The Development of the Horizon Graph

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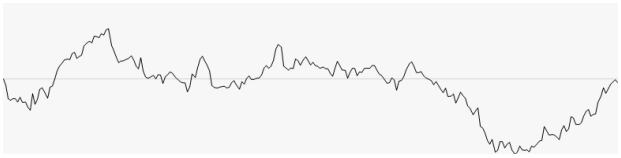
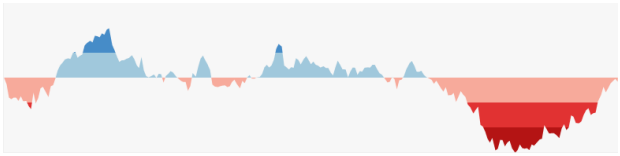
The Horizon Graph is a time series visualization developed at Panopticon Software. Many of our clients are financial portfolio managers who want to see the performance of a large number of stocks at the same time. The Horizon Graph was developed to support this need in a way that allows our clients to:

1. Spot outliers, exceptional behaviors, and predominant patterns.
2. View changes in performance with reasonable precision.
3. View performance for stocks individually.
4. Compare the performance of different stocks.

A time series dataset containing daily stock prices for one year was our starting point. The most effective way to display how a single stock performs over time is to use a regular line graph, which is what we began with. We used percentage price changes since the initial day instead of prices. This makes it reasonable to let several stock performance line graphs have a common height scale and facilitates performance comparisons.

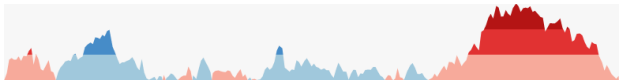


In order to enable users to spot outliers, exceptional behaviors, and predominant patterns we added color bands with colors from a diverging color scheme (the color scheme should be diverging since stock performance can be both positive and negative). The dark saturated parts of the graph now stand out clearly, just like in a regular heat map.



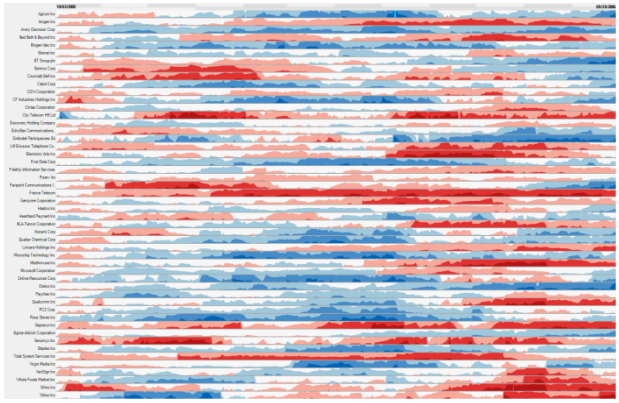
This solution also makes it easier to view changes in performance since the color bands amplify the differences between values. It also allows for more precise reading of values since information about the height scale is reflected in the color bands. In this example each color band represents a 10% stock price change. If a value falls outside of the value range represented by the color bands it will result in a saturated outlier color — aqua for positive outliers and orange for negative outliers.

A requirement was that the visualization must be able to display the performance of a large number of stocks in a single view. We therefore mirrored the red color bands, corresponding to negative values, with respect to the x-axis (keeping the information in the colors). We have now reduced the height by half. However this is not a solution without drawbacks since we lose the intuitive way of thinking about ups and downs in stock performance.



To reduce the height even more we collapsed the color bands in the graph (again keeping the information in the colors). This technique is known as two-tone pseudo coloring [1]. The height of the graph is now reduced by another two thirds. Since we restricted the number of color bands to three bands of each hue it is easy to determine what value range a color band represents. Note that the values still can be read with great precision.

Finally in order to meet the basic requirement of displaying a large number of stocks in a single view and to let users view the performance of individual stocks as well as compare the performance of different stocks, we utilized small multiples [2] by adding a large number of horizon graphs stacked one above the other.



This example displays the daily performance of 50 different stocks over a year and fulfills all of the design requirements.

The Horizon Graph is used by Panopticon's customers for viewing stock performance and other types of time series data, including data for order flows and financial reports.

References:

[1] Saito, T., Miyamura, H.N., Yamamoto, M., Saito, H., Hoshiya, Y., Kaseda, T. Two-Tone Pseudo Coloring: Compact Visualization for One-Dimensional Data. IEEE Symposium on Information Visualization, 2005.

[2] Tufte, E. R. The Visual Display of Quantitative Information. Graphics Press, 2nd edition, 2001.