Top Ten Dos and Don’ts for Charts and Graphs

February 25, 2014

Angela Zoss (angela.zoss@duke.edu)
Data Visualization Coordinator
Data & GIS Services, 226 Perkins Library

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

[Anscombe’s Quartet](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
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.

(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.  
Do use the full axis.

Maintain consistency.

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.

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://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://onforb.es/MjG84K
Don’t use 3D or blow apart effects.

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

Source: http://blog.visual.ly/2ds-company-3ds-a-crowd/
Color me carefully.
Don’t use rainbows.

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 figures harder to read.

“Rainbow Color Map (Still) Considered Harmful”
D Borland, RM Taylor, UNC-CH

Related: Salience

Rainbows also cause salience problems; some colors in the inner part of the rainbow “pop out” more than colors at the extremes.

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/
Instead of rainbows...

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://www.flickr.com/photos/sadrzy/4154089647/
Fixed it for you...

http://www.wired.com/wiredscience/2013/09/rim-fire-map-color-scale/
Category color choice is also tricky.

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
Category color choice is also tricky.

Categories can have different colors, if they can be easily distinguished from afar.

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

Try to stick with about 6 colors, max.
Category color choice is also tricky.

And remember, some people have color blindness.

http://onforb.es/SvDkFQ
Use http://www.vischeck.com/ to test.
Category color choice is also tricky.

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

Colors to grayscale

http://dx.doi.org/10.1038/nmeth0810-573
More on color.

List of good color resources:

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.

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.


Don’t make users do “visual math.”

http://enb105-2012s-rw.blogspot.com/2012/02/lab-two-mapping-excercise.html
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.
GOOD CHART MAKEOVER EXAMPLES
The Why Axis

Chart remakes: http://thewhyaxis.info/remakes/

Example: http://thewhyaxis.info/defaults/
Storytelling With Data

Visual makeover:
http://www.storytellingwithdata.com/search/label/Visual%20Makeover

Example: http://www.storytellingwithdata.com/2014/02/more-americans-are-tying-knot.html
GETTING HELP
On the web

• Bad examples:
  WTF Viz, http://wtfviz.net/

• Good examples:

• Ask for help:
Data & GIS Services

• Data collections, LibGuides, etc.
  http://library.duke.edu/data/

• Blog (tutorials, announcements, etc.)
  http://blogs.library.duke.edu/data/

• E-mail consultations
  askdata@duke.edu

• Additional workshops (often share files)
  http://library.duke.edu/data/news/
  (listserv – dgs-announce@duke.edu)
More on Data Visualization

See the Intro to Data Visualization LibGuide for general examples and tools/tutorials:
http://guides.library.duke.edu/datavis/

Additional Visualization LibGuides:
http://guides.library.duke.edu/vis_types
http://guides.library.duke.edu/topten
http://guides.library.duke.edu/visualcomm
QUESTIONS? SUGGESTIONS?

angela.zoss@duke.edu
http://twitter.com/duke_vis