Top Ten Dos and Don'ts for Charts and Graphs

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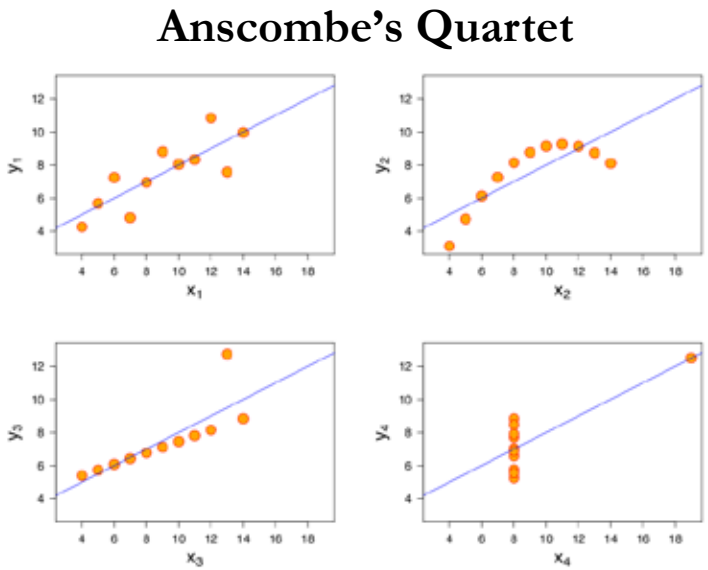
http://guides.library.duke.edu/topten

Workshop Feedback Form

To give feedback on this workshop:
http://library.duke.edu/data/feedback.html

Charts? What are they good for?

- Maintain complexity in the data that summary statistics might lose
- Easier/faster to process data using visual capabilities
- Improve memory for information



http://en.wikipedia.org/wiki/Anscombe%27s_quartet

First, do no harm.

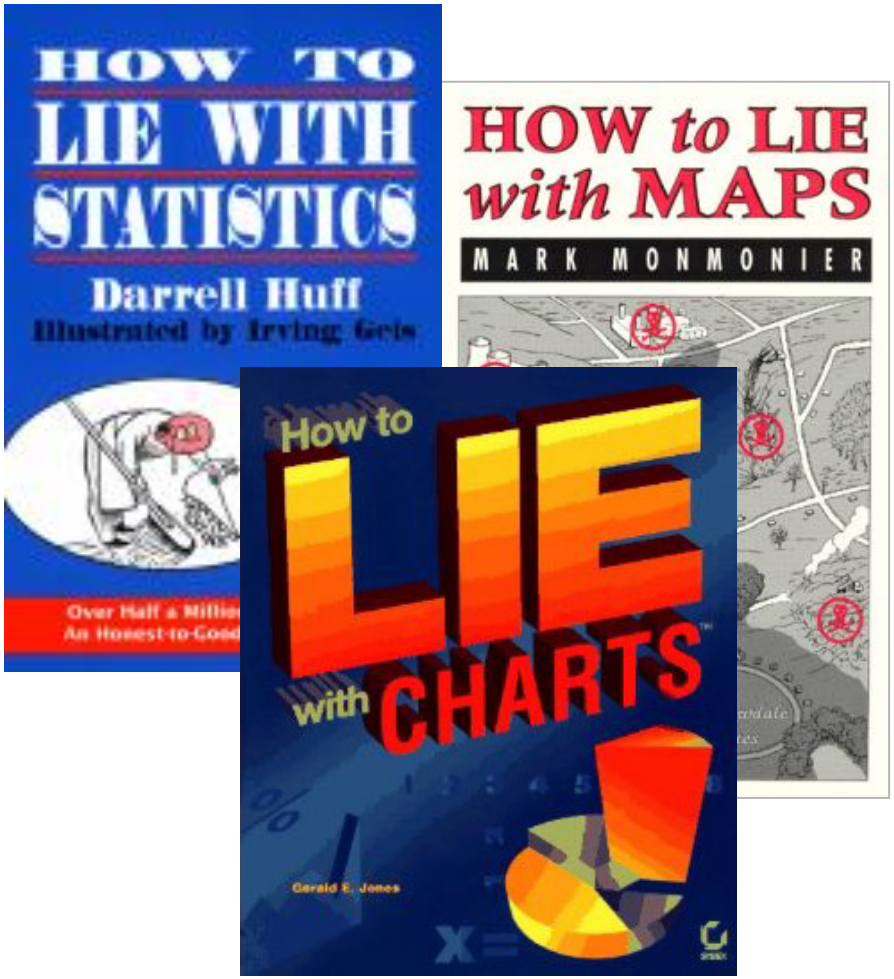
http://eagereyes.org/criticism/above-all-do-no-harm

Do...

- use the full (numerical) axis
- simplify less important information
- be creative with your legends and labels
- pass the squint test
- ask others for opinions

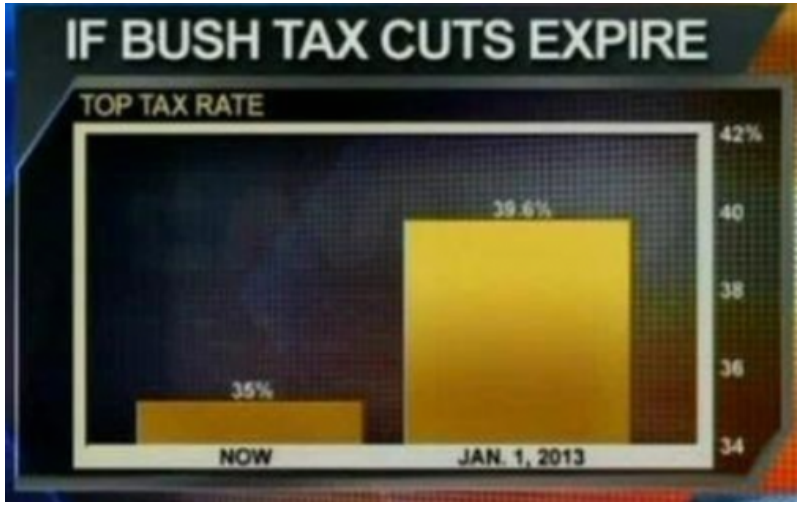
Don’t…

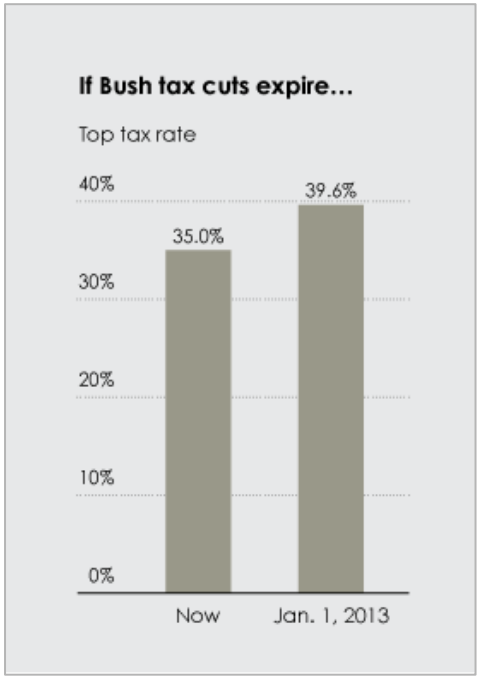
- use 3D or blow apart effects
- use more than six colors
- change “style” boats midstream
- make users do “visual math”
- …or overload the chart


HOW TO
LIE WITH
STATISTICS
Darrell Huff
Illustrated by Irving Geis
HOW to LIE
with MAPS
MARK MONMONIER
How to
LIE
with CHARTS
Gerald E. Jones

Do use the full axis.

Avoid distortion.





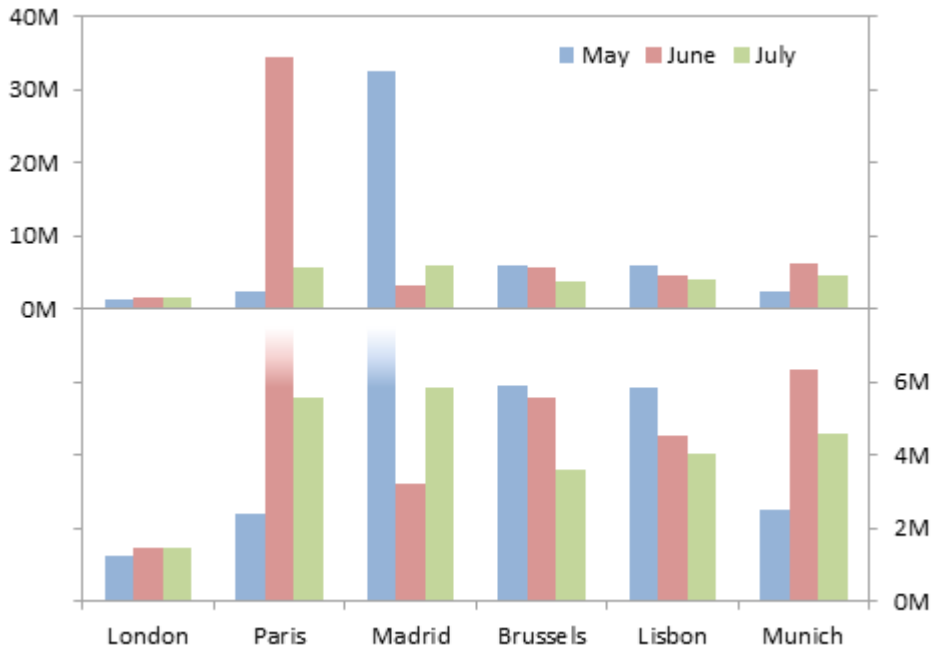
http://flowingdata.com/2012/08/06/fox-news-continues-charting-excellence/

(But for line graphs, it may be okay to truncate the y axis.
http://onforb.es/OsgXv5 | http://www.excelcharts.com/blog/of-bars-and-lines/)

(Or maybe not. http://eagereyes.org/basics/baselines)

Do use the full axis.

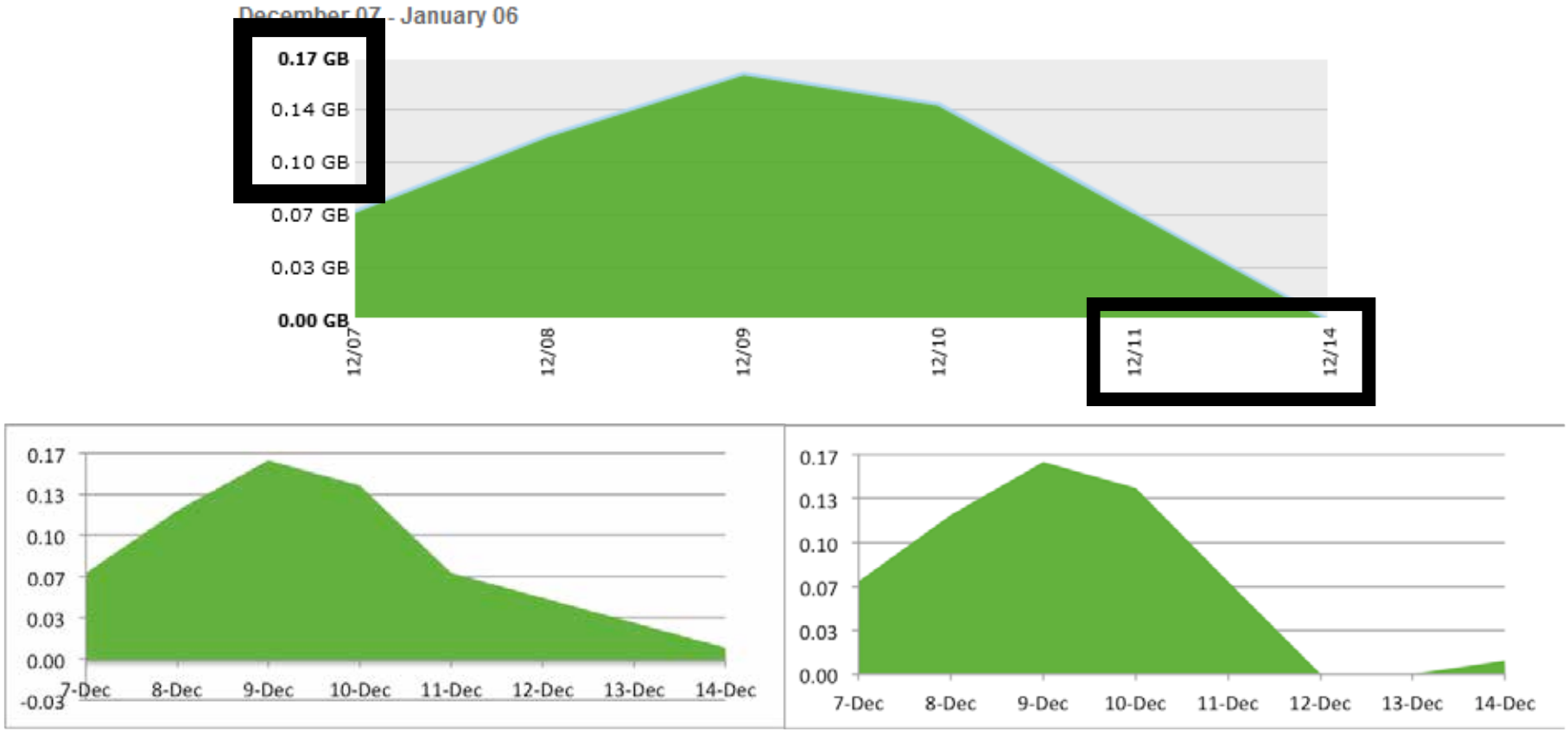
Have some very tall bars?



Consider using multiple charts to show the full scale and a “zoomed in” view.
http://peltiertech.com/WordPress/broken-y-axis-in-excel-chart/

Do use the full axis.

Maintain consistency.



http://www.forbes.com/sites/naomirobbins/2012/12/27/line-charts-are-not-always-the-best-way-to-show-time-series/

Keep it simple.

Do simplify less important information.

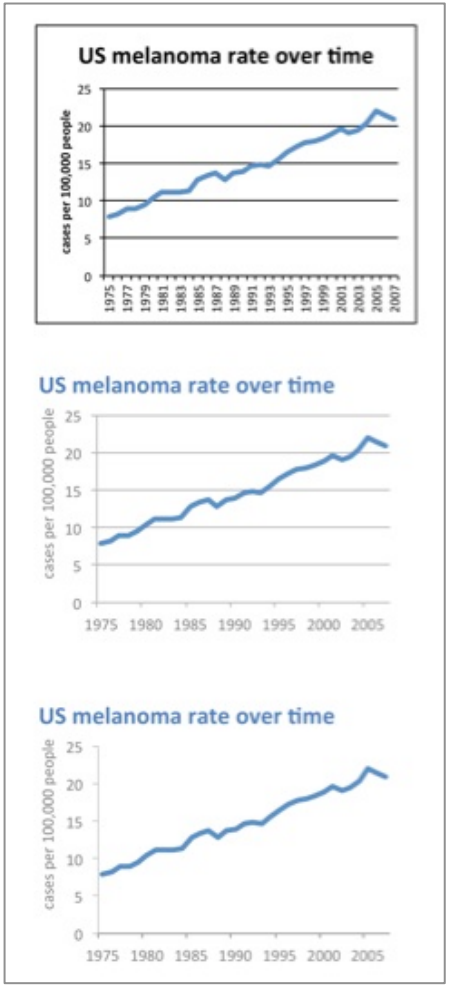
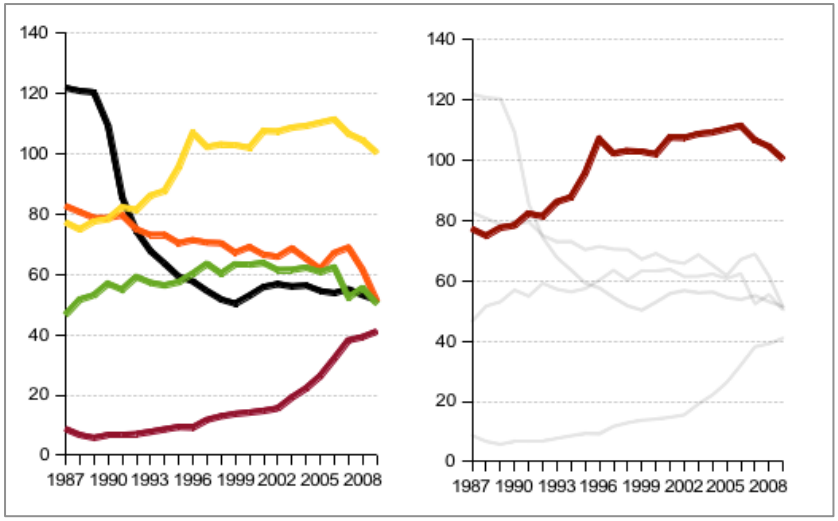


Chart elements like gridlines, axis labels, colors, etc. can all be simplified to highlight what is most important/relevant/interesting.



http://bit.ly/Ykxlr9

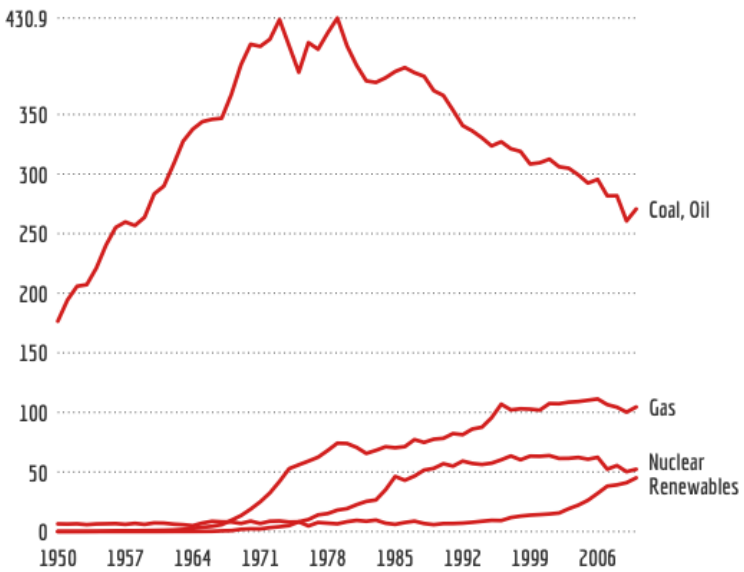
http://vis4.net/blog/posts/doing-the-line-charts-right/

Use your words.

Do be creative with your legends and labels.

Possibilities:

- Label lines individually
- Rotate bars if the category names are long
- Put value labels on bars to preserve the clean lines of the bar lengths



http://bit.ly/M70xek

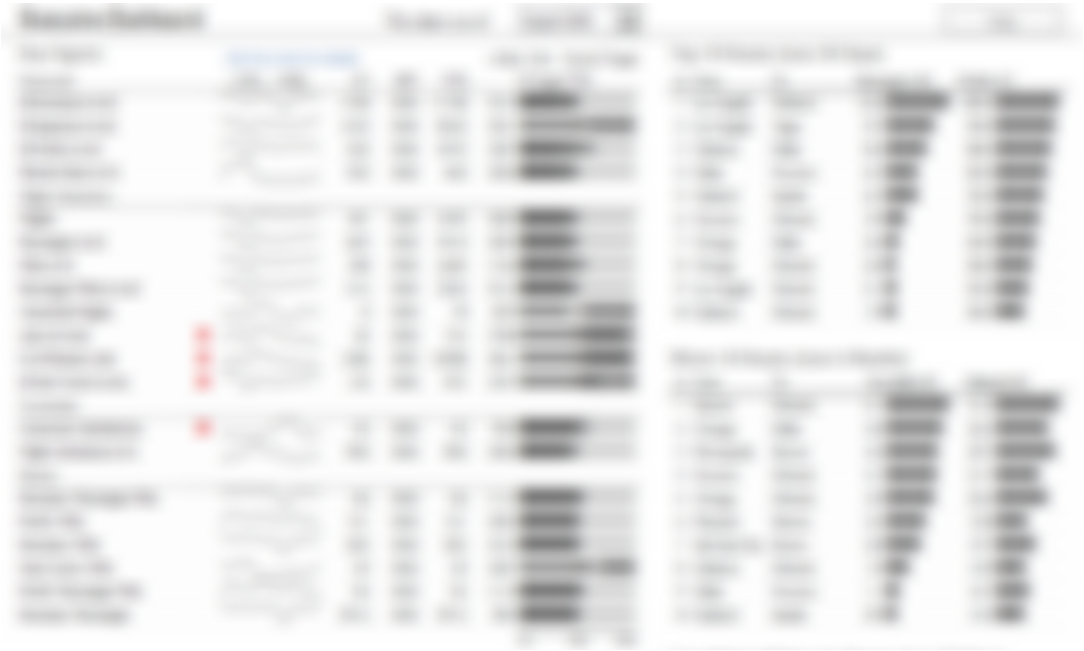
http://bit.ly/RrUOPi

Take a step back.

Do pass the squint test.

“When you squint at your page, so that you cannot read any of the text, do you still ‘get’ something about the page?”

http://extremepresentation.typepad.com/blog/2006/09/simplicity_of_d.html

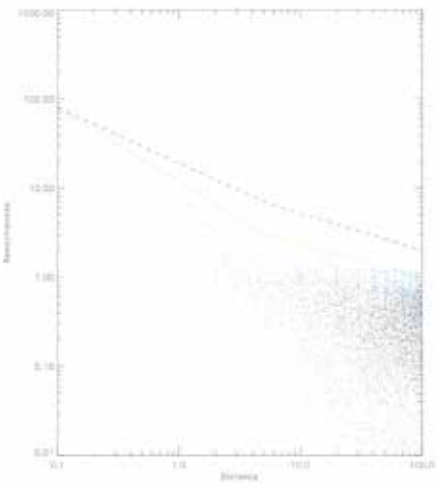


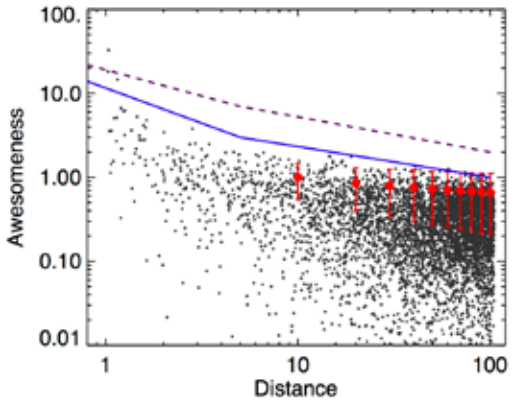
http://blog.xlcubed.com/2008/08/the-dashbord-squint-test/

Do pass the squint test.

- Which elements draw the most attention? What color pops out?
- Do the elements balance? Is there a clear organization?
- Do contrast, grouping, and alignment serve the function of the chart?

http://blog.xlcubed.com/2008/08/the-dashbord-squint-test/





Related:
Projectors often wash out figures. The squint test can simulate this. Try high contrast designs with clear trends.

http://shar.es/CWktB

Find more eyes.

Do ask others for opinions.

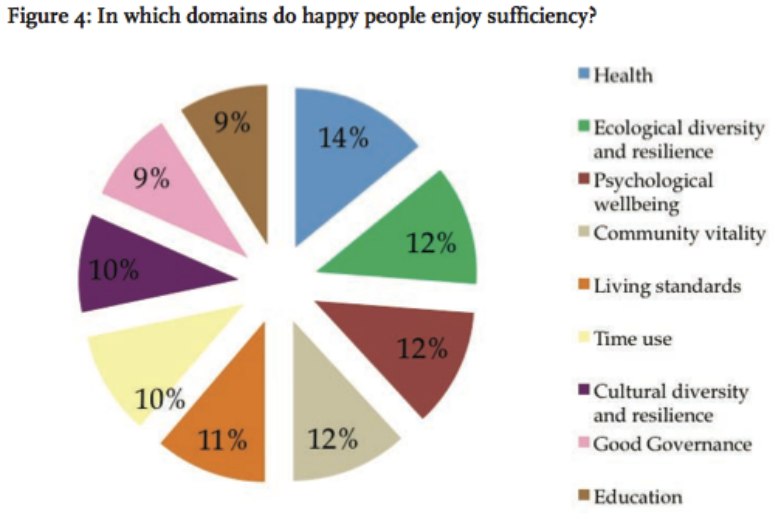
Have a fresh set of eyes look at what you've done and give you feedback.

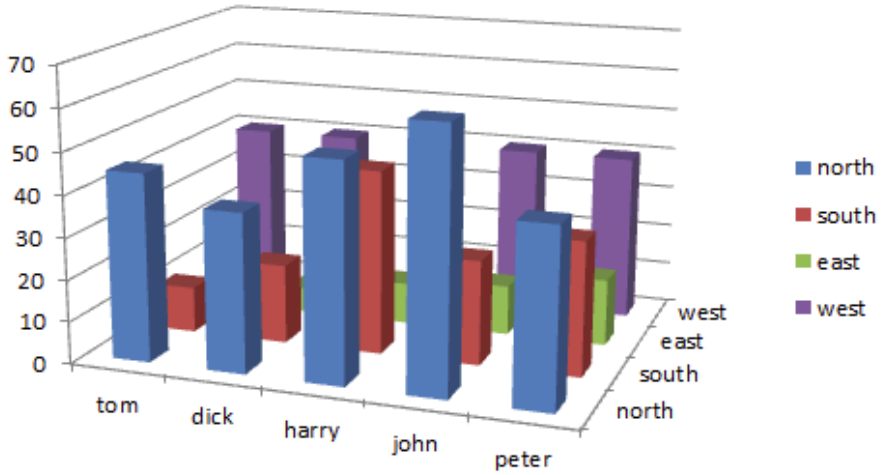
You may be surprised by what is confusing – or enlightening! – to others.

Don’t gild the lily.

Don’t use 3D or blow apart effects.

Studies show that 3D effects reduce comprehension. Blow apart effects likewise make it hard to compare elements and judge areas.

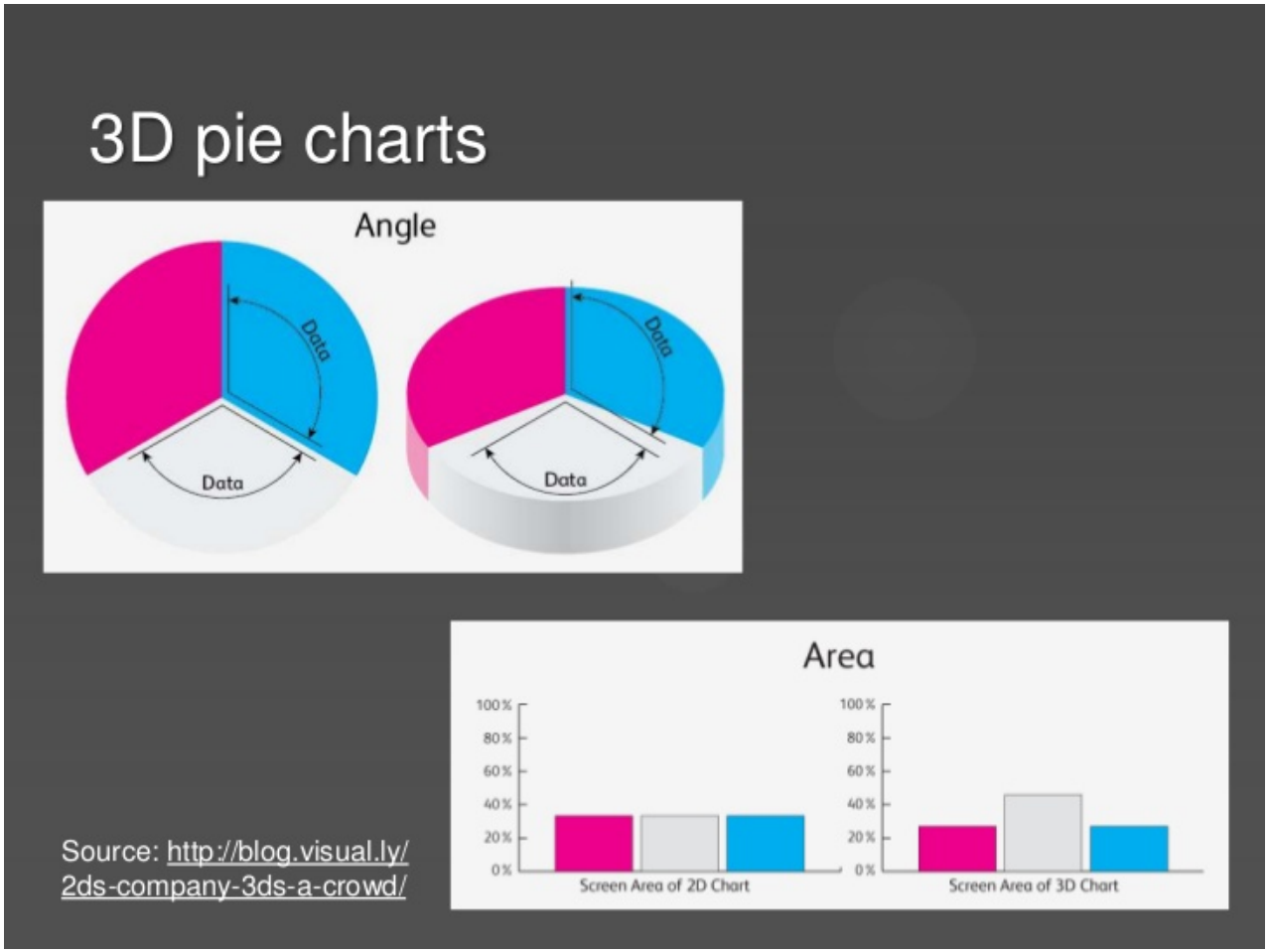




http://flowingdata.com/2012/04/25/world-happiness-report-makes-statisticians-unhappy/

http://onforb.es/MjG84K

Don’t use 3D or blow apart effects.



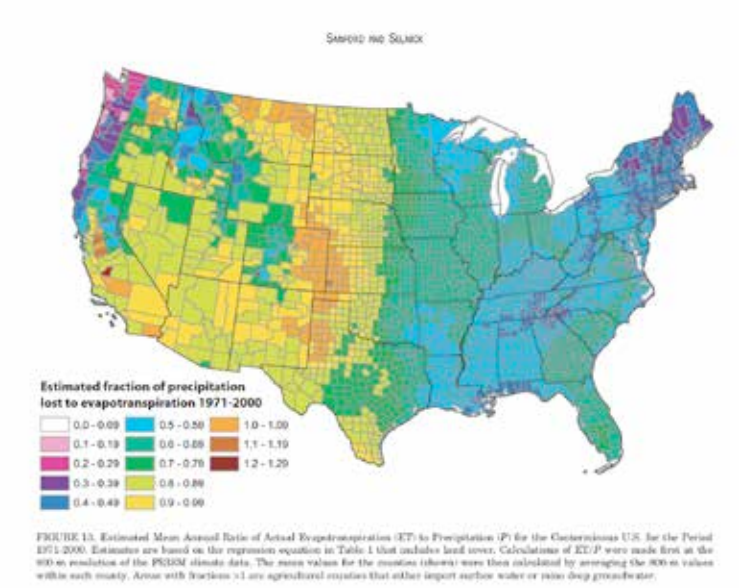
http://www.slideshare.net/jschwabish/making-excel-graphs-better/18

Color me carefully.

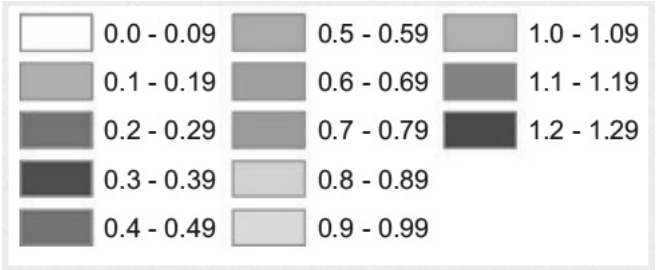
Don’t use more than (about) six colors.

But first things first:

Don’t use rainbows for continuous values in a range (e.g., age, temperature)



Problem one: Luminance ordering



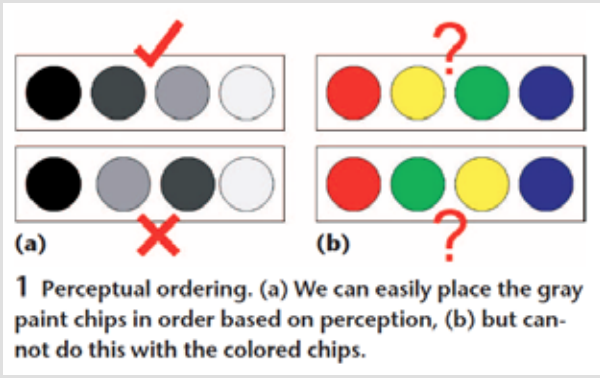
http://onlinelibrary.wiley.com/doi/10.1111/jawr.12010/full

Via http://eagereyes.org/basics/rainbow-color-map

Don’t use more than (about) six colors.

Problem 2: Hue ordering

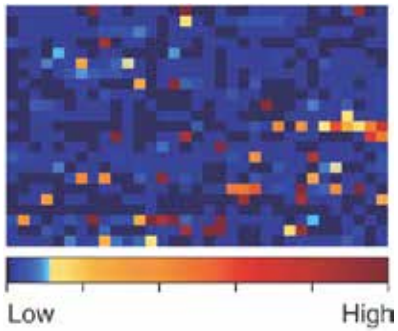
We often think that the order of colors in our “rainbow” is easy for everyone to understand, but this order is not universal and will make charts and maps harder to read.



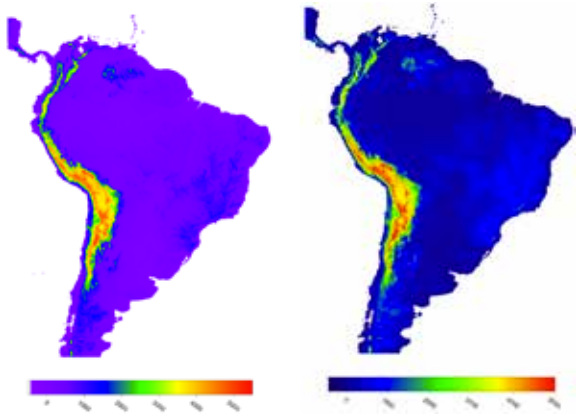
1 Perceptual ordering. (a) We can easily place the gray paint chips in order based on perception, (b) but cannot do this with the colored chips.

bit.ly/UDzaNe

Related: salience versus relevance

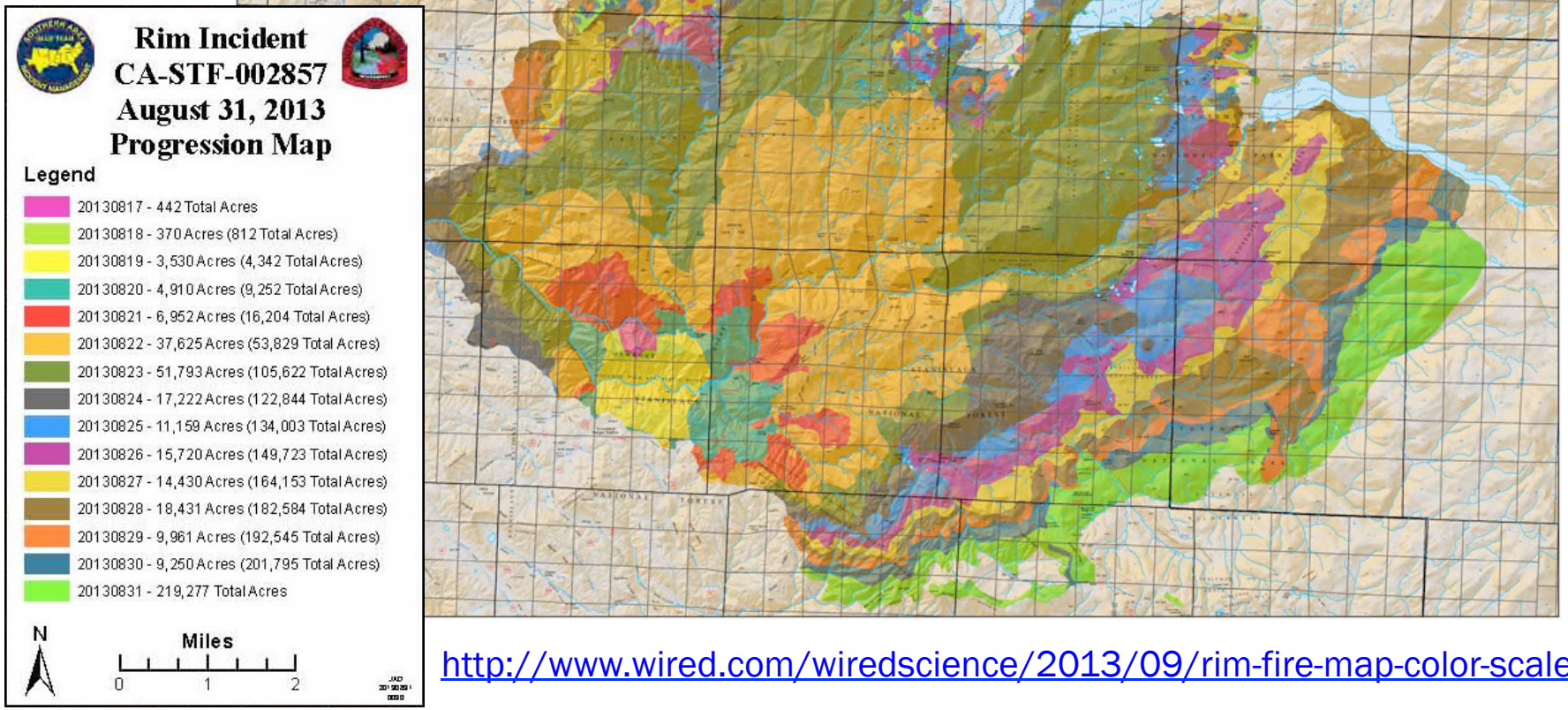


http://dx.doi.org/10.1038/nmeth.1762



http://mycarta.wordpress.com/2012/12/21/comparing-color-palettes/

Case in point:



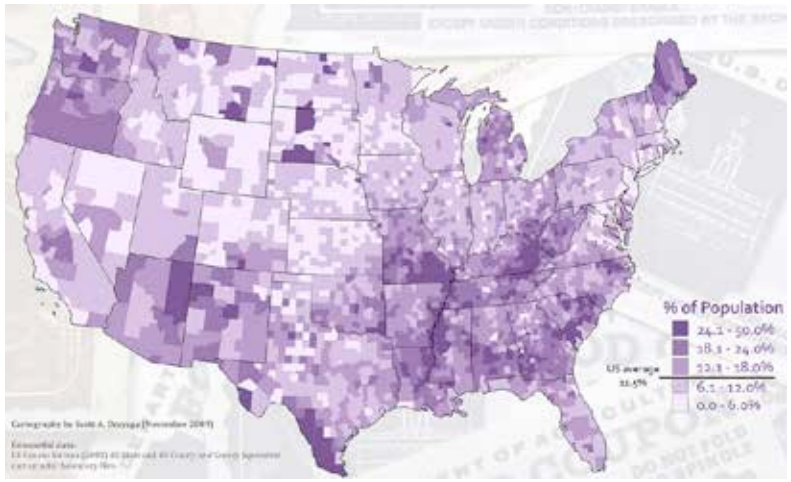
http://www.wired.com/wiredscience/2013/09/rim-fire-map-color-scale/

Don’t use more than (about) six colors.

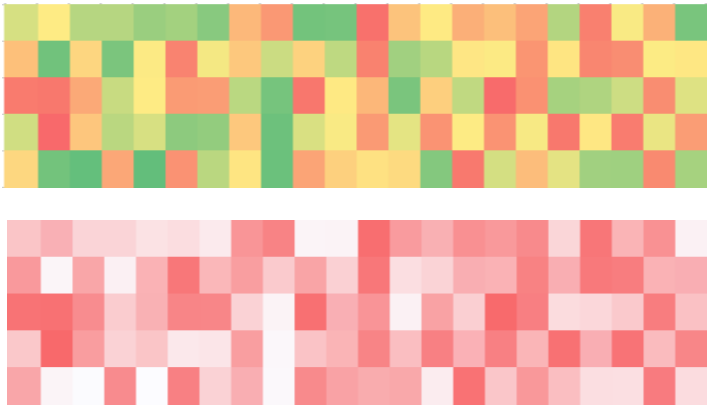
Solution: Single hue, varying luminance

If you want color to show a **numerical value**, use a range that goes from white to a highly saturated color in one of the universal color categories.

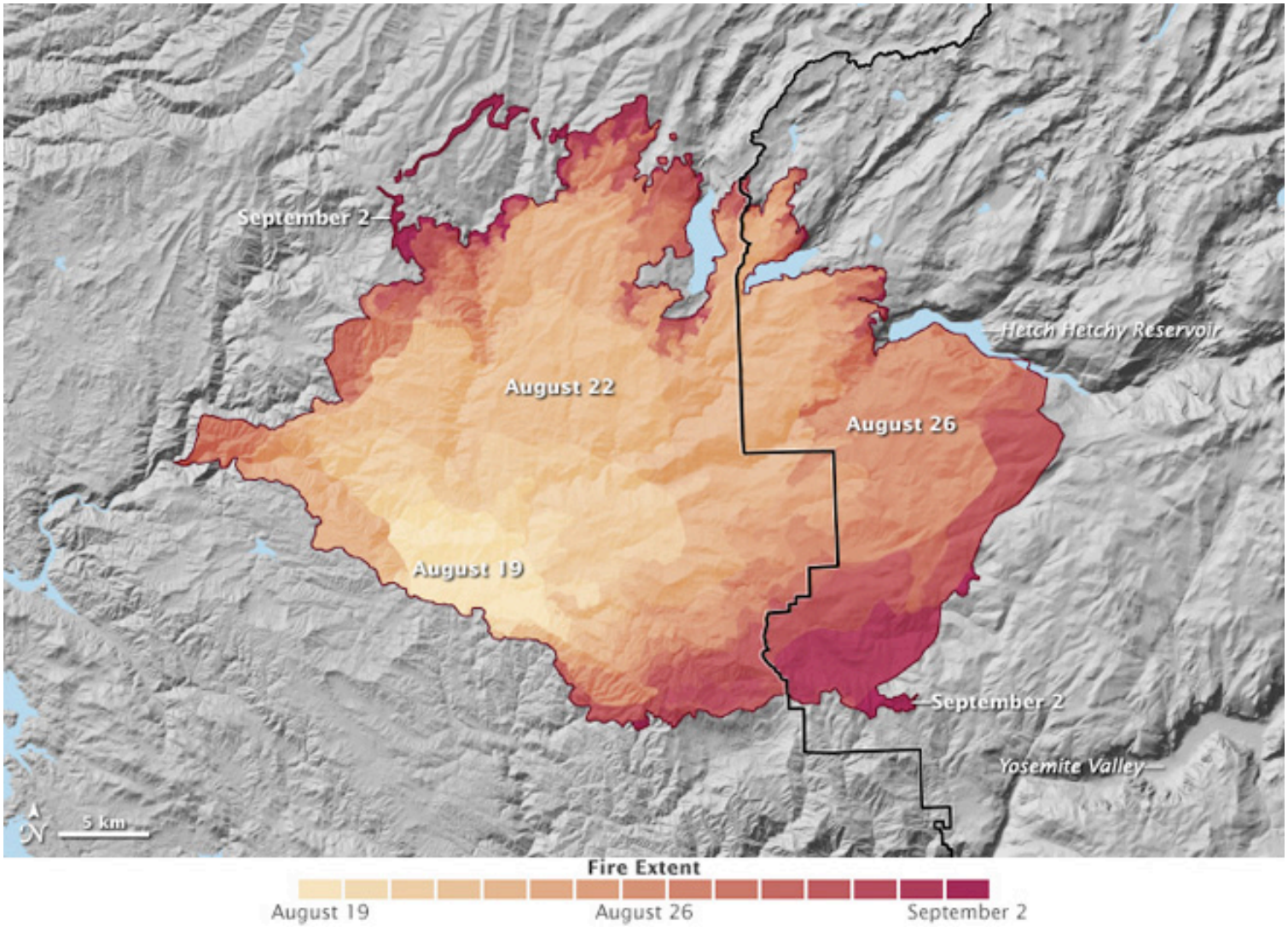
http://shar.es/CfbSd



http://www.flickr.com/photos/sadrzy/4154089647/



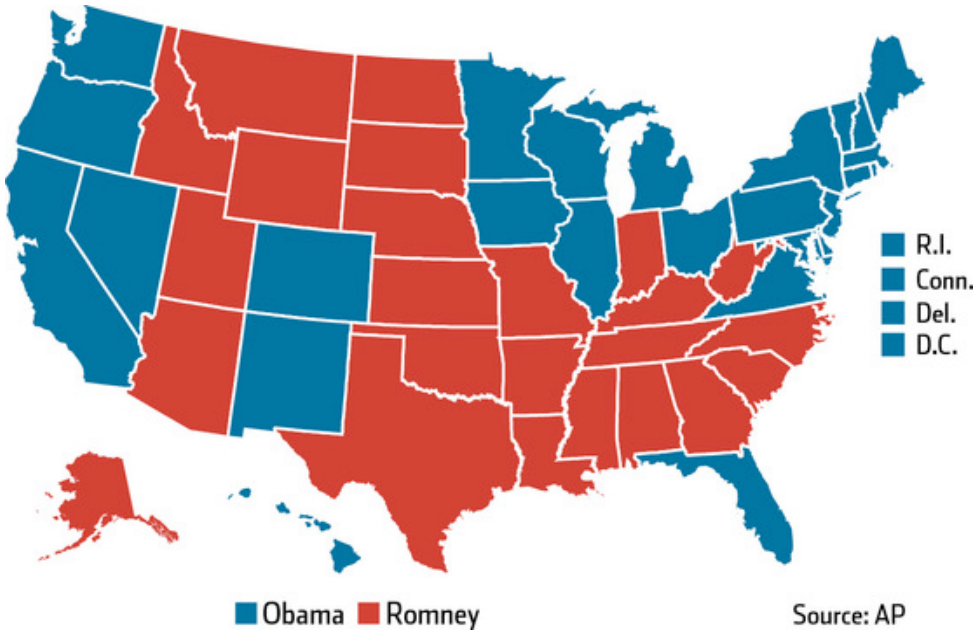
Fixed it for you...



http://www.wired.com/wiredscience/2013/09/rim-fire-map-color-scale/

Don’t use more than (about) six colors.

But what if you have different **categories** (e.g., male/female, types of fruit), rather than different **values** in a range?

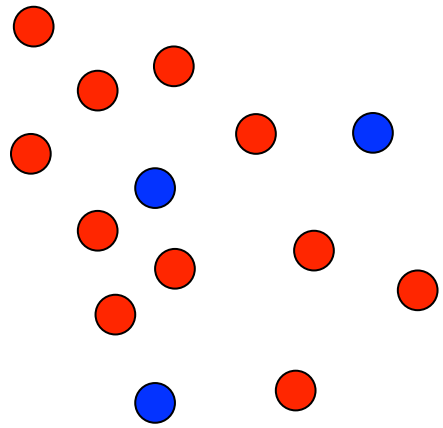


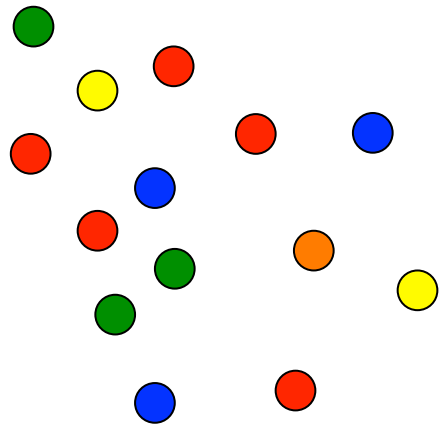
http://on.wsj.com/QpkL6t

Don’t use more than (about) six colors.

Different colors **can** be used for different **categories**, but it’s important to maximize the differences between colors to make it easy to group similar objects and separate different ones.

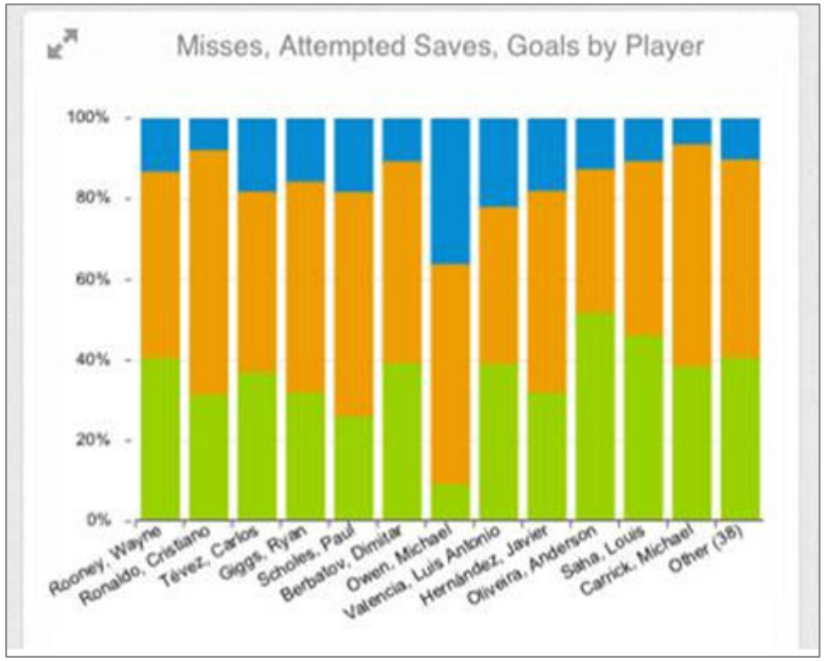
The more colors you need (that is, the more categories you try to visualize at once), the harder it is to do this.

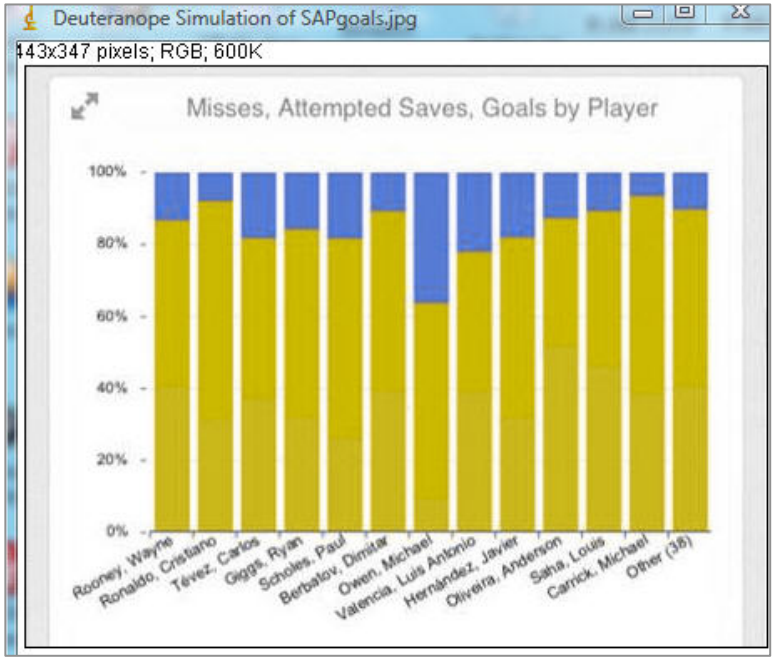




Don’t use more than (about) six colors.

And remember, some people have color blindness.





http://onforb.es/SvDkFQ

Use http://www.vischeck.com/ to test.

Don’t use more than (about) six colors.

Also, test what it looks like in gray scale.
(Vary both hue and saturation.)


OPINION

Obama’s Divided Nation

ama presides over
ica more divided
any time in 50
ry that was riven
g racial lines gath-
2008 to elect its
ident. That presi-
four years dividing
the basis of eco-
The campaign re-
vealed no evi-
dence that Mr.
Obama will close
the chasm he has
created between
his voters and
those he attacked
and vilified.

It may be true
that Mitt Romney
failed to respond

R.I.
Conn.
Del.
D.C.

Obama Romney

Source: AP

drawn attention to what hap-

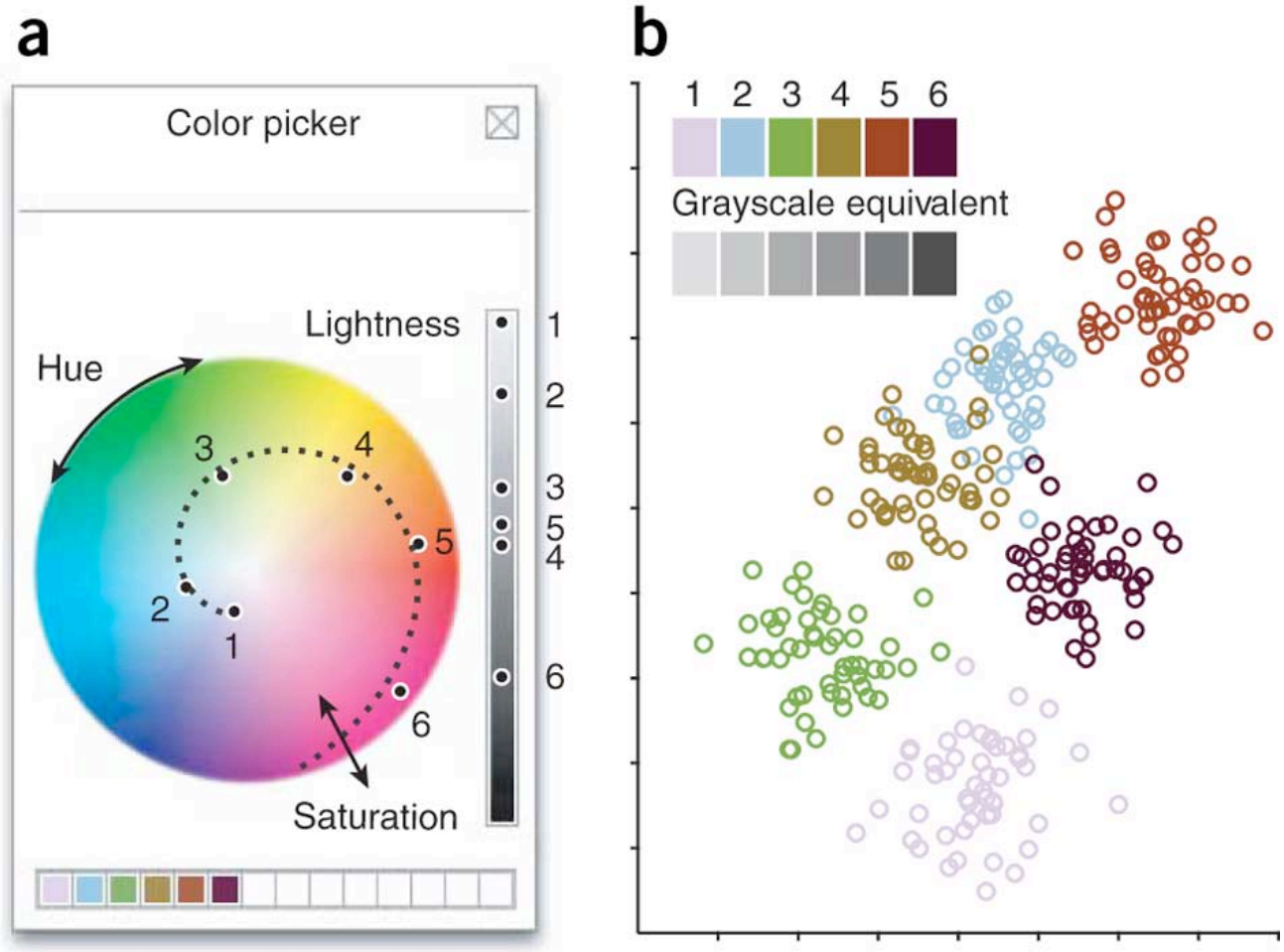
Obama spokestotum replied:

problem with pols, e
verbally facile as Mr.
that in crunch time,
reverts to No. 1. Exi
that 9% of the electo
who to vote for jus
Tuesday; and amo
42% said Mr. Oban
Sandy response—t
tie photo-op—wa
factor. Of those,
voted for Mr. Ob
Mr. Christie is o
politico who is

Yes, Republic
across two pres
that there are
how crudely
issue like ill
Blowing up th
if you thoug
day’s results

http://flowingdata.com/2012/11/09/incredibly-divided-nation-in-a-map/

Colors to grayscale



http://dx.doi.org/10.1038/nmeth0810-573

Don’t use more than (about) six colors.

List of good color resources:

http://www.ifweassume.com/2012/12/colors-in-visualizations-rainbow-of.html
http://blog.visual.ly/web-based-color-tools/

Especially, Color Brewer 2:

http://colorbrewer2.org/

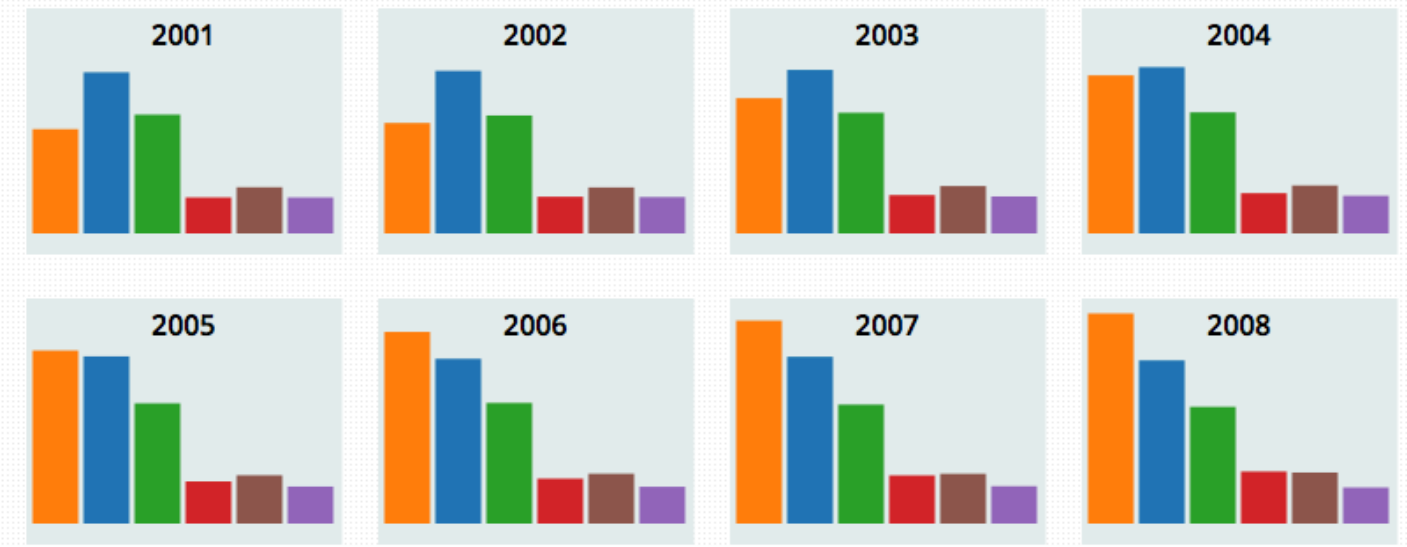
Subtleties of Color blog series by Robert Simmon:

http://blog.visual.ly/?s=%22subtleties+of+color%22

Same bat time, same bat channel.

Don’t change (style) boats midstream.

One of the easiest ways to get the most out of charts is to rely on **comparison** to do the heavy lifting.



http://vallandingham.me/small_multiples_with_details.html

Our visual system can detect anomalies in patterns.

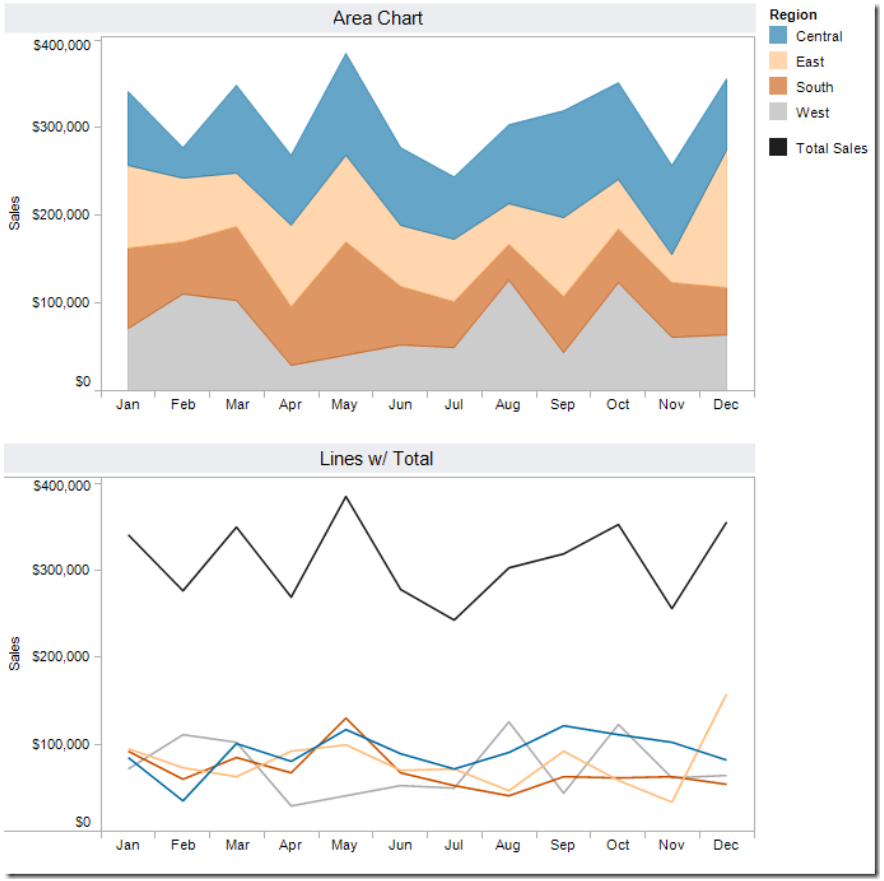
Try keeping the form of a chart consistent across a series so differences from one chart to another will pop out.

Blinding me with science.

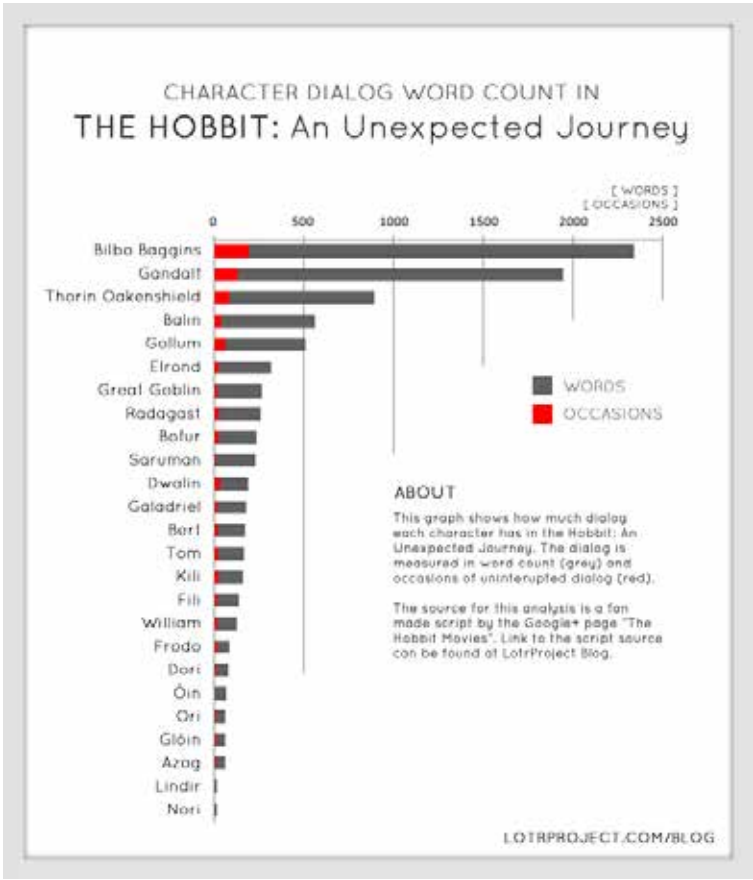
Don’t make users do “visual math.”

http://eagereyes.org/criticism/visual-math-wrong

If the chart makes it hard to understand an important relationship between variables, do the extra calculation and visualize that as well.



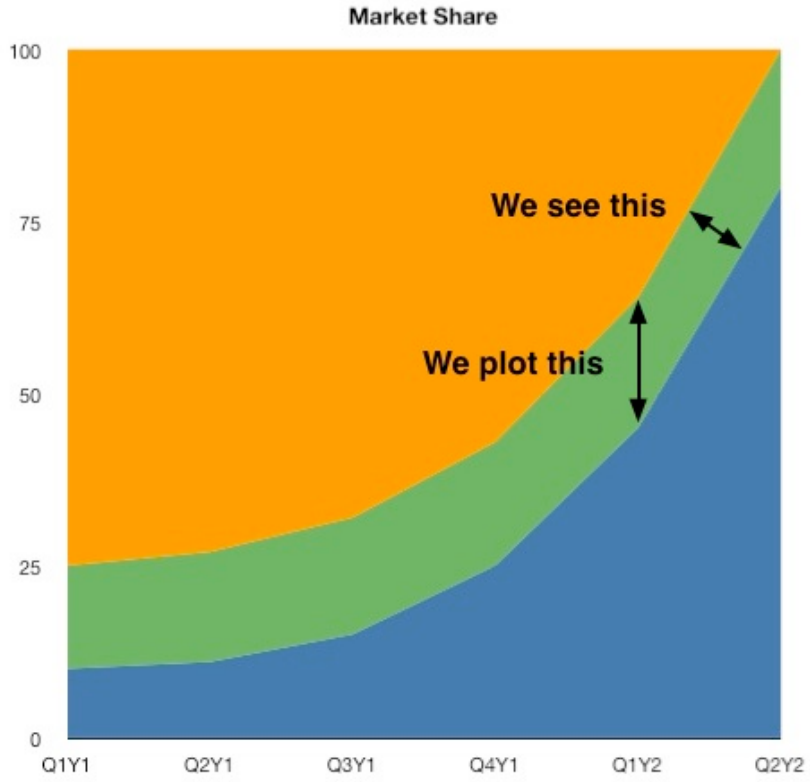
http://bit.ly/PszKw0



http://bit.ly/SFeAwz

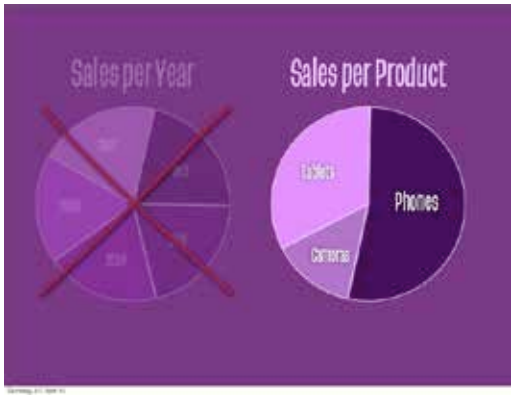
Don’t make users do “visual math.”

People are bad at comparing areas of shapes or judging certain relationships.
If precision is important or data values are very similar, bars may help.



http://www.leancrew.com/all-this/2011/11/i-hate-stacked-area-charts/

http://de.slideshare.net/vis4/making-data-visualizations-a-survival-guide/162



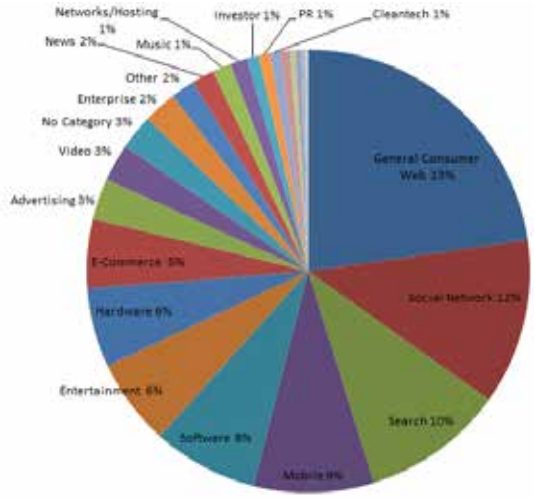
http://de.slideshare.net/vis4/making-data-visualizations-a-survival-guide/25

All the fish in one basket.

Finally, **don't overload the chart.**

Adding too much information to a single chart eliminates the advantages of processing data visually;
we have to read every element one by one!

http://shar.es/CWUiu



http://bit.ly/r3NUCs

Try changing chart types, removing or splitting up data points, simplifying colors or positions, etc.

More on Data Visualization

What kinds of visualizations are out there?
How hard are they to reproduce?

See the Intro to Data Vis LibGuide for general examples and tools/tutorials.

http://guides.library.duke.edu/datavis/

And a couple of great chart make-over posts:

http://thewhyaxis.info/defaults/

http://thewhyaxis.info/gap-remake/

http://imgur.com/WntrM6p

Data & GIS Services

- Data collections, LibGuides, etc.
  http://library.duke.edu/data/
- Blog (tutorials, announcements, etc.)
  http://blogs.library.duke.edu/data/
- Walk-in consultations
  http://library.duke.edu/data/about/schedule.html
  (or by appointment – askdata@duke.edu)
- Perkins 226 computing cluster
  http://library.duke.edu/data/about/lab.html
  (fast hardware, diverse software)
- Additional workshops
  http://library.duke.edu/data/news/
  (listserv – dgs-announce@duke.edu)