

Paper SIB-112

Ride the Wave – Using Waterfall Graphs to Easily Depict Gaps between Starting and Ending Values

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ABSTRACT

The Waterfall graph is an innovative way of displaying data graphically to allow the viewer to quickly see what categories are contributing to differences in starting and ending values. The Waterfall graph is deceptively easy to create using SAS/GRAPH® and is understood by audiences everywhere. This type of graph is growing in popularity and an example appeared in *The Wall Street Journal*. At HMC, these graphs are used primarily to demonstrate where cases leave the process between identification and member engagement. The Waterfall has proven to be a useful tool that allows the viewer to quickly determine areas of impact within a process to allow him/her to narrow his/her focus. The examples in this paper are not specific to the healthcare industry and demonstrate how Waterfalls can be applied to other industries as well.

Keywords: Waterfall graphs, SAS/GRAPH, GCHART

INTRODUCTION

HMC is one of the nation's largest, most experienced managers of integrated care and total health solutions. HMC helps members navigate the complexity of health care – from the most difficult, costly and debilitating medical conditions that increase health care costs, to the wellness programs that help prevent them.

For 25 years, HMC has been a pioneer and leader in providing health solutions for employers, insurance companies and government entities. We are a wholly owned subsidiary of WellPoint Inc., serving as both partner and proprietor in the delivery of innovative health care programs and services nationwide.

Through the Life² total-health solution, we give people the tools they need to take control of their health and see positive results, whether they've just started careers, are planning families or are nearing retirement. HMC's population-based yet individualized approach to health care encompasses prevention, lifestyle and condition management and complex care.

Nearly 26 million eligible members reside within HMC's scope of care.

The programs at HMC are designed to provide services to members throughout their lifetime. Members can be identified through predictive modeling or can refer themselves into the program. Not every member who is identified participates in the program to the highest level possible. This can happen as a result of not being able to get in contact with a member, a member declining entrance in the program, or various data issues that can result in identifying members incorrectly. The Waterfall was originally created to explain to the President of HMC where members were falling out in the process.

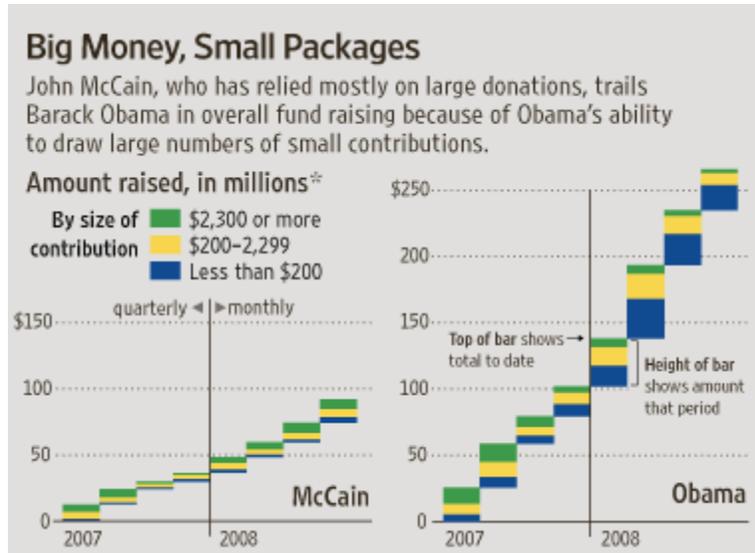
SAS/GRAPH

SAS/GRAPH programs are procedures that can be called to visually produce SAS data. SAS/GRAPH can produce a number of graphs, including scatter, horizontal bars, vertical bars, pie charts, maps, three dimension graphs and others. The Waterfall graph uses a horizontal bar, with part of the graph having no color to allow for the 'floating' effect.

All of the options for SAS/GRAPH work with the Waterfall as well. The one potentially new consideration when producing a Waterfall is the order of the columns. Once the columns are in the appropriate order, the user can utilize all of the color, font and formatting options available through SAS/GRAPH.

RIDE THE WAVE – THE WATERFALL GRAPH

The Waterfall graph is ideal for display areas of loss or gain between starting and ending values. In the graph below, featured in *The Wall Street Journal* on June 20, 2008, the Waterfall is used to show quarterly campaign contributions by contribution size. The graph begins with a fixed bucket for the first quarter in the period, and each additional quarter floats where the previous quarter left off. On a metric that is increasing, this has a stair-step effect. On a decreasing graph this creates the Waterfall appearance.



BUILDING A WATERFALL

In addition to data for each category in each bar, an additional data point is needed to allow the graph to float above the x-axis. For any bar that rests on the x-axis, this value will be zero.

The code below builds the dataset for the first four quarters for Obama.

```
data donors;
  input period $ donation class $;
  cards;
  Q12007 0 Clear
  Q12007 5 Large
  Q12007 10 Medium
  Q12007 15 Small
  Q22007 30 Clear
  Q22007 6 Large
  Q22007 12 Medium
  Q22007 15 Small
  Q32007 63 Clear
  Q32007 5 Large
  Q32007 5 Medium
  Q32007 6 Small
  Q42007 79 Clear
  Q42007 6 Large
  Q42007 5 Medium
  Q42007 3 Small
;
```

```
RUN;
```

Note that there are four observations for each period – one for each of the three funding levels, and a fourth to give the floating appearance. Also note that the values are approximations of the information provided by *The Wall Street Journal* and not necessarily the exact values.

Once the data is created, building the graph is a basic GCHART procedure and some basic formatting to make the bottom bar match the background.

```
/* create a white bar for the clear values and format other bar colors */
pattern1 v=s c=white;
pattern2 v=s c=blue;
pattern3 v=s c=yellow;
```

```

pattern4 v=s c=green;

/* Define axis characteristics */

axis1 minor=none;

/* Add the title */

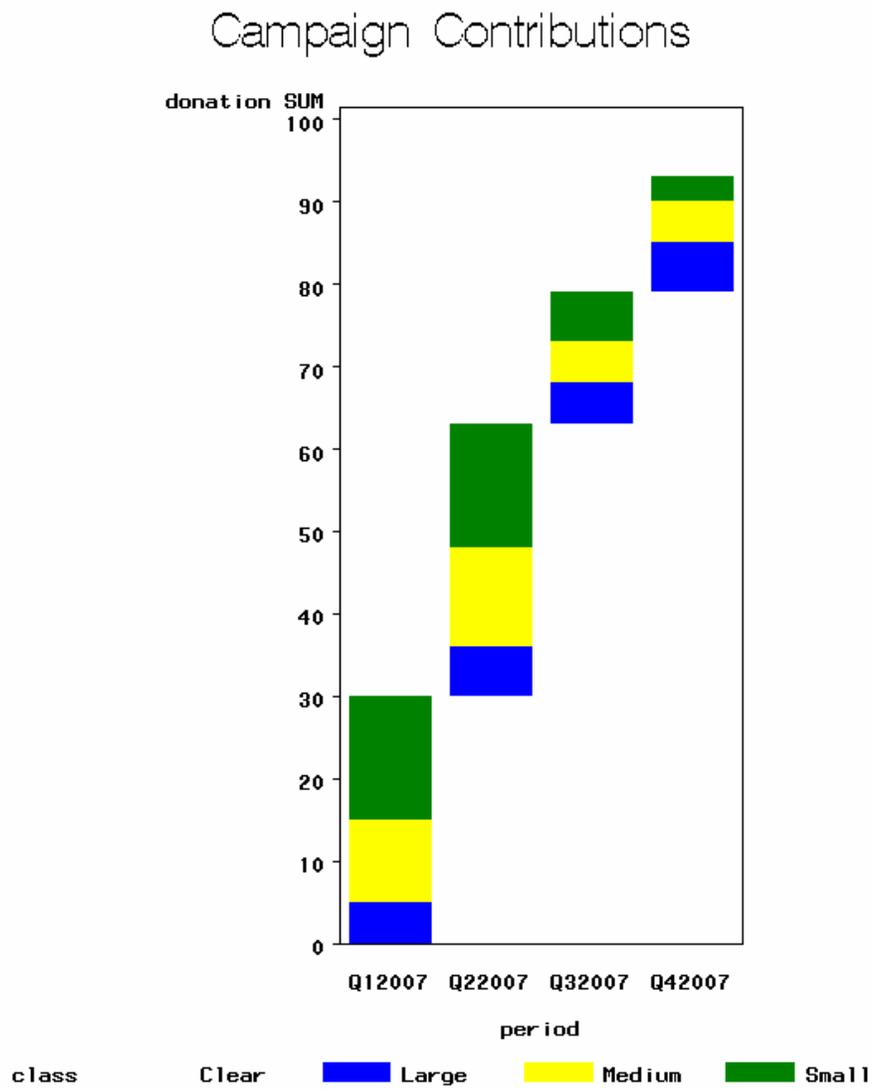
title 'Campaign Contributions in 2007';

/* Produce the bar chart */
PROC GCHART data=donors;
    vbar period / sumvar=donation raxis=axis1
                subgroup=class;

run;
quit;

```

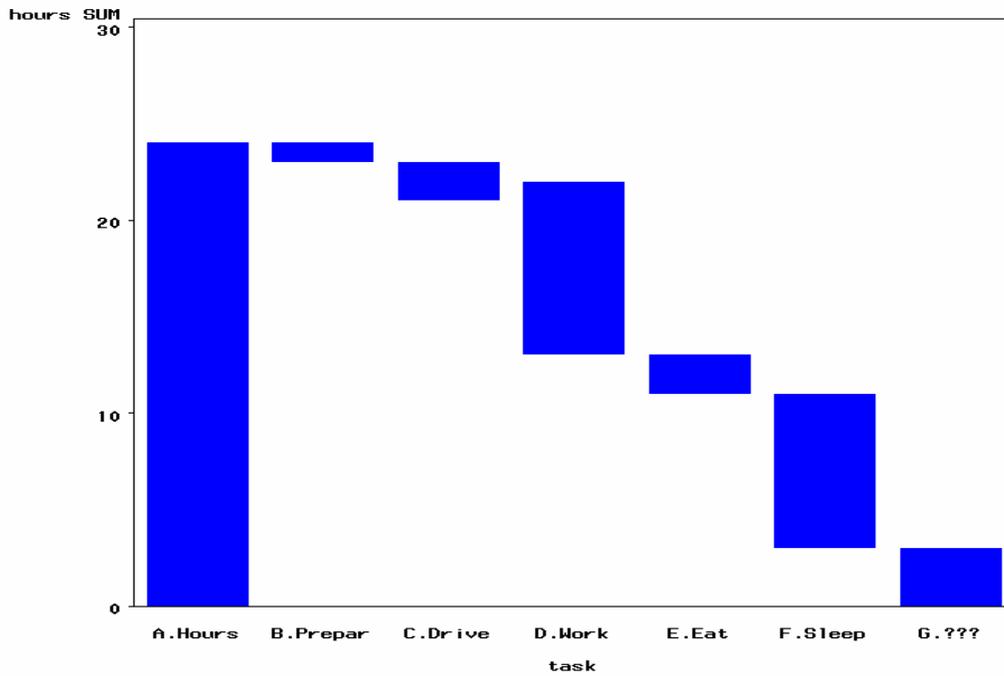
This produces the following graph



OTHER WATERFALL OPTIONS

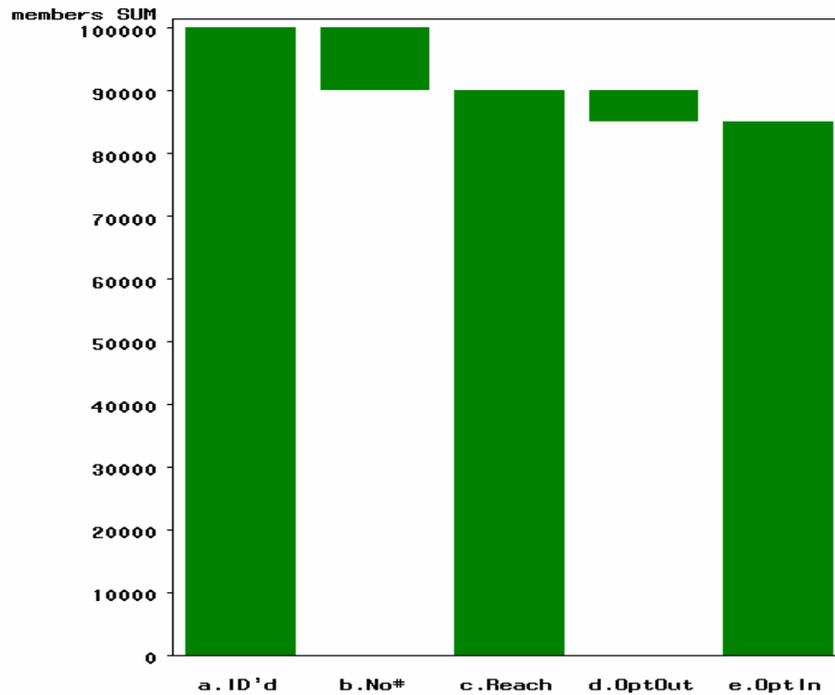
The graph above is an example of an ascending Waterfall. Waterfalls can take other forms as well, including descending

Where the Day Goes



Or having multiple bars touch the x-axis to depict subtotals or stages within a process.

Members Reached and Not



CONCLUSION

The Waterfall graph allows you to quickly see the primary sources of change over time or through a process. While they may look impressive, building a Waterfall requires only a PROC GCHART statement and some minor formatting. These graphs can be used by any industry to display differences in starting and ending values and can take multiple forms depending upon the need.

REFERENCES

More information about SAS/GRAPH can be found at
http://www.sas.com/technologies/bi/query_reporting/graph/index.html

Cooper, Christopher and Brody Mullins. "Obama Rejects Public Financing for General Election" The Wall Street Journal 6 June. 2008. A6.

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