

The Power to Show: Using Information and Image to Reveal and Persuade

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Abstract & Introduction

Some TV ads make you remember action and images, but not what was being promoted. The time and attention of the “audience” for your charts are precious, as are your time and effort to create those charts. Software and hardware are power tools, but defaults produce lots of sub-optimal results quickly.

This paper and presentation show: (a) how to design charts to inform and to influence, not to impress, so you can deliver the messages and the meaning in your data with images easily and quickly interpreted, and having memorable *significance*; and (b) how to design charts with overview impact, to accelerate decision-making, and—for situations where it is needed—precise detail, to facilitate reliable decision-making.

My focus is on some guidelines and examples, not code. Take-away knowledge is SAS/GRAPH® applicable, but is also software- and hardware-independent. Learn how to make and to let the information and the image reveal and persuade: customizing for communication, not for decoration.

B. Basic Graphic Guidelines

There is no Section A, only B, W, C, and T.

1. Special Effects are for Movies, 3D is for Three Variables

Good design and interesting data can stand on their own. Omit drop-shadows, clip art, etc.

3D pie charts *always distort* relative size of shares of the whole, defeating the visual communication purpose of pie charts (see Figure 2). 3D bar charts needlessly complicate a simple image, usually making it more difficult to interpret (see Figure 3).

2. For line charts or bar charts, usually start the response axis at zero. Minimize meaningless fluctuations/differences point-to-point, and avoid magnified “growth” or “decline”. Prevent needless questions, and undeserved elation or alarm. See Figures 4 & 5. Note the desirable near-flatness of the upper chart in Figure 4—the variation over twenty-two years was less than ten

percent. (But, of course, when the fine structure of a chart is really important, devote all the available space to the actual data range.)

3. Remove axis clutter. (See all custom charts.)

Turn off axis lines—they tell nothing. Turn off tick marks. Label (invisible) tick marks sparingly. If not turning off axis labels, supply your own, but not to state the self-evident (e.g., that dates are dates). Annotate plot points and ends of bars.

3. Use Sparse Annotation. (See Figure 4.)

Annotate y-values for the critical points of a plot line, and label only corresponding (invisible) x-axis tick marks. For a crowded or crossing multi-line plot, put critical point values in the legend. The *critical points* are start, end, maximum, minimum, and points at which the rate of growth or decline persistently changes.

4. Use area fill wisely, if at all.

Omit area fill on line charts and on radar charts. On simple bar charts, omit area fill; but use light gray if bars are close together. When fill is really needed, use solid colors or grays; use parallel lines or cross-hatching only in desperation.

5. Rank data with descending/ascending bar or pie charts. (See Figures 2, 3, & 6.)

6. To rank shares of the whole when numerous, use an Annotated Ranked Horizontal Bar Chart.

When the shares of the whole are too numerous or too small, there is not room to display pie slice name, value, and percent of whole. (See Figure 6.)

7. Use the powerful Pac-Man Pie Chart to summarize shares of the whole into two. (See Figure 1.) The idea of a two-part pie chart may seem trivial, if not silly. However, when the share of interest to your message is either tiny or huge, the image is very “impactful” and, therefore, memorable. If needed, supply details for “Other” with a table below the pie chart. Do not blunt the message by splitting the big wedge into little ones that may be as small as or smaller than the wedge whose smallness you are emphasizing.

W. Web Design

Dilbert (Scott Adams' cartoon character) said, "I made a study of Internet use in the workplace. I found that the time spent waiting for web pages to load has wiped out all the productivity gains of The Information Age."

1. Keep your image simple. Simple loads faster. And never underestimate power of simplicity.

2. Use browser-safe color. For what this means, see Section C (on Color).

3. Can they read it? Verify that the text parts of your image will, in fact, be readable by other people who web-browse your image. A graphic image accelerates decision-making; text-borne details may be essential to decision reliability. For more about text, see Section T (on Text).

C. Communicate with Color

1. For those who can't see the color difference, there is no color difference.

Always remember this fact about color—the commonest form of color blindness cannot distinguish red and green, which is a frequently used color combination in the USA. Prof. Jay Neitz of the Eye Institute of the Medical College of Wisconsin: 8 to 10 percent of American males have some form of color blindness, but, due to genetic differences, only about 0.5 percent of females.

2. Color does not improve bad design.

Use color to communicate, not to decorate. So,

- No response levels/categories, black & white
- Few levels or categories, gray shades maybe
- Many levels or categories, color necessary

3. Beware of SAS® Predefined Color Names.

There are almost 300 of these, listed in Table 7.2 in both the Version 6 and the Version 8 edition of the SAS/GRAPH manual. They have English language names or abbreviations, such as "VIOLET", or "LIV" for "Light Violet" (where "Light Violet" itself is not an assignable value). There's a problem. Many names are misleading. If you display or print VIOLET and LIV, you will see that Light Violet is darker than Violet. There are other contradictions like this, such as PINK and LIPK (Light Pink). Furthermore, many of the predefined colors are too dark to be useful. Even in Version 8 these problems are not fixed. In fact, in Release 6.12 some colors were changed (e.g., GREEN), but not always for better (more about Green later). The

new VIOLET, like the old, is lighter than LIV, but the new VIOLET is not Violet, for which any reasonable standard is the color of the flower. The new PINK is a better Pink, but, unlike the old (which was actually a non-Pink), is lighter than Light Pink. To make wise color choices, create samples and pick yourself a palette. Here's an easy way to make color samples:

```
proc gslide;
note f=SWISSB c=black `C=PINK'
c=PINK h=5 move=(+0,-1) `03'X;
note f=SWISSB c=black `C=LIPK'
c=LIPK h=5 move=(+0,-1) `03'X;
run; quit;
```

4. What are "browser-safe" colors?

Well, unlikely as we may think it, there are people out there with monitors or video cards that are limited to 256 colors. How many I don't know. Unless sure of your entire audience, you should design for the lowest common denominator. To deal with this problem, web browsers determine the limits of the video display, and, if needed, remap colors. All web browsers agree on a universal common subset, which all support.

There are 216 "browser-safe" colors. They are RGB colors, with odd names, in the SAS/GRAPH language, of the form CXrrggbb. The browser-safe RGB colors restrict rr, gg, and bb to six values 00, 33, 66, 99, CC, and FF. (6 X 6 X 6 = 216.) When a browser detects a color outside this set on a web page to be displayed on a 256-color monitor, it remaps the color to a browser-safe one. Any color that is already browser-safe displays as expected.

All SAS predefined colors have RGB equivalents, but only seven are among the safe 216 values. (GREEN used to be, but despite the listed RGB value in the manual, it was changed in Version 6.12, and is now unsafe—ironic, since true green is one of the RGB primaries, Red, Green, and Blue.)

See Figure 7 for examples of browser-safe colors. White samples are due to a coding convenience in the macro used to make the charts, not an attempt to be weird. The basic browser-safe colors are Red (CXFF0000), Yellow (CXFFFF00), Green (CX00FF00), Cyan (CX00FFFF), Blue (CX0000FF), Magenta (CXFF00FF), Black (CX000000), and White (CXFFFFFF). The upper chart in the figure is the only easy way for RGB colors to vary lightness for constant hue. The lower chart shows small sets of varied lightness, plus Purple. It is much easier to vary lightness using the HLS color system, but which HLS colors are equivalent to browser-safe RGB colors is unknown to me at this time.

T. Text Is For Reading

0. Pulitzer's First Rule for Journalists:

"Make it brief so that they will read it."

1. Make your graph title your headline. You are using the graphic image to persuade and/or reveal. Don't be reluctant to tell the viewer what you know or think it means.

2. Sparse Text makes the graph talk. Be sure every letter or number in the graph *must* be there. Superfluity detracts from emphasis.

3. Use high contrast (e.g., our old friend Black on White). On light backgrounds, colored text must be sufficiently thick. Never use Yellow on White.

4. For emphasis, usually use **Bold**, *Italic*, Underline, or ALL CAPS, not color. If using ALL CAPS for emphasis, use it SPARINGLY. ALL CAPS is hard and slow to read. To verify this, prepare, and read, a long paragraph in ALL CAPS.

5. Check your SAS log for messages that the ugly SIMULATE font has been substituted for your requested font. (Unfortunately, you are not always notified. Why not?) Fix the problem, if you can. A common error is a misspelled font name, in which case the SAS log notifies you of substitution. For a sample of this font (or of any other SAS/GRAPH font specified with name=), use:

```
proc gfont name=SIMULATE nobuild
  SHOWROMAN HEX H=2; run; quit;
```

Wherever you use f=NONE in your SAS/GRAPH program, the device driver uses its default font. If you also specify a height other than one cell (i.e., not h=1), then SIMULATE will be used, but you will not be notified. Be aware that some drivers (e.g., the EMF driver I use to create graphs to be INSERTed into my word processing documents) do not have a default font—SIMULATE is used without notification. See *default graphs in Figures 3 & 5*. GOPTIONS SIMFONT= assigns the default font. The software as shipped has this as SIMULATE.

6. Set defaults with FTEXT, HTEXT, CTEXT.

7. We are fortunate to have access to Windows TrueType fonts in Version 8. Best fonts include: Rockwell (serif—used for this paper, my readability favorite because it's the only elegant serif font, since the loss of Clarendon, that is thickly drawn along the entire contour of every character); Courier New (fixed width—essential when you need columns of numbers to line up); and Matthew Carter's creations designed for readability on the screen

and the web, Verdana (sans serif—useful for small letters and numbers on your graph) and Georgia (serif—useful for titles, prominent footnotes, etc.). Note that the prior sentence uses each font when discussing it. See if you can determine how each of these fonts has been used in the Figures.

Author Information and Related Work

If you have suggestions, comments, questions, etc., or if you want a bibliography, talk to me.

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Born to See, Meant to Look
- Goethe

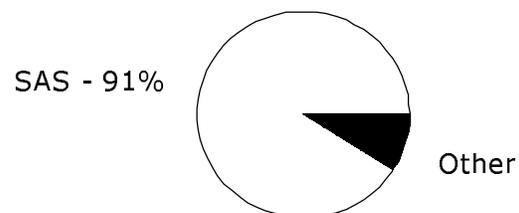
Since 1987 I have been talking about graphics, SAS/GRAPH, and SAS application development matters. The earliest SUGI presenter on graphic design was Chris Potter, who encouraged me. Content for this paper is from a book in preparation, which will offer guidelines, examples, and macros for best practices with SAS/GRAPH. At SUGI, see also my poster about PROC GMAP.

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Figure 1. Pac-Man Pie Chart

Mainframe Data Analysis Software
Market Shares



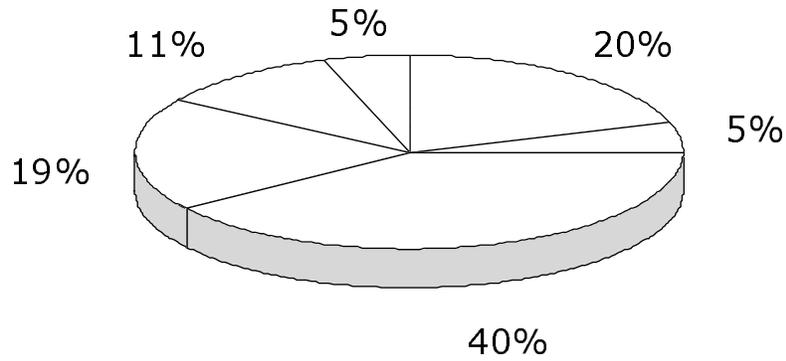
Source: Computer Intelligence, 1993

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The Power to Show

Figure 2. Comparison of 3D and 2D Pie Charts

3D Pie Chart Always Distorts Apparent Relative Size



2D Pie Chart Always Presents Accurate Relative Size
Descending Pie Chart Shows Them What's Important

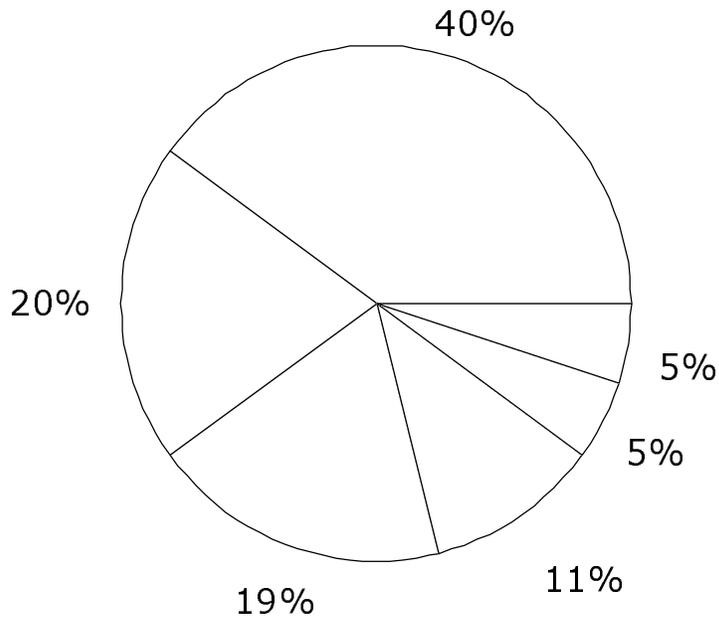
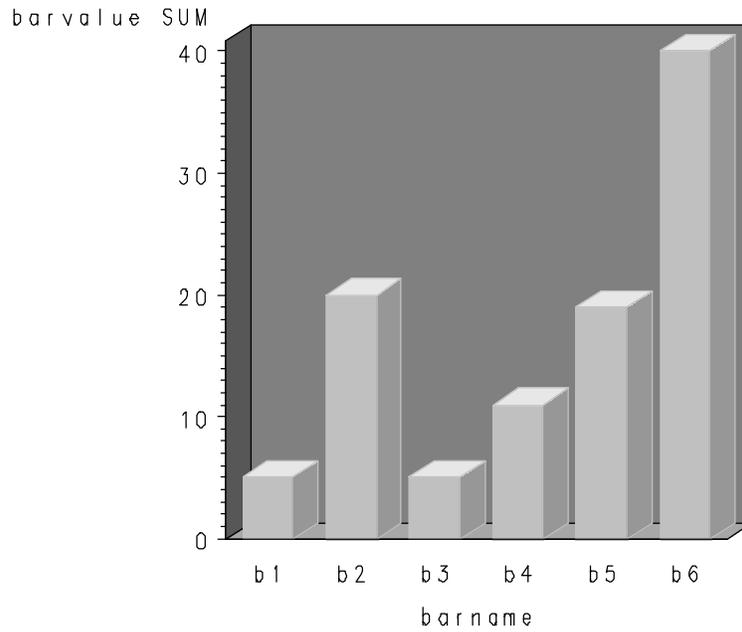


Figure 3. Comparison of 3D and 2D Bar Charts

Default 3D Bar Chart Unnecessarily Complex and Harder To Interpret



Optimized 2D Bar Chart Shows Them What's Important

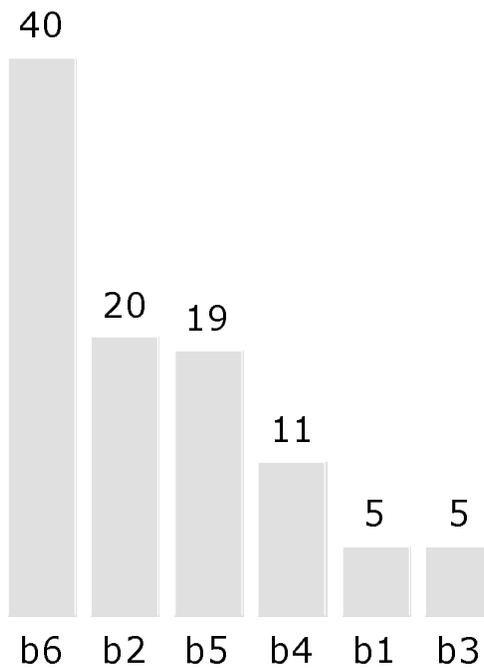
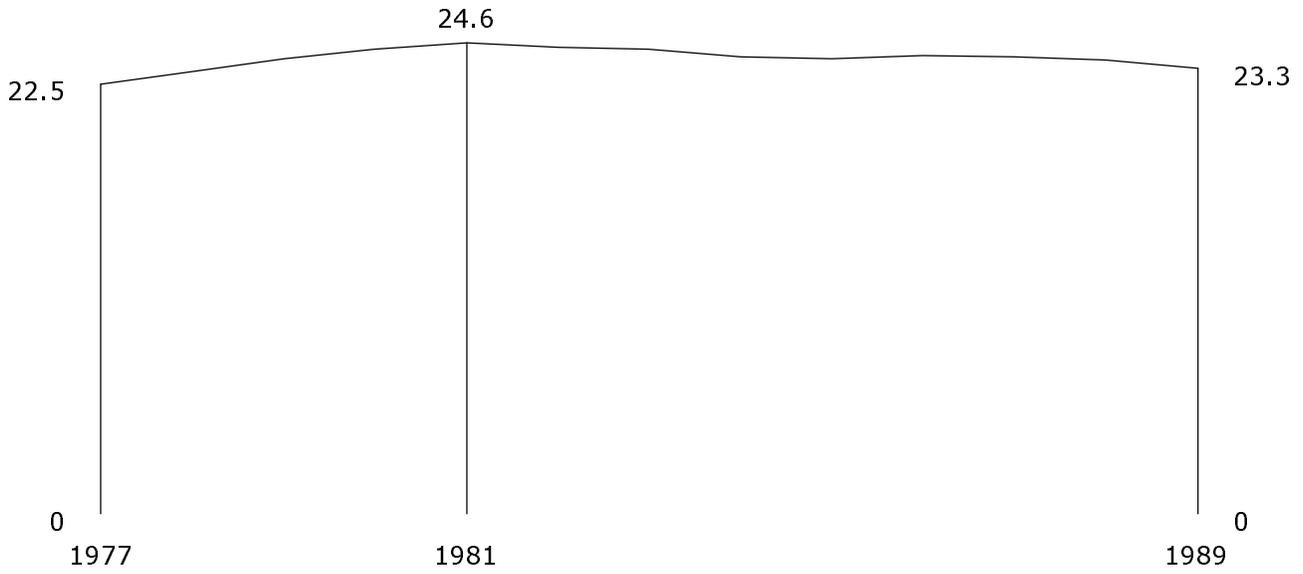


Figure 4. Sparse Annotation: Focus on Critical Points

Annual U.S. Beer Consumption Peaked in 1981
Gallons per Capita



Annual Miller Lite Production Growth Slowed in 1981
Millions of Barrels

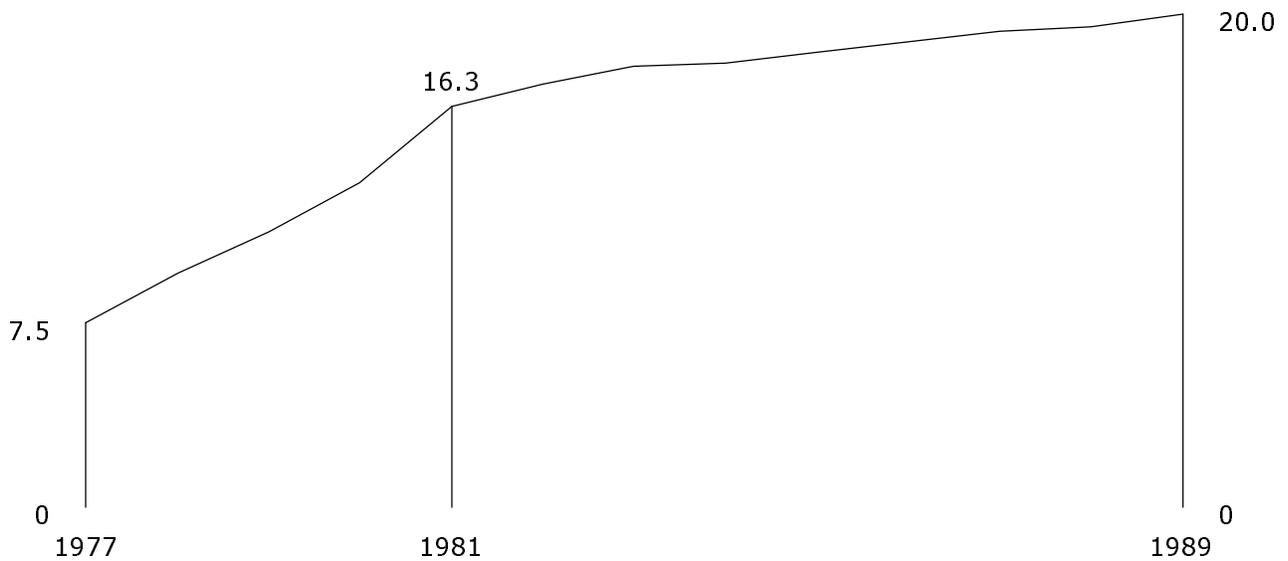
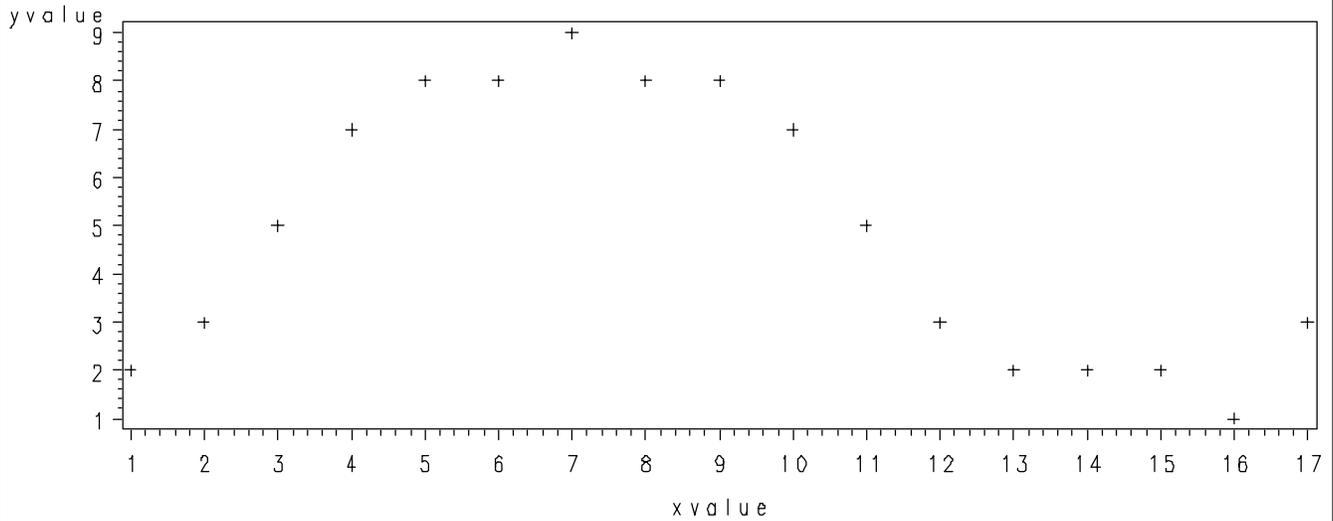


Figure 5. Trend Chart - Default vs. Custom

Default Plot of all fourteen possible 3-point / 2-segment trend changes:
 up-steeper, up-same-slope, up-less-steep, up-flat, flat-up, up-down, down-flat, flat-down,
 down-steeper, down-same-slope, down-less-steep, down-flat, flat-flat, and down-up



Reliably Collision-Free Annotated Plot Using My Custom TRNDANNO Macro

Version 8 SAS/GRAPH has a POINTLABEL option for automatic annotation, but can suffer line-value collisions in some cases (e.g., for displays in small areas such as a quarter-page).
 %TRNDANNO does Full Annotation, Sparse Annotation, or Selective Annotation for a list of x-values.

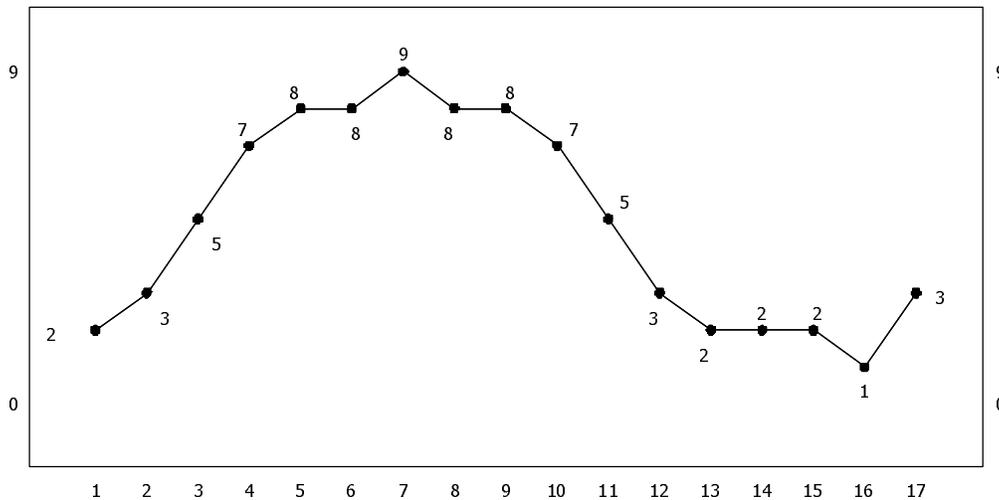
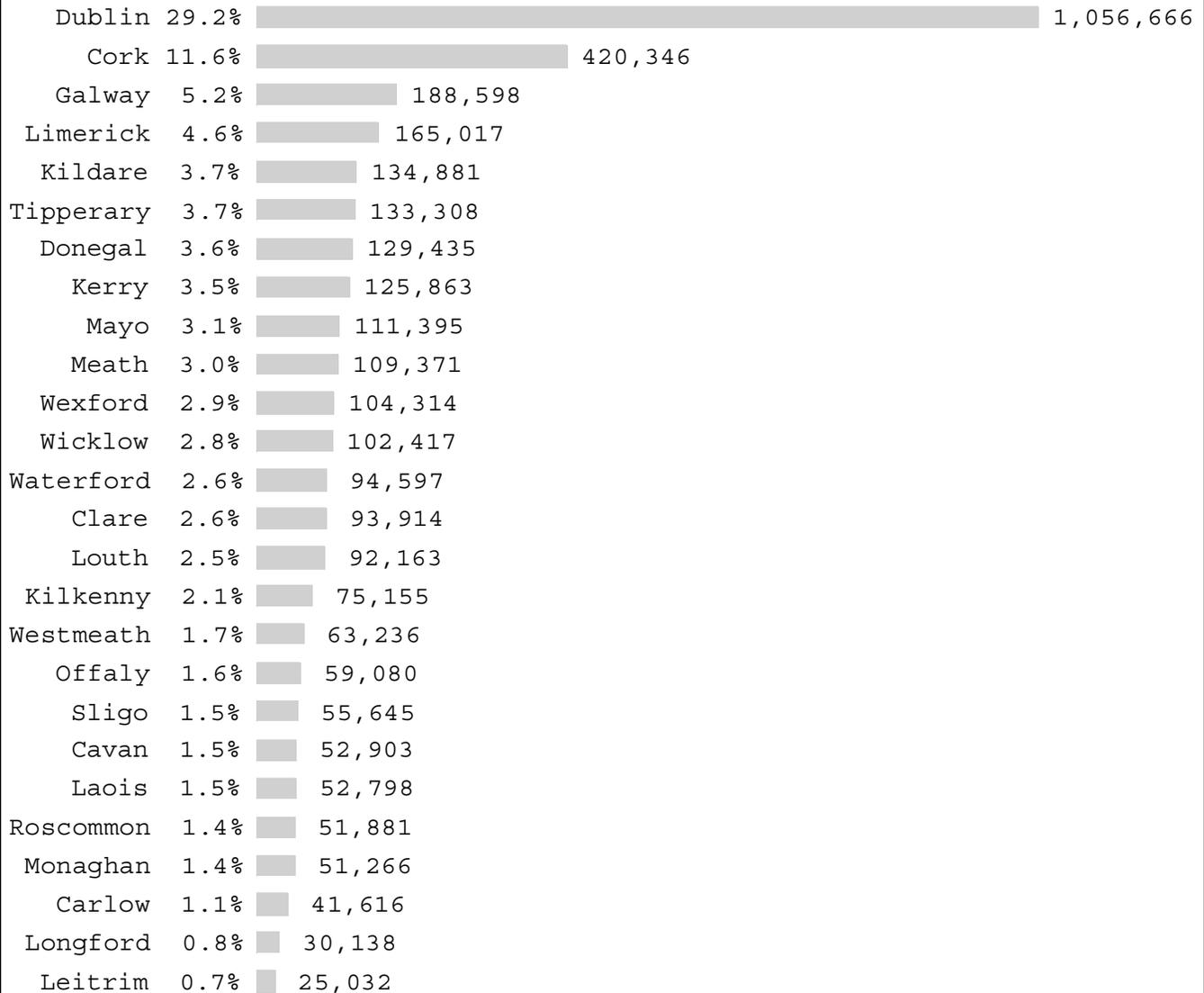


Figure 6. Ranked Bar Chart with Percent of Whole

Distribution of Population by County in the Republic of Ireland

County, Percent of Total Population, and Population



Total All 26 Counties = 3,621,035

Figure 7. Some of the Browser-Safe Colors

Shades of Basic Safe Hues with RGB Codes, Including White (CXFFFFFF)



Not all shades of the same hue are easily distinguishible

Other Safe RGB Colors

