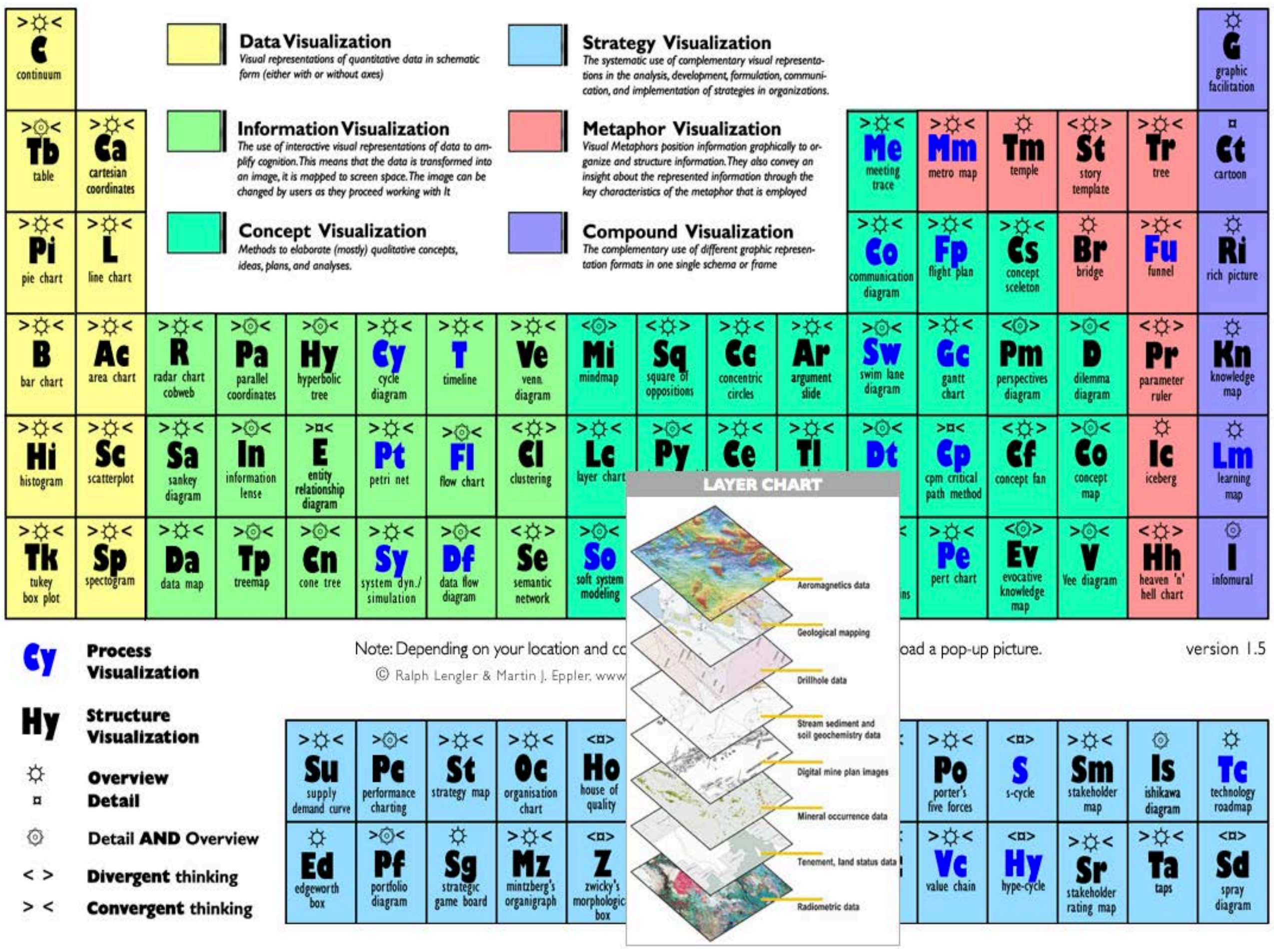
Diagram 2 - Anhui Co-Provincials in Chen's Networks

Online Tools

- **Wordle.net** **http://www.wordle.net/**
- **Google Chart** **https://developers.google.com/chart/**
- **Tableau Public** **https://public.tableau.com/s**

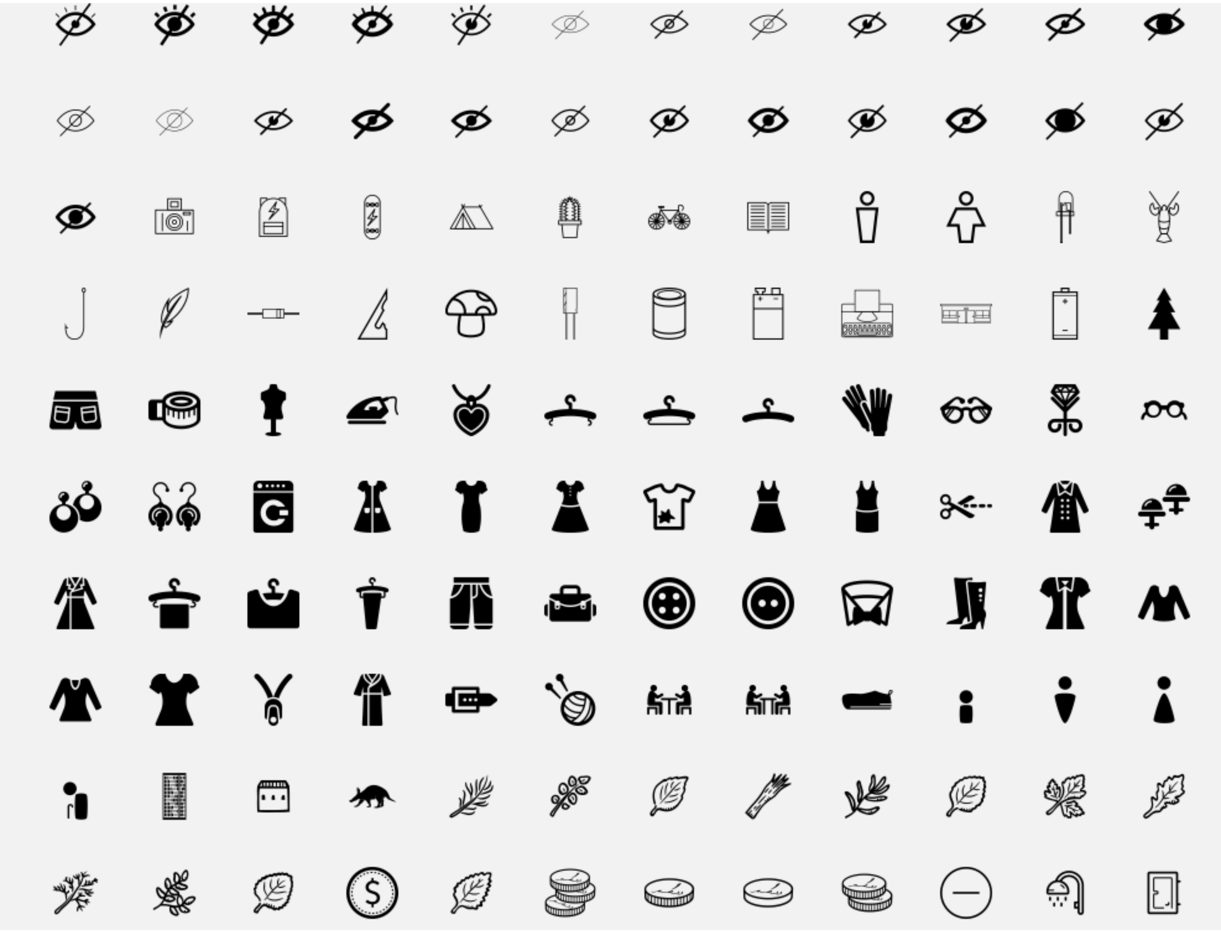
Online Infographics Resources

Periodic Table of Visualization Methods



Online Infographics Resources

[The Noun Project]



Online Infographics Resources

- Periodic Table of Visualization Methods
- The Noun Project
- 22 free tools for data visualization and analysis
- infographics world
- Datavisualization.ch Selected Tools http://selection.datavisualization.ch/

More Sample Infographics

- Cool infographics
  http://www.coolinfographics.com/
- Edward Tufte
  http://www.edwardtufte.com/tufte/posters
- Information is beautiful
  http://www.informationisbeautiful.net/
  by David McCandless, an author and designer.

Data Sources

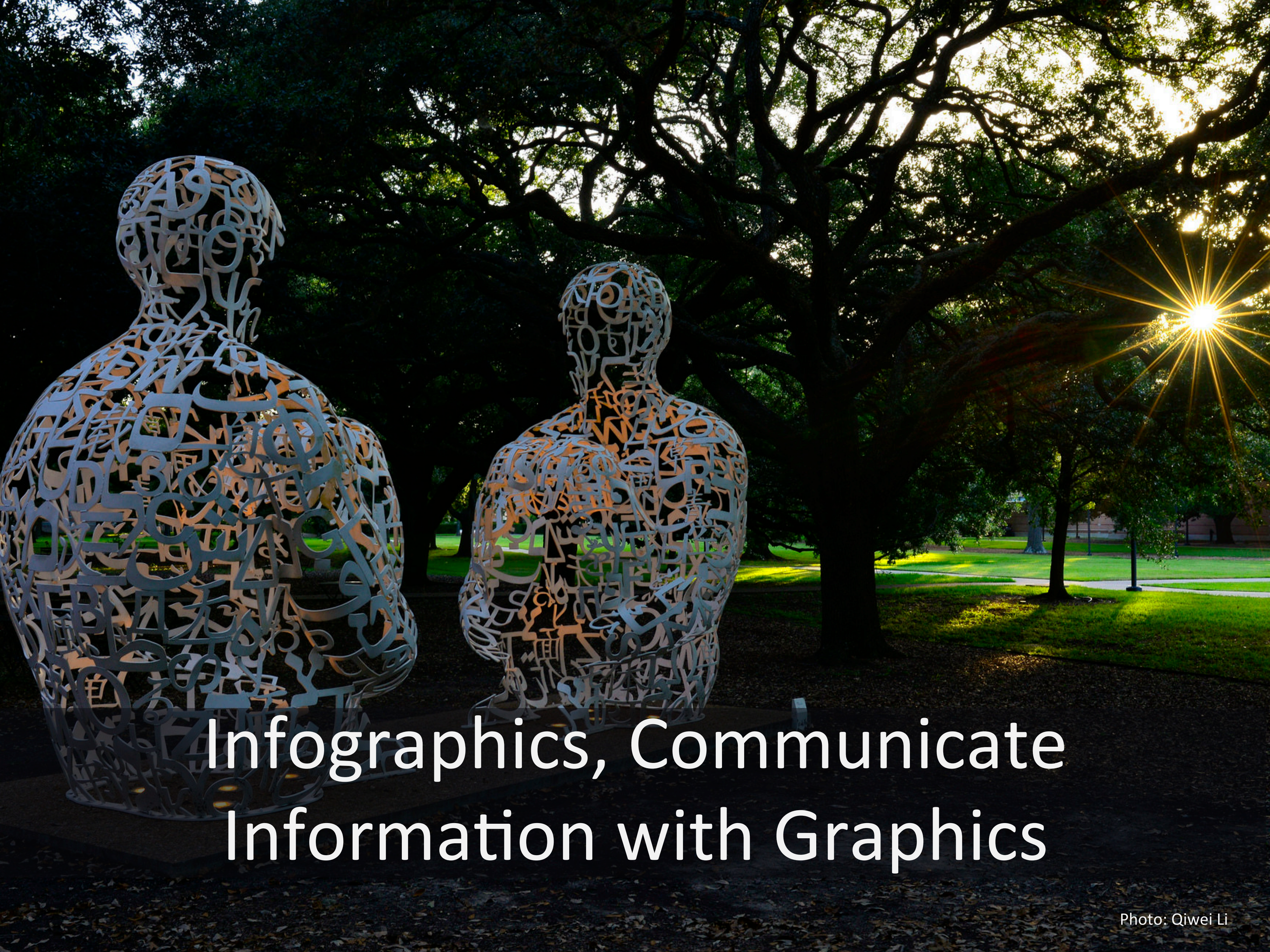
- **data.gov**
  http://www.data.gov/.
- FactBrowser
  http://www.factbrowser.com/
- Google Public Data
  http://www.google.com/publicdata/directory
- Wolfram Alpha
  http://www.wolframalpha.com/
- Wikipedia
  https://en.wikipedia.org/wiki/Main_Page

On Campus Resources

- Data Visualization Center
- Kelly Center for Government Information, Data, and Geospatial Services
- GIS Data Center

Summary

- A good infographic should be useful, sound, and beautiful.
- Best practices
  - Information Design
    - Keep it simple
    - Use a simple text combined with a relevant image
    - Make it unique
  - Data Visualization
    - Bar Chart – for ranking and time series, starting with zero baseline, avoid 3-D
    - Pie Chart – for part-to-whole comparisons, limiting to 5 slicess, avoid 3-D
    - Line Chart – for time series, limiting to 4 or less
- Use color schemes that are color-blind friendly
- Tools
  - PowerPoint, Excel, Illustrator, InDesign, Gephi, Photoshop, Gimp
  - Wordle, Google Chart, Tableau Public



Infographics, Communicate Information with Graphics

Photo: Qiwei Li