

Make It Pretty!

An Introduction to Graphical Post-Processing with Adobe Illustrator

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Quantitative Methods Brownbag

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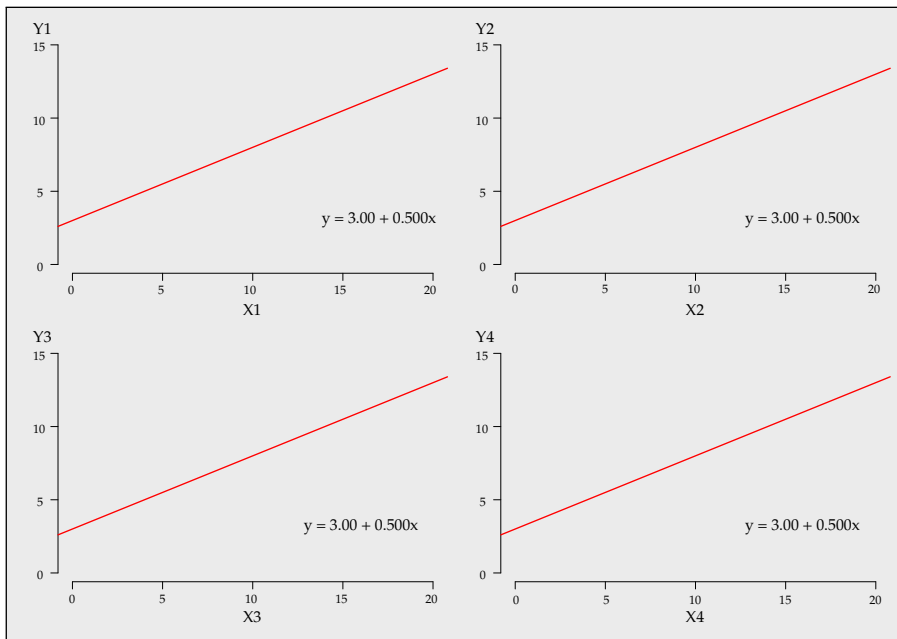
Why Visualize?

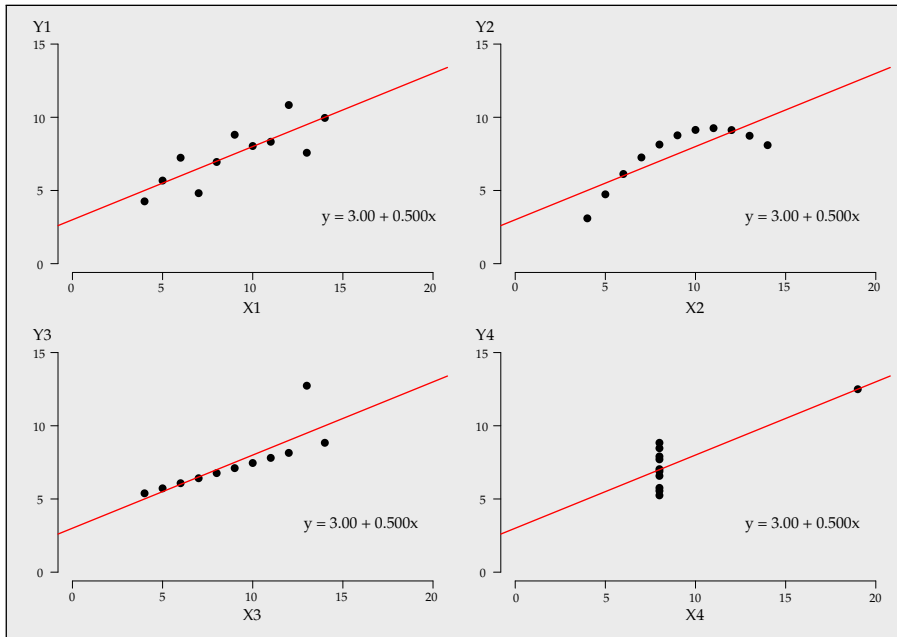
- Looking for patterns and relationships.
- Providing a narrative for the reader.
- Summarize complex data structures.
- Help avoid erroneous conclusions based upon questionable or unexpected data.

Four Sample Datasets

For example, let us look at these four datasets:

	Dataset I		Dataset II		Dataset III		Dataset IV	
	X	Y	X	Y	X	Y	X	Y
	10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
	8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
	13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
	9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
	11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
	14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
	6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
	4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
	12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
	7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
	5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89
\bar{x}	9.0	7.5	9.0	7.5	9.0	7.5	9.0	7.5
s^2	11.0	4.12	11.0	4.12	11.0	4.12	11.0	4.12
r	0.86		0.86		0.86		0.86	





This data was artificially constructed by Francis Anscombe to emphasize the *worst-case scenario*, but the point remains that it is absolutely *vital* for applied researchers to visually inspect their data before attempting to model it.

Tenets of Data Visualization

What makes a good visualization?

- Relevance
- Appropriate Knowledge
- Salience and Discriminability
- Promote Understanding and Memory
- Attractiveness!

Aids in Graphical Interpretation:

- Lead-in Text
- Distinguishable Elements (length, width, orientation, size, shape, enclosure, blur, color hue and intensity, position)
- Non-obtrusive and Meaningful Axes
- Reference Lines
- Annotations
- Source Reference

Brief Introduction to Adobe Illustrator

Beyond, “Well, if it is good enough
for *The New York Times*...”

Brief Primer on Adobe Illustrator

- Programmed for **graphic design**, with precision in mind.
- Available for both Windows and OS X.
- Has **built-in graphing functionality** for simple plots (e.g., bar graphs, pie charts, time series plots).
- Graphics are **vectorized**, rendering them able to be scaled losslessly.
- **Artboards can be expanded** to give more room to work, **or cropped** to remove extraneous margins.
- **SEM path diagrams** can be easily produced.
- **Every element** of PDF output is **accessible** and **manipulatable**.
- **Changes in context!**

TAX RELIEF FOR FAMILIES' BUDGETS

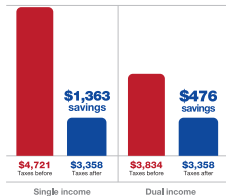
For the last eight years, more new and unexpected taxes and costs have been sprung on us, taking more and more out of the family budget. The HST, health tax, eco taxes, and skyrocketing hydro bills are just some examples.

You have a clear choice in this election. You can vote for more unannounced and undesired tax hikes. If the Liberal government is re-elected they will hike taxes, just like they've done twice before. Or you can vote for change, and for tax relief by voting for the Ontario PC Party and our changebook.

With a debt that will have doubled in just eight years and massive deficits for the next several years, we can't reduce the tax burden as much as we would like. But we can, and will, ease the tax burden with a package of relief.

[income sharing]

\$70,000 in applicable income



We will let families reduce their taxable income through income sharing.

We will change the tax system to allow all couples to share up to \$50,000 of their income for tax purposes. This change is an important step towards recognizing that there really is a family budget. A middle class family, earning \$70,000, could save almost \$1,400 per year in taxable income.

Our income sharing plan builds on the Government of Canada's proposed Family Tax Cut. We're calling on the federal government to implement their tax relief for families at the same time as ours, to give Ontario families more tax relief, more quickly.

[overall tax burden]

Impact of Dalton McGuinty's tax increases



Source: Ministries of Finance, Energy, and Environment

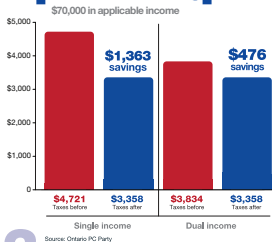
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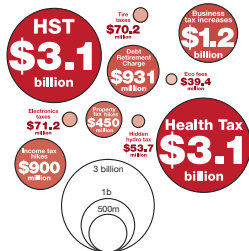
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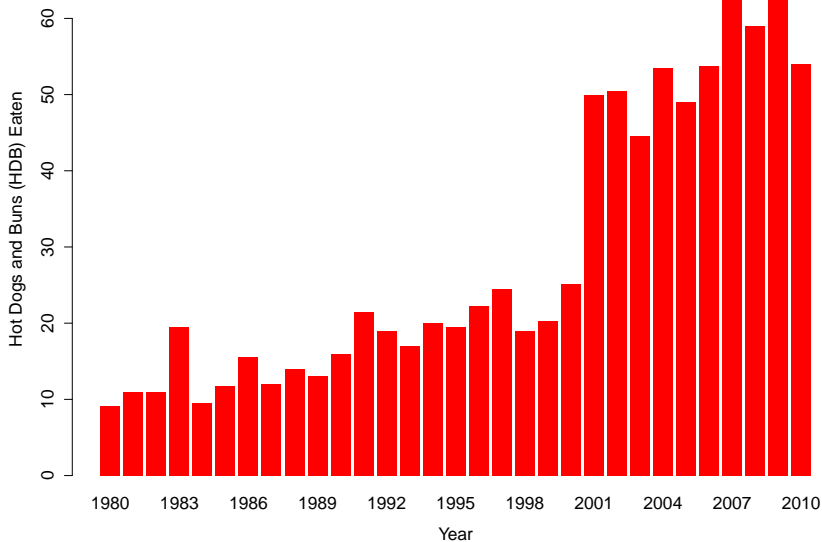
Guidelines for Post-Processing

General Steps for Post-Processing:

- **Create Plot:** In R, typically use the `plot()` and `barplot()` functions.
- **Export:** Save the plot as a PDF (landscape orientation, US Letter sized (8.5" x 11")).
- **Import:** Simply open the PDF file with Adobe Illustrator.
- **Remove Clipping Masks:** Select - Object - Clipping Masks and then press Delete key.
- **Change Artboard Size:** Use the Artboard Tool to give yourself room to work.
- **Post-Processing:** Based upon our knowledge of aids in graphical interpretation and our data, go element-wise through changes to improve the graphic!

Examples

In the following slides, I want to present some of the default plots produced by R and how they could be improved using post-processing techniques.

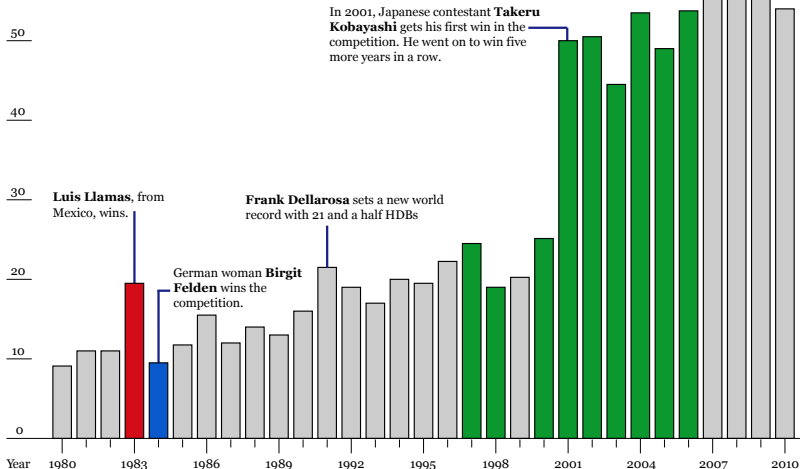


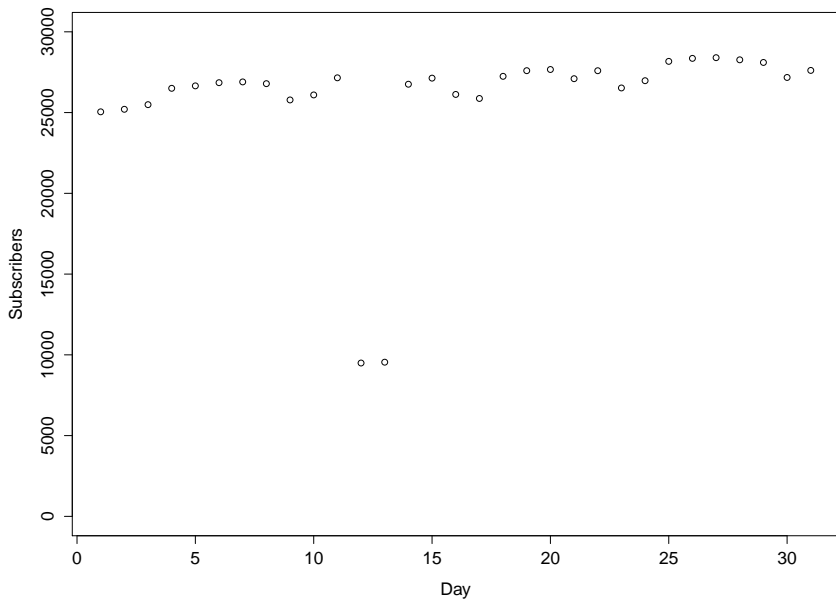
HOT DOG EATING

Nathan's hot dog eating contest every July 4th has been going on since the early 1900s, but it wasn't until 2001 when things got serious. Takeru Kobayashi from Japan raised the bar, more than doubling the previous world record. United States wins are gray, Japanese are green.

For the first time since 1999, an American reclaims the title when **Joey Chestnut** consumes 66 HDBs.

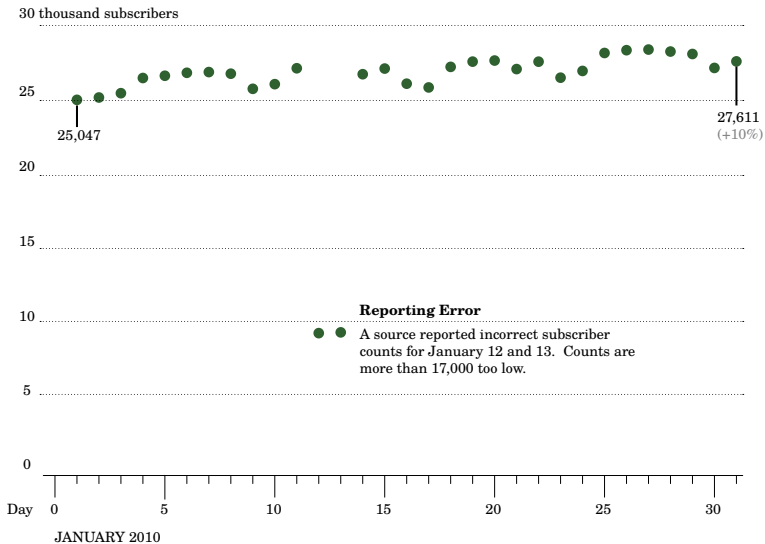
60 Hot Dogs and Buns (HDB) Eaten



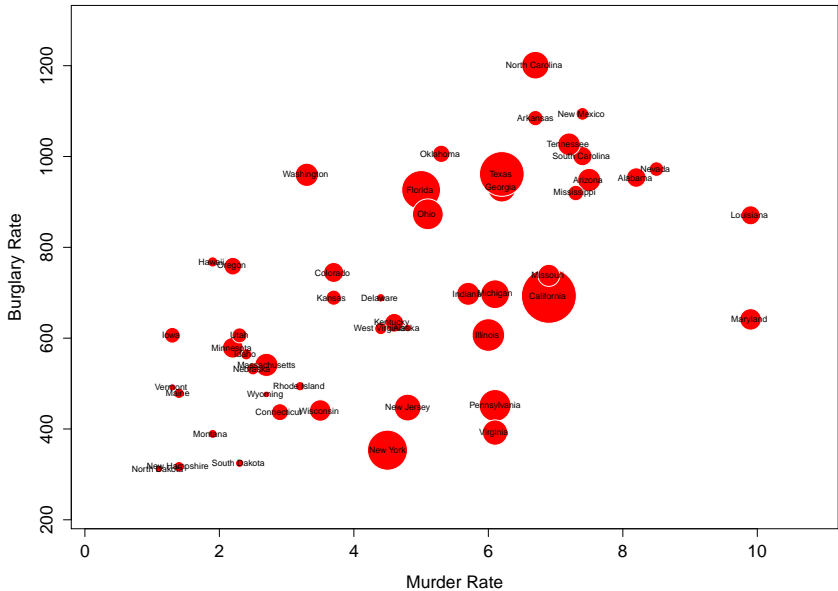


INCREASE IN SUBSCRIBERS

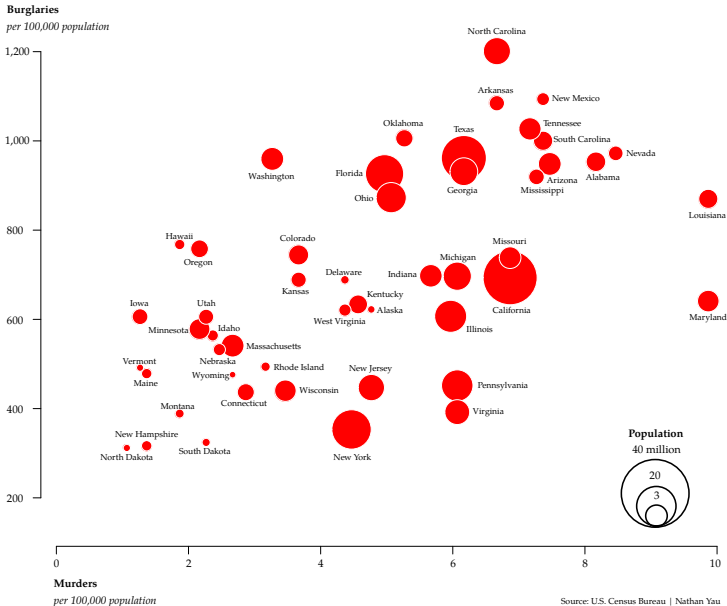
In January 2010, the number of subscribers via RSS and email increased to 27,611, making it the tenth month in a row with at least a ten percent increase.



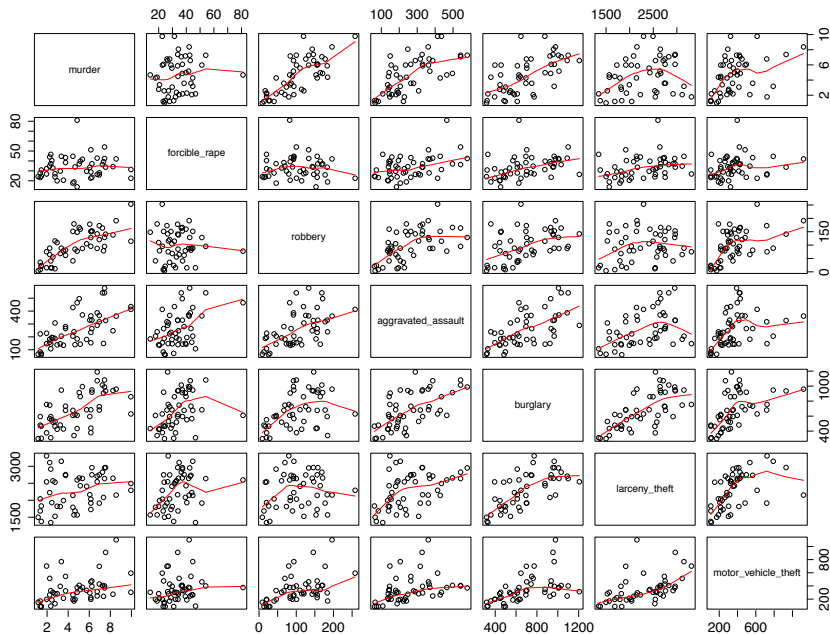
Source: Feedburner | Nathan Yau



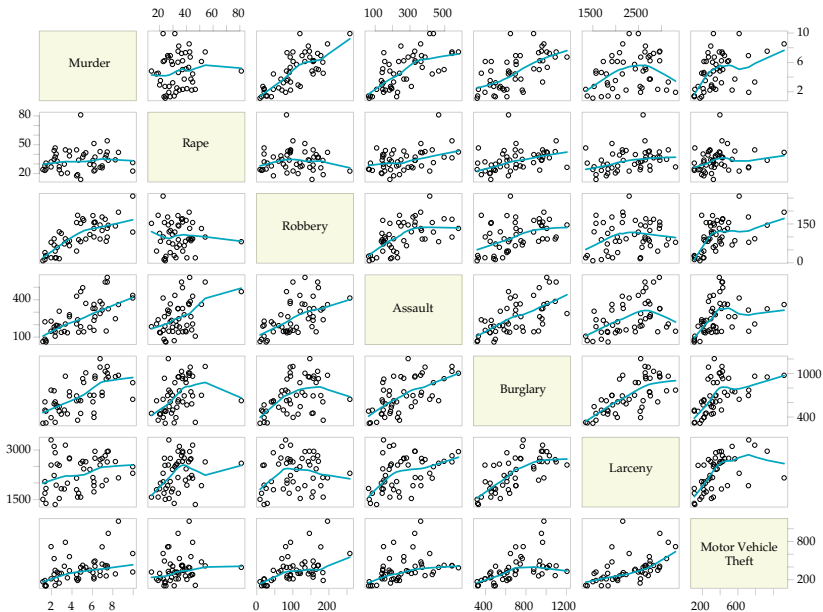
MURDERS VERSUS BURGLARIES IN THE UNITED STATES



Source: U.S. Census Bureau | Nathan Yau



Rates by State per 100,000 population



Working with Adobe Illustrator

Brief Tour:

Illustrator File Edit Object Type Select Effect View Window Help

LIKE PHOTOSHOP CS Live

No Selection Stroke 1 px Uniform - 2 pt. Oval Style Opacity 100 % Document Setup Preferences

Untitled-1* @ 141% (CMYK/Preview)

Context Sensitive Menubar

Useful Menu Items:

- File - Place
- Object - Transform - Transform Each
- Object - Arrange
- Object - Group (Ungroup)
- Select - Object - Clipping Masks
- View - Rulers - Show Rulers
- View - Perspective Grid - Show Grid

Artboard.

Selection Tool

Text Tool

Line Tool

Free Transform Tool

Chart Builder Tool

Artboard Tool

Direct Selection Tool

Align Tool

141%

X : 14.51 px W : 9 px
Y : -8.78 px H : 9 px

COLOR SWATCHES SYMBOLS

C M Y K

APPEARANCE GRAPHIC STYLES

No Selection

Stroke 1 px

Fill

Opacity Default

TRANSPARENCY

Normal Opacity 100 %

LAYERS SEPARATIONS PREVIEW

Layer 1

Tips for Efficient Post-Processing:

- **Making It Straight:** When drawing a line, hold the **Shift** key to ensure it is perfectly straight (or square, or circular, if using the shape tool).
- **Nudge It, Faster:** When nudging an object, hold the **Shift** key to move the object by 10 pixels instead of 1.
- **Change Lengths:** Use the **Direct Selection** tool to double click and drag on a vector end point to make line longer.
- **Recolouring Elements:** Use **shift** and the **Direct Selection** tool to select multiple elements before changing shades.
- **Colour Picker:** Use the **Eyedropper Tool** to select an element colour and apply it to other objects.

Tips for Efficient Post-Processing:

- **Object Selection:** Make use of the [Select menubar](#) to instantly select elements with the same fill or stroke color, blending mode, opacity, or stroke weight.
- **Alignment:** Use the [Align palette](#) box to quickly organize elements (by selection, key object, or artboard).
- **Glyphs:** Use the [Type - Glyphs](#) menu item to add custom symbols (such as Greek letters).
- **Access Sub-Icons:** Many of the icons in Illustrator are [cyclable](#), indicated by a black triangle in the lower right corner. Hold Option (Alt on Windows) and click to cycle through functions.
- **Use the Keyboard:** Many of the functions in Illustrator have convenient [keyboard shortcuts](#). Learning them is one way of making post-processing extremely more efficient.

Quick tip for creating axis tickmarks:

- **Set Scale:** Illustrator's default is **pixels**, can change to inches, centimeters, etc. in the program Preferences - Units.
- **Drawing:** Draw the first tick mark using the **line tool**.
- **Initial Duplication:** Using the **Selection Tool** and while holding the **Option key** (Alt on Windows), click and drag the first tick mark to create and place the second.
- **Subsequent Duplication:** Simply press the **Command and D** keys (Control + D on Windows) to create the remaining tick marks using the spacing you specified in the Initial Duplication stage!



Alternative Software for Data Visualization

Software for Static Graphical Post-Processing

- Inkscape - free, cross-platform, and open-source.
- CorelDraw.
- Raven.
- Gimp / Adobe Photoshop (*not* vector based).

Software for Interactive Visualizations

- The googleVis package in R
- HTML/JavaScript/CSS (Protovis, D3, jQuery, MooTools)
- ActionScript/Flash (Modest Maps library)

References on Post-Processing and Data Visualization

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