

## Eye-catching graphics with the Google Charts API

# WEB GRAPHER

The Google Chart API lets you draw custom graphs, charts, maps, and barcodes through a simple web interface. **BY MARTIN STREICHER**

If a picture is worth a thousand words, a chart must be something akin to a novella. With just a glance, a chart can convey the state of the stock market, a trend in website traffic, the distribution of voters by county, and how monies are allocated in a household budget. Additionally, a chart is simply more memorable than a large table full of numbers.

Oddly, though, very few websites use charts to great advantage, largely because creating a chart requires unique programming and specialized, server-side software to render data. For example, if your site is based on PHP, you must install pChart [1] (or an analog), add the GD graphics library, and write code to produce a graphic of any kind. Ideally, any contributor – an editor, a writer, or a user adding comments – should be able to create and embed a chart.

Indeed, dynamism, simplicity, and convenience are at the heart of the Google Chart application programming interface (API) [2], perhaps more accurately described as software as a service (SaaS). Simply craft a parameterized URL in the form `http://chart.apis.google.com/chart?parameter1&parameter2&parameterN` and let Google Chart do all the heavy lifting. Google Chart lets you render six kinds of charts, a Google-o-meter, a QR code (a kind of barcode),

and maps, and you can specify a googol of customizations, such as bar color, background color, legend, and more.

In this article, I'll help you get started with Google Chart. You'll learn how to draw charts and how to add special effects to improve your graphic creations.

### Charting 101

To generate a chart with Google Chart, provide the prefix `http://chart.apis.google.com/chart?`, the chart type (such as pie or line), the size of the chart, your data, and any chart-specific parameters, such as colors and axis labels, to tailor the final result.

All chart options are set with *key = value* pairs. Some keys are common to all charts, whereas others are unique to a specific chart type. The syntax for the *value* specified in the pair tends to vary by chart type.

Chart size is measured in pixels and specified with the parameter *chs = WxH*, where *W* is the width and *H* is the height. For instance, *chs = 200x100* generates a chart 200 pixels wide and 100 pixels high. (The area of a map cannot exceed 440 pixels wide by 220 pixels high. For all other charts, width or height cannot exceed 1,000 pixels, and the maximum area is 300,000 square pixels.)

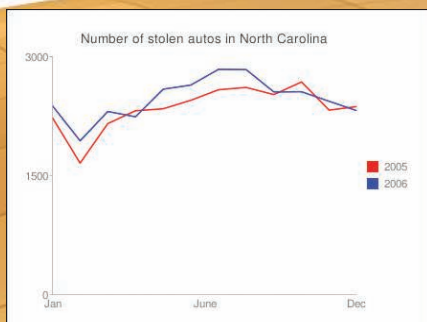
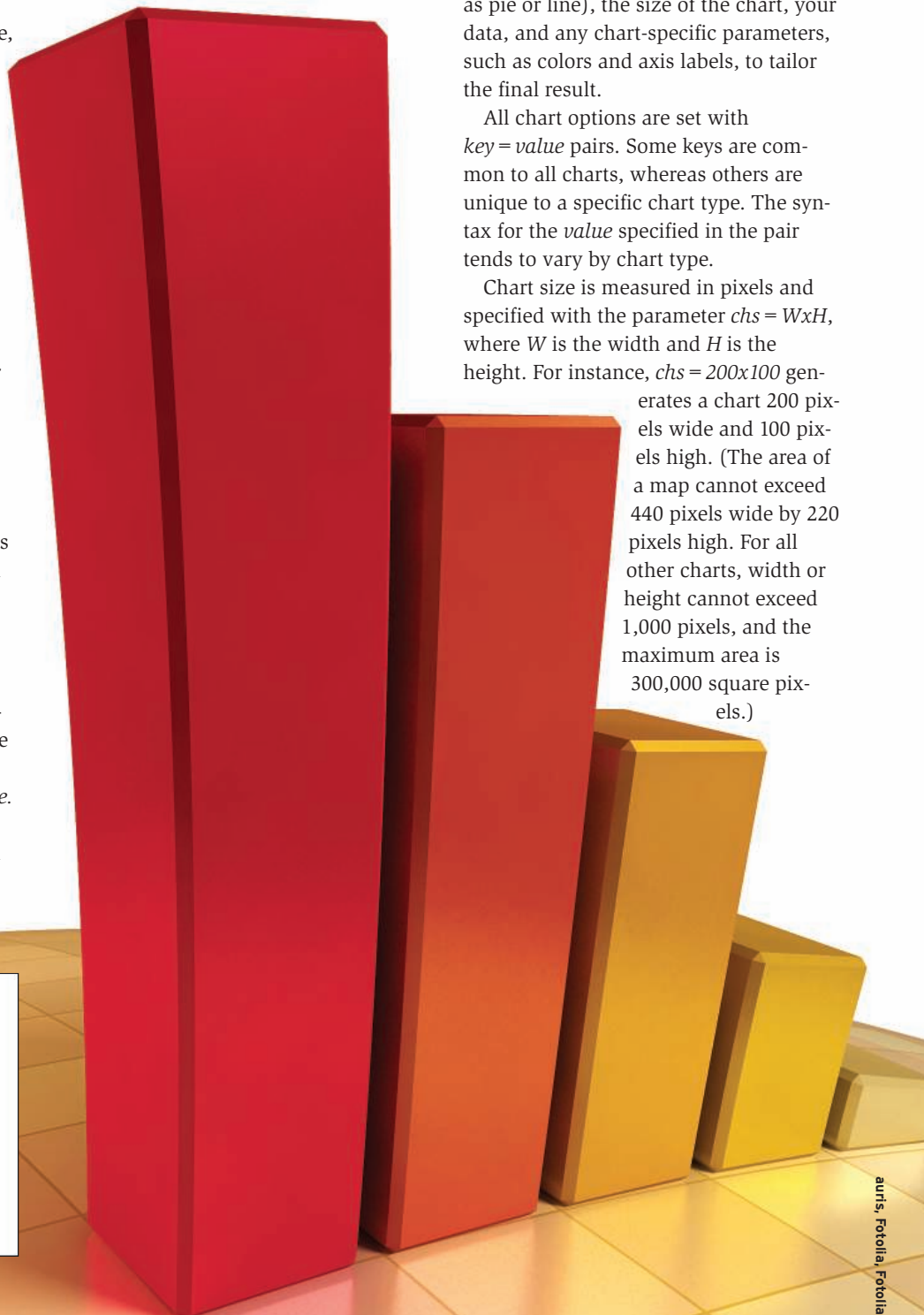


Figure 1: A sample line chart generated by the Google Chart API.



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Chart type is chosen with *cht = type*, where *type* is one of several pre-defined constants. For example, to draw a simple line chart with equidistant points on the *x*-axis, specify *cht = lc*. For each chart type, you can find the appropriate constant in the Google Chart documentation.

Chart data may be provided in several formats – from a simple list of raw data, to a collection of alphanumeric codes to map values onto a predefined scale. Typically, a raw data set is a comma-separated

### Listing 1: Auto Theft Trends in North Carolina

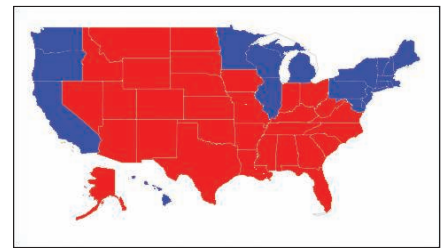
```
01 http://chart.apis.google.com/chart?
02 cht=lc&
03 chtt=Number of stolen autos in
   NC, by month and year&
04 chs=400x300&
05 chd=t:2231,1658,2156,2318,2343,24
   50,2583,2612,2522,2681,2326,2371|
06      2381,1939,2309,2242,2590,2642,2
   840,2837,2555,2558,2437,2319&
07 chds=0,3000&
08 chco=FF0000,0000FF&
09 chdl=2005|2006&
10 chxt=x,y&
11 chl=0:|Jan|June|Dec|1:|0|1500|30
   00|&
12 chxp=0,0,50,100|1,0,50,100
```

arated list of values, and an encoded data set is a contiguous string of alphanumeric characters. For instance, to provide data as plain text, use `chd = t:values`, where *values* is a comma-delimited list of positive floating-point numbers between 0 and 100. The `_` (underscore) may be used as a placeholder for a missing datum. Multiple data sets are delimited by the `|` (pipe or vertical bar).

To demonstrate, open a browser and type the URL `http://chart.apis.google.com/chart?cht=lc&chs=500x400&chd=t:7,3,9,2,0,7,9|15,15,18,11,0,16,12&chco=FF0000,00FF00` into the address bar. As you might guess, the *chco* parameter lists RGB values to color each data set.

Figure 1 shows another example of a line chart, including labels. The URL used to generate the chart is shown in Listing 1. (Each URL shown in this article intentionally spans several lines for better readability.)

Briefly, *chtt* provides the chart title. The data is provided as raw values expressed in simple text, but because the values are larger than 100, *chds* provides a minimum and maximum value to normalize the data to a percentage. (Here, because the two data sets are within the same range, one minimum and maxi-



**Figure 2: The division of red (Republican) and blue (Democratic) states in the 2004 United States presidential election.**

imum value suffices for both data sets. However, if each of your data sets is drawn from a unique range, provide a minimum and maximum value for each set.) The *chxt* parameter is combined with *chxl* and *chxp* to create and position the axis labels.

And believe it or not, drawing a chart is that simple! To embed a chart in a

### Listing 2: Red and Blue States

```
01 http://chart.apis.google.com/chart?
02 cht=t&
03 chtm=usa&
04 chs=440x220&
05 chco=FF0000,0000FF,0000FF&
06 chld=CACTDEDCHIILMEMDMAMIMNNHNJNY
  ORPARIVTAWAI&
07 chd=s:AAAAAAAAAAAAAAAAAAAAAAAAA
```

## Google Chart Tricks and Tips

The following tricks and tips will make your charts more readable:

- Be sure your chart size is wide enough to display the title, labels, and legend. Unfortunately, determining the minimum proper width is not algorithmic – you might need to use a little trial and error.
- To alter the color and size of text in the chart title, use *chts=color,fontsize*. Also, you can change the color and font size of an axis label with *chxs*. Unfortunately, you cannot specify the typeface.
- The four axes are *x*, *t*, *y*, and *r*, shorthand for bottom *x*-axis, top *x*-axis, left *y*-axis, and right *y*-axis, respectively. If you want multiple labels for any axis, repeat the axis name in the *chxt* parameter and specify its details in *chxl*.
- Read the Google Chart API documentation carefully and pay particular attention to the syntax of each option. Even one typo can render a chart unreadable. For instance, the *chd* parameter uses the vertical bar to separate each set of data, yet *chds* does not. Unfortunately,

this is not the only inconsistency in the Google Chart API (the clipping of bar charts is another), so keep the manual close by.

- In the past, a bar chart with negative and positive values required hacks to render properly. Now you can use the *chp* parameter and a percentage to place the zero line a proportional distance from the origin on the *y*-axis. Values must then be interpolated to be rendered properly. For example, assume that cash flow in your company was (in millions) -20, -5, 1, 3, 10. To place the zero line at 0.5, or half-way up the *y*-axis, values less than 50 will be drawn “below the line,” values of 50 “on the line,” and all other values up to 100 “above the line.” To normalize the data, add 50 to all values and plot the new values.

```
http://chart.apis.google.com/chart?
cht=bvg&
chs=400x400&
chbh=40.5&
```

chd=t:30,45,51,53,60&

chp=.5&

$$chm=r,000000,0,.495,.5$$

Figure 5 shows the finished chart.

The *bvg* parameter is the constant for the vertical bar chart type, and *chd* expresses the normalized data set. The *chp* parameter places the zero line halfway up the y-axis, whereas *chm* is an option to draw a range marker on the chart. Its parameters (in order) are *r*, for a horizontal marker; *000000* to draw the marker in black; *0*, which is ignored; and *.495* and *.5* to express the bottom and top margins of the range marker as a proportion on the y-axis. Because the zero line is placed at 0.5, *.495* and *.5* draw a hairline at zero.

The *chbh* parameter specifies the width of a bar and the space between each bar. Unlike other chart types, if *chbh* is too large and *chs* is too small, some of your chart is clipped. Be sure to adjust one or both of these size parameters when drawing a bar chart.

web page, use an *img* tag and set its *src* attribute to the URL of the chart. Provide a description of the chart in the *alt* attribute.

## Map Maker

Drawing a map with the Google Chart service is as simple as drawing any other chart:

First, specify the map chart, select a region of the world to draw, then associate data with

each country, province, or state found in the map. Data can be discrete – say, to represent blue or red states in the United States – or continuous. Furthermore, you can associate a color with the minimum and maximum in a range and Google Chart renders intermediate values in graduated colors.

For example, Listing 2 generates a map of the United States, showing how states voted in the 2004 presidential election. Figure 2 presents the result.

In Listing 2, *cht = t* selects the map chart, *chtm = usa* chooses the United States as the region, and *chs = 440x220* draws the largest map possible. In the map chart, *chco = FF0000,0000FF,0000FF* specifies the default color of each state (red), and the beginning and end color (both blue) of the gradient.

The *chld* parameter contains the two-letter state code of each of the states won by the Democratic presidential candidate. Finally, *chd = s*: selects the simplified data encoding scheme, wherein all values must be represented by one of A-Z, a-z, and 0-9, where A is the minimum and 9 is the maximum. In other words, the simplified encoding scheme provides a granularity of 62 distinct values. Given that all states are colored red by default, any state with any other value – here, A – is colored blue.

Google Chart provides additional maps for Africa, Asia, Europe, the Middle East, South America, and the entire globe.

## Swap Barcodes

In trendy Japan, kids share contact information in a

truly digital fashion: they swap barcodes. And now you can, too. Google Chart provides an API to encode up to 4,296 characters in a two-dimensional, monochrome glyph called a QR code.

To begin, I'll encode my email address in a QR code. Listing 3 shows how the image in Figure 3 was created.

When you use the QR code chart, *choe* specifies the text encoding. The *chld* parameter dictates the amount of error correction provided in the image. (Q embeds enough duplicate information that 25 percent of the QR code

can be destroyed without affecting readability.) *chl* is the text to encode, typically provided as a URL that is then interpreted by an application.

If you have a cell phone, you can download BeeTagg [3] for free, take a picture of Figure 3, and decode the results to send me an email message. (As an alternative, Google offers a free QR code reader library called Zebra Crossing [4][5] and an experimental online barcode reader that interprets images you upload.)

A QR code can capture up to 4,296 characters. Figure 4, for instance, encodes an entire vCard.

## Chart Your Heart Out

The Google Chart API is simple to use and easy to integrate into web applications. As shown here, you can use the API immediately – just embed a static link in your web page and let the browser request and render a chart each time the page is drawn.

To speed page rendering, you can request and cache the chart image on your own server, recreating the chart only when the underlying data changes. In addition to providing better efficiency, this technique better protects your raw data. A visitor



Figure 3: The author's email address captured in a QR code.



Figure 4: An entire vCard represented as a QR code.

### Listing 3: Contact Information in a QR Code

```
01 http://chart.apis.google.com/chart?
02 cht=qr&
03 chs=200x200&
04 choe=UTF-8&
05 chld=Q&
06 chl=mailto:martin.streicher@gmail.com
```

to your site cannot “View Source” and copy the URL.

Of course, you can also mix the Google Chart API with AJAX techniques to modify charts on the fly in response to user input. Chart Maker [6] is a basic but effective demonstration of dynamic charting; others have used the Google Chart API to implement a loan calculator

and executive dashboards.

Of course, Google Chart is often slower than charting tools that run on the desktop, such as Apple Numbers or Microsoft Excel. These latter applications use native drawing engines and do not require an Internet round-trip to transmit data and download a large graphic image. However, Google Chart is a free application

that is available from anywhere. If you are serious about using Google Chart in a production setting, pre-flighting and caching can greatly improve response time. ■

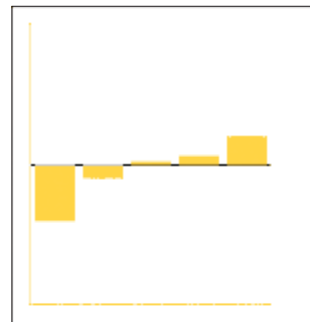


Figure 5: Rendering positive and negative values in a bar chart.

### INFO

- [1] The pChart graphing framework for PHP: <http://pchart.sourceforge.net/>
- [2] The Google Charts API documentation: <http://code.google.com/apis/chart/>
- [3] BeeTagg: <http://www.beetagg.com/>
- [4] Google's free Zebra Crossing barcode reader library: <http://code.google.com/p/zxing/>
- [5] A guide to encoding data in QR codes: <http://code.google.com/p/zxing/wiki/BarcodeContents>
- [6] A simple Google Chart generator: <http://almaer.com/chartmaker/>
- [7] The JFreeChart charting library: <http://www.jfree.org/jfreechart/>