VISUALIZING TIME

BEYOND THE LINE CHART

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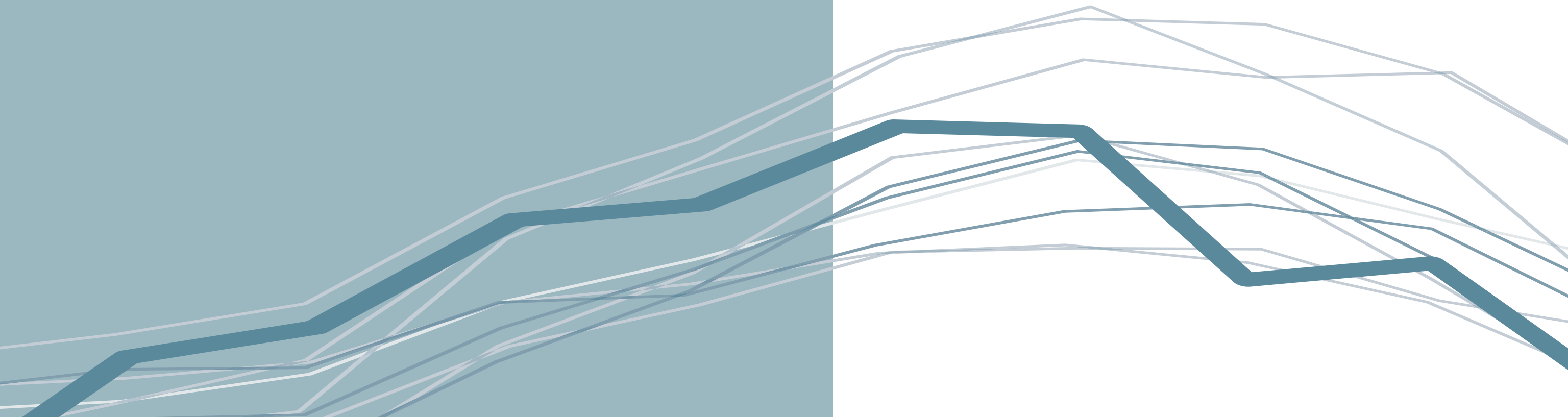
Time is precious.

With visual analytics we often seek to discover what's happening within our data over time. We also need to find insights as quickly as possible. So what is the best way to chart time in order to get the most out of it?
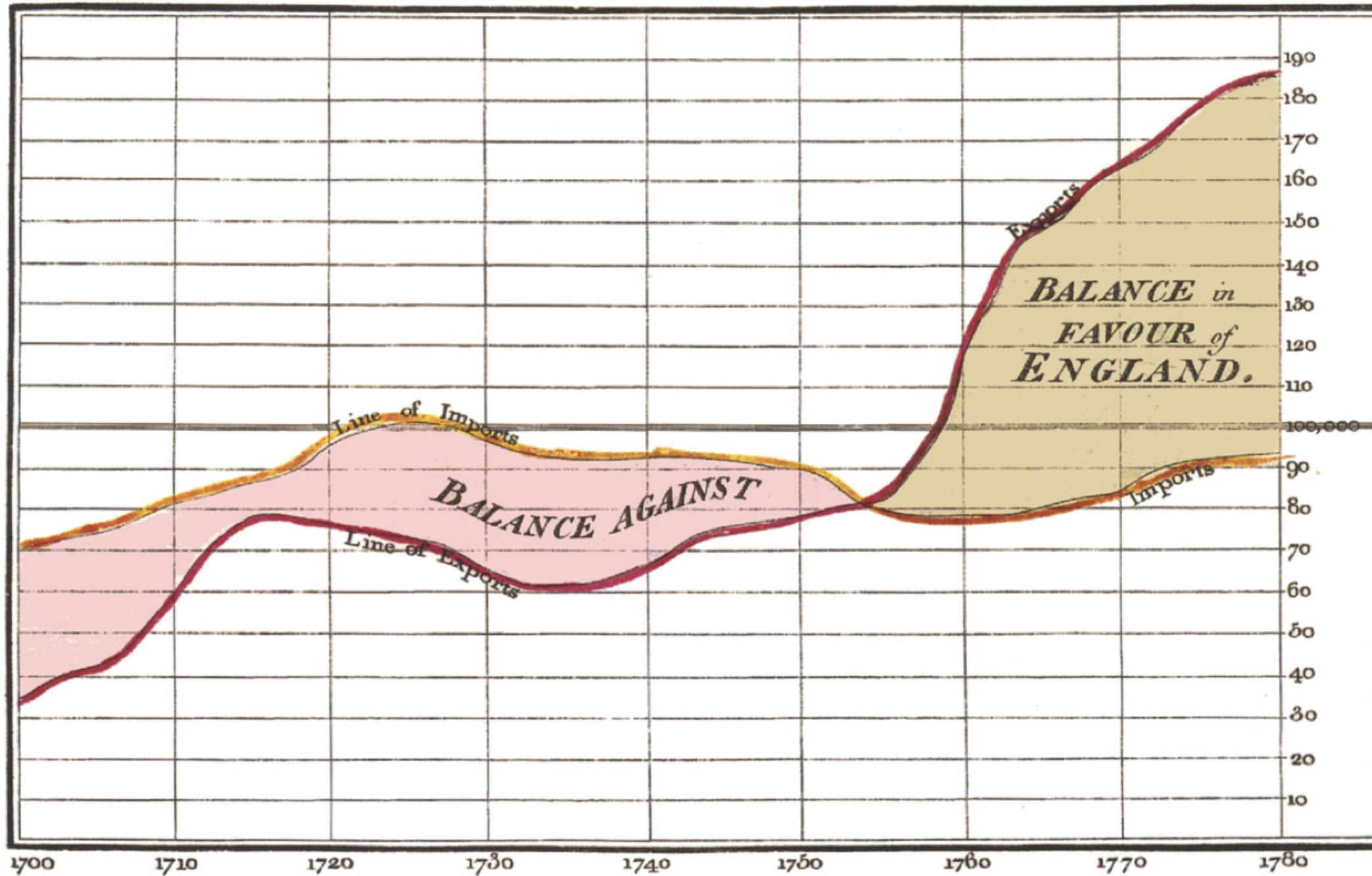
Is the line chart always the best way to visualize time?

It depends.

The first statistical line chart dates back to 1786 when William Playfair visualized imports and exports between Demark and Norway.

Exports and Imports to and from **DENMARK & NORWAY** from 1700 to 1780.

Even today, the line chart remains a valuable analytics tool, as seen in a nearly-identical 2015 *Financial Times* visualization about international trade.

Trade with central Asian countries

Merchandise exports and imports, sum over previous 12 months ($bn)

China

After the breakup of the
Soviet Union, the trade links
of the central Asian countries
still centered on Russia ...

Russia

... but China's huge appetite for
commodities has made it the
region's dominant trading partner

1995 96   97   98   99 2000 01   02   03   04   05   06   07   08   09   10   11   12   13   14 15
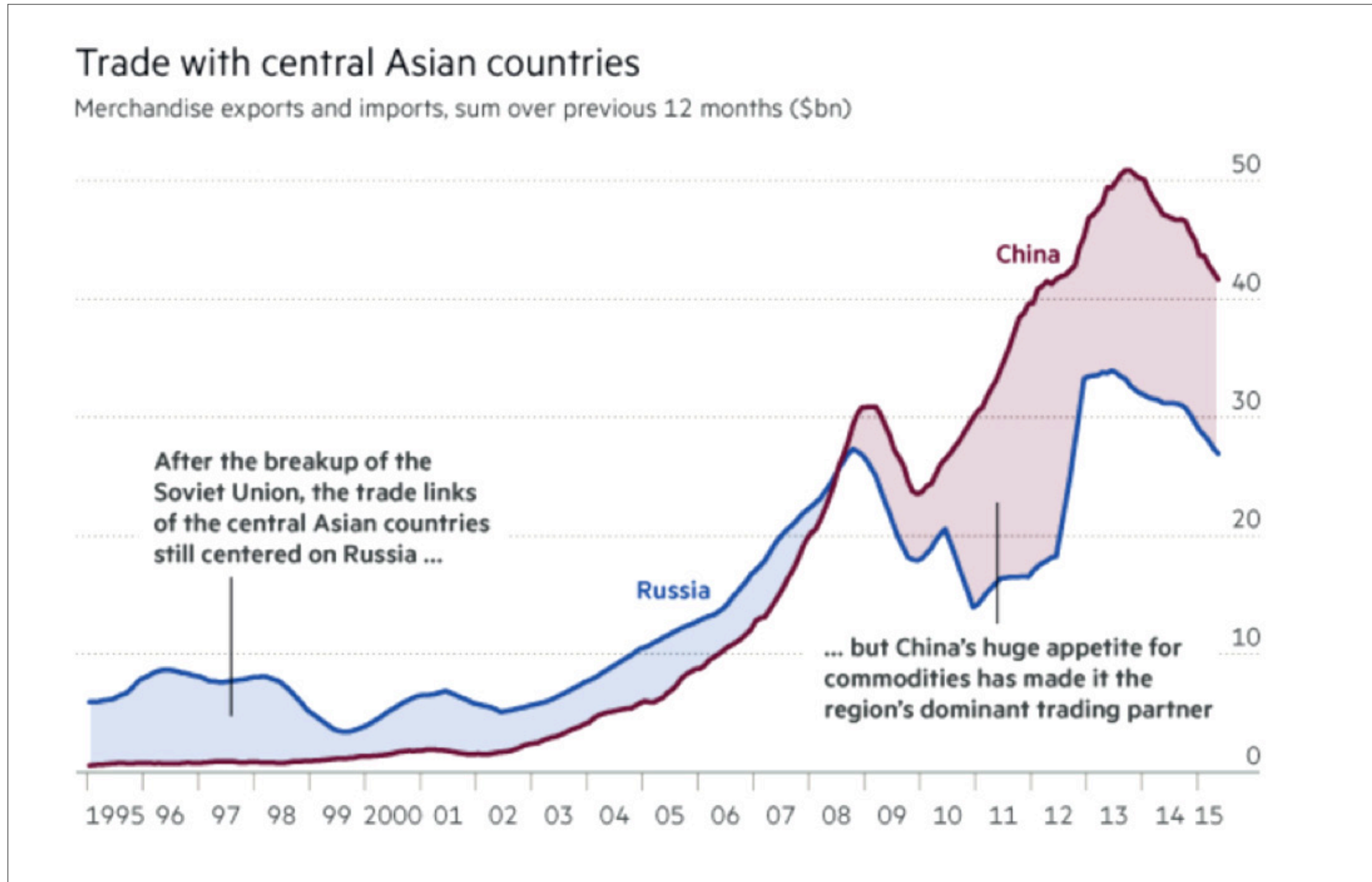
" Lost time is never found again.

- BENJAMIN FRANKLIN, 1758

Linear Timelines are Powerful.

The lines' heights, angles, and positions can tell many data stories. But line charts may not always be the best way to maximize our understanding of time.

In fact, there are many more ways to explore data and time, each potentially surfacing insights that would have remained hidden in a basic line chart.

Various chart types unveil slightly-nuanced perspectives, unknown unknowns, and even multiple truths in a single data set.

Here are three ways to cheat Benjamin Franklin's ominous quote and expand your creative conversation with data and time.
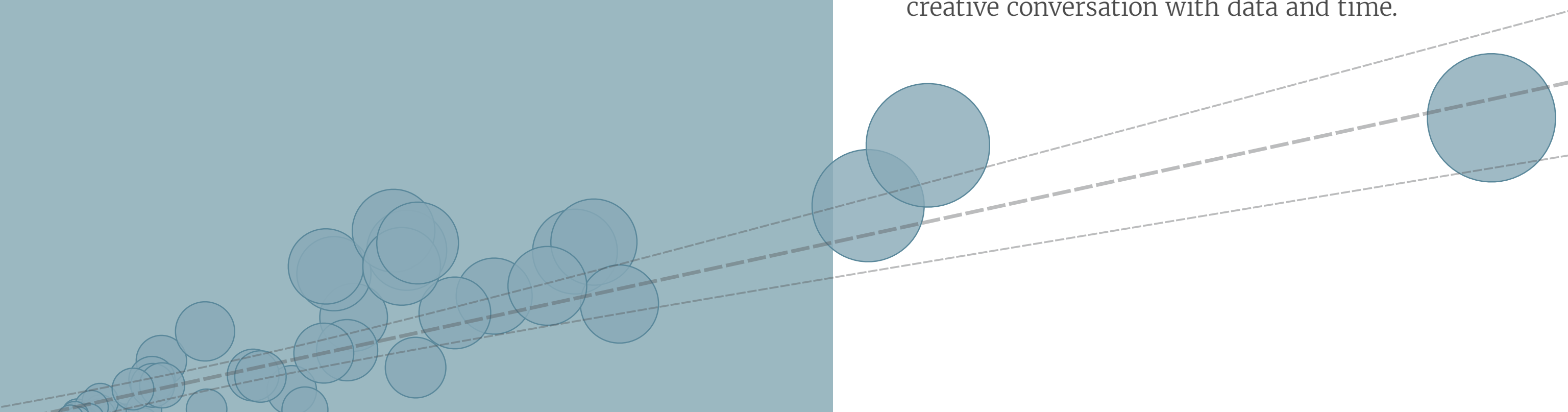
The Slope Chart

From Start to Finish

A slope chart will show only the change between a start point and an end point, eliminating the distracting minutia between those points.

These straight, angled lines may reveal answers to your questions faster, or even provoke new questions to ask.

These charts show the top eight New York City bike stations and the number of journeys over the course of a year. The top chart shows how each station's traffic has changed over the course of time in a regular line chart. The bottom is the same data visualized in a slope chart.

With a regular line chart, you can quickly see the seasonal lows and peaks of all of the stations, but the noise between the start and end of the data set hides the biggest insight of all.

The Top 8 NYC Bike Stations Traffic, Basic Line Chart
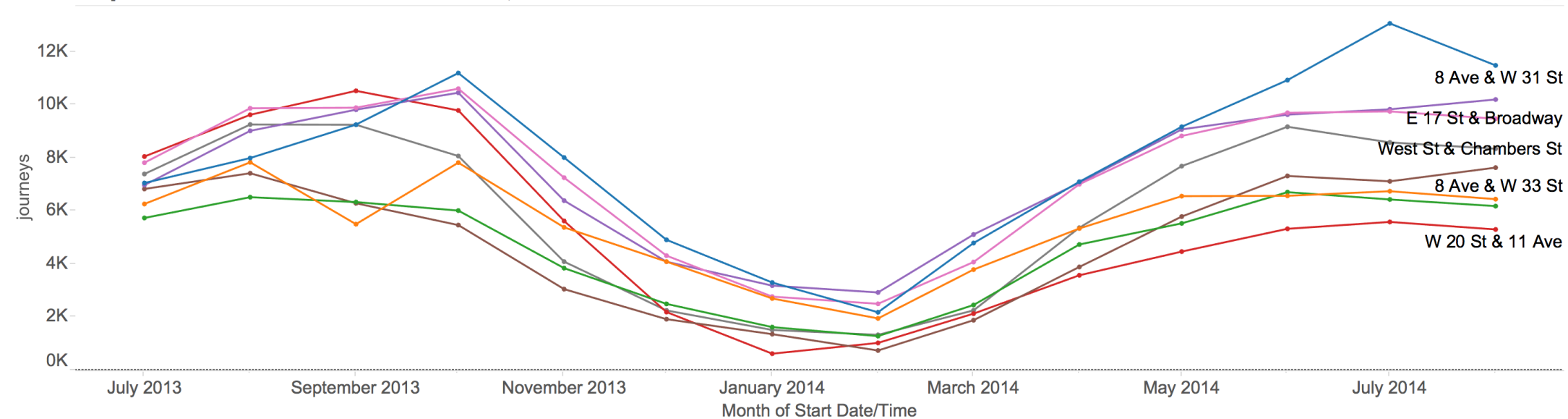
The Top 8 NYC Bike Stations: Slope Chart
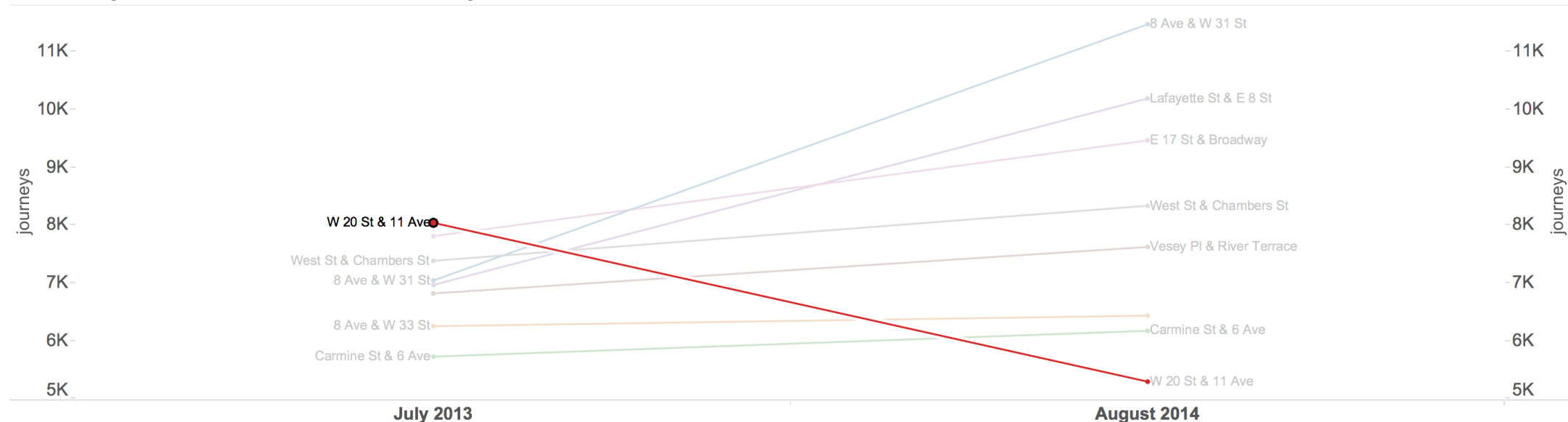
The slope chart eliminates the in–between data points and immediately reveals that the W. 20th Street station went from the number one station to the number eight station.
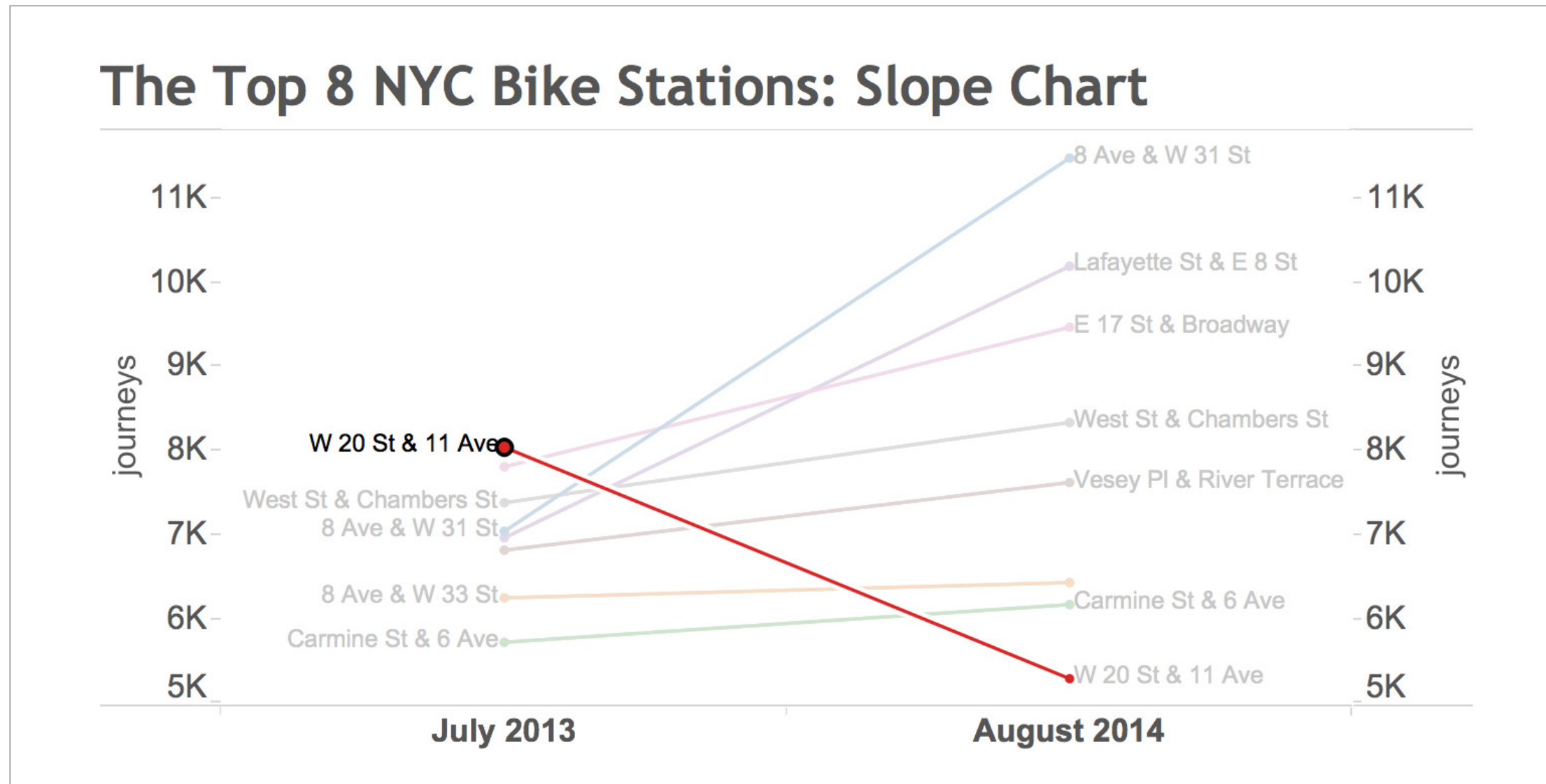
For marketers, using a slope chart to visualize social media data can reveal more insights about follower growth, brand–name mentions, engagement, and reach against competitors.

Further Learning

How To Make a Slope Chart
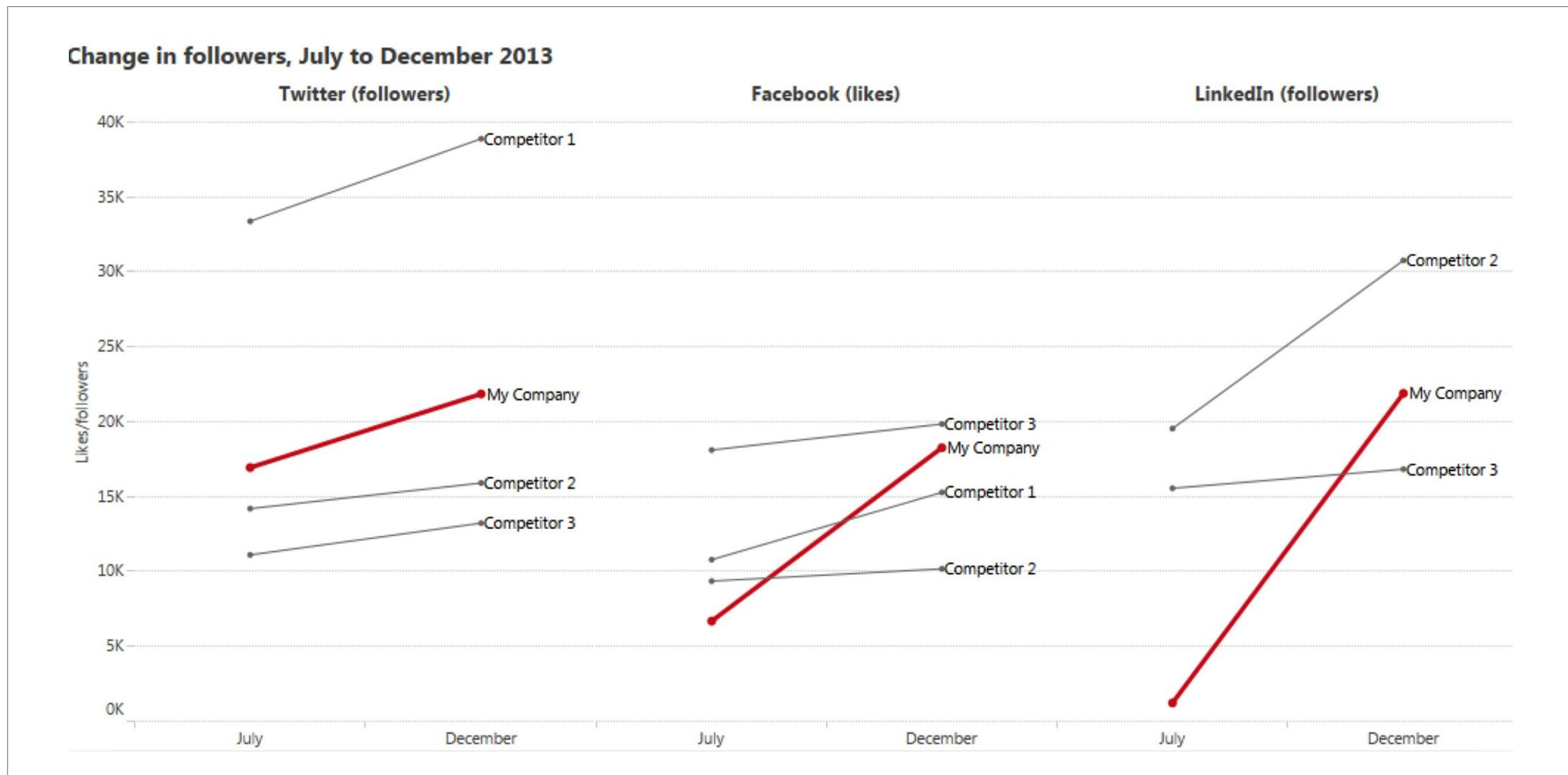
This dashboard shows generic social media data visualized in slope charts, where it is fast and easy to see changes in followers over time for four companies.

Cycle Plots

Trends and Seasonality

With data, we often look for seasonality and trends. But if we just have a time series that only connects start and end points, trends may remain hidden. And what if you need to compare two trends?

Cycle plots show the trends of two different time periods simultaneously. Because cycle plots show trends over the whole time period as well as shorter periods, you can present more information at once.
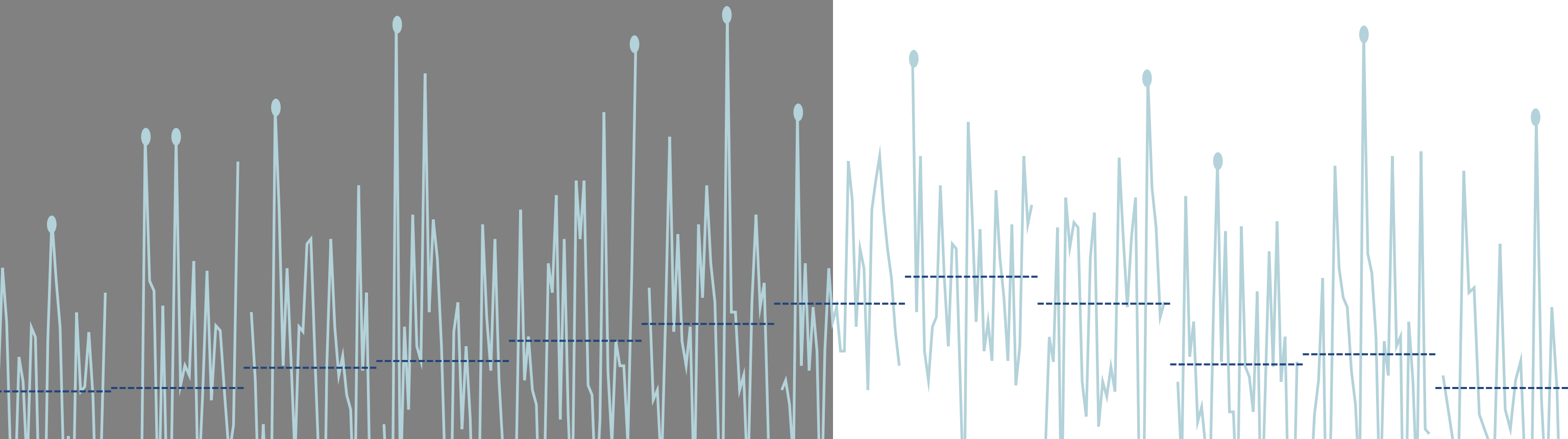
This visualization shows ten years of wildlife strikes on airplanes across the United States. If you were to see this on a regular line chart, you might notice that there were more strikes in 2010 than there were in 2000, but key insights remain missing.

Because a cycle plot allows you to visualize several periods of time and see multiple trends at once, you can see that bird strikes are far more common in August, September, and October than the other months of the year. The black line shows the monthly average, and the blue line shows the annual trend for that month.

Wildlife strikes on planes in the US, 2000-2010

Black line shows monthly average for all years. Blue line shows annual trend for that month.
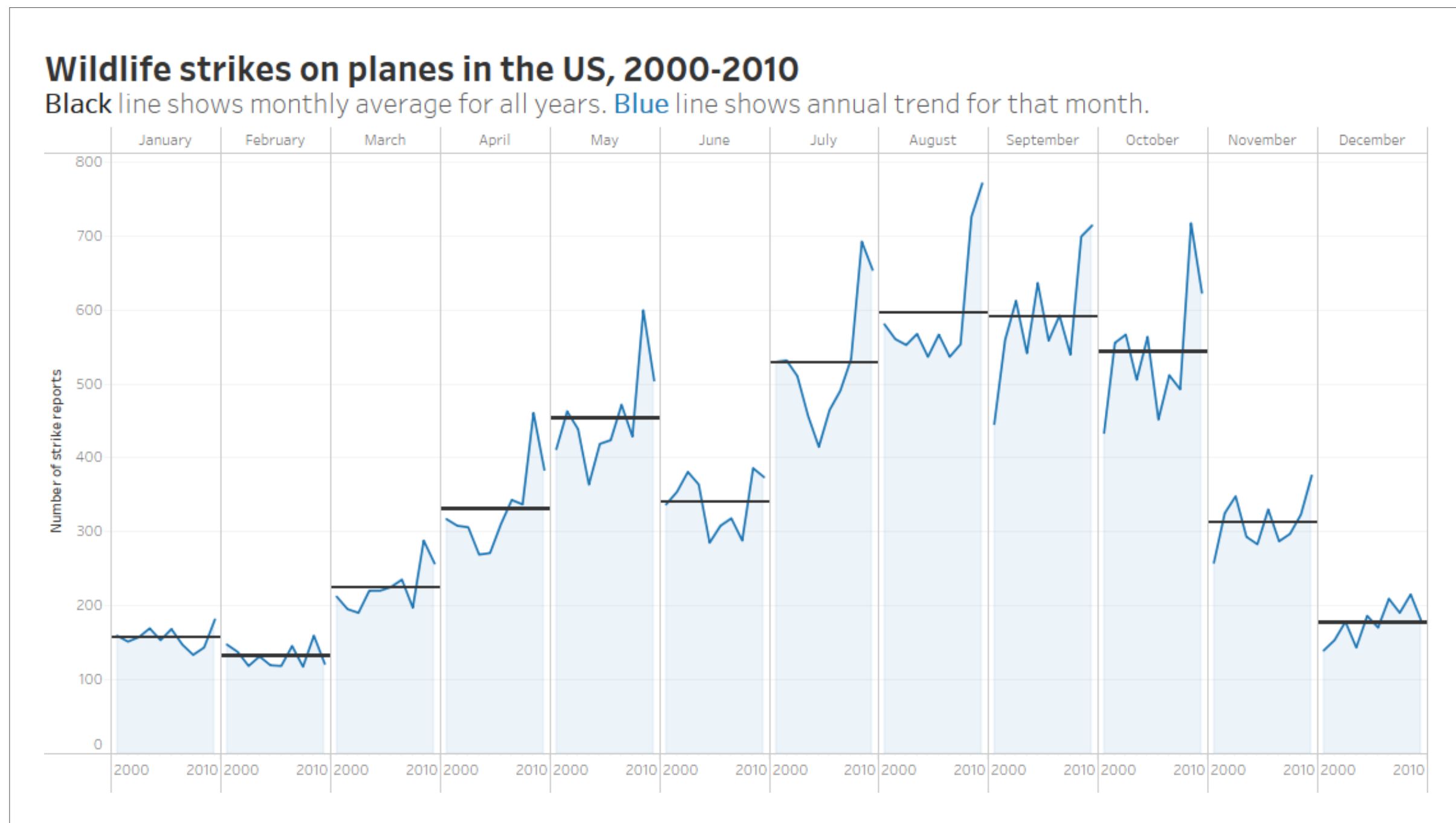
For real estate agents or sales reps, cycle plots can quickly show important trends just under the surface of your data. Cycle plots will answer questions like: How has sales changed on each weekday over the past six months? What days of the week in each month are better for closing deals? Or what hour of the day is the highest performing? Knowing this information can drastically improve quarter planning and seasonal decision-making.

Further Learning

How To Make a Cycle Plot

Sales by the hour, numbers during the week and weekend
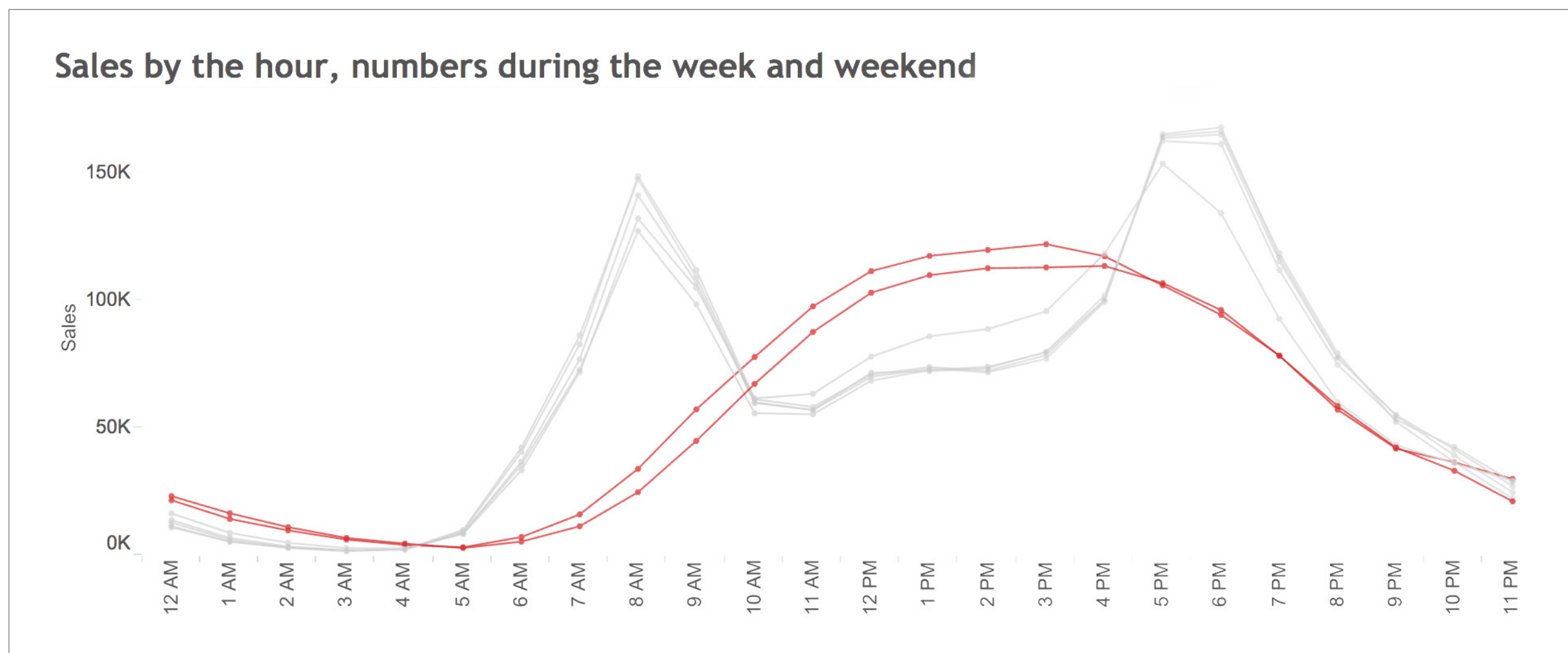
This dashboard shows generic sales data visualized in a cycle plot, with the number of sales broken up by hours of the day. The red lines, which show the daily sales per hour on the weekends, compared to the grey lines, which show the daily sales per hour during the weekdays, reveal clear trends.

The Highlight Table

Finding Patterns with Color

Colorful highlight tables make it easy to look at time data horizontally so you can quickly scan for patterns and hotspots.

With a highlight table, you can look at time patterns in two different dimensions.

Using both month and year, this highlight table shows how common birth dates are in the US compared to the UK. The darker the color, the more common the birthday. You can look at individual dates as well as trends in the colors.

How common is your birthday?
Two charts showing the most and least popular birthdays in the USA and England/Wales.
The darker the colour, the more common that birthday is.

If you're a scientist, a government worker, or even a journalist, highlight tables come in handy when you need to show impact over time in a more meaningful way.

This chart shows the US drought index for each month for almost twenty years. The colors quickly direct your eye to the particularly driest months and years.

Drought in the USA, 1985-2014

Chart shows the Drought Index for each month. The redder the cell, the more severe the drought.

-2.0 ▮▮▮ 3.0

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	0.3	0.3	0.2	-0.4	-0.4	-0.3	-0.1	0.4	0.9	1.3	1.7	0.9
1986	0.4	0.6	-0.1	-0.2	-0.3	-0.2	0.0	0.2	0.8	1.0	1.2	0.9
1987	0.8	0.5	0.4	-0.4	-0.6	-0.6	-0.5	-0.3	-0.6	-0.8	-0.7	-0.6
1988	-0.7	-0.9	-1.0	-1.1	-1.5	-2.1	-2.1	-2.1	-1.6	-1.7	-1.1	-1.4
1989	-1.4	-1.1	-0.9	-1.1	-0.5	0.0	0.0	0.1	0.3	0.2	-0.1	-0.6
1990	-0.3	-0.1	-0.2	-0.4	0.4	-0.1	0.1	0.1	-0.3	0.2	0.0	0.4
1991	0.0	-0.5	0.0	0.2	0.3	0.0	-0.2	-0.3	-0.4	-0.3	-0.1	-0.1
1992	-0.3	-0.3	-0.3	-0.5	-0.8	-0.1	0.8	1.0	1.0	0.8	1.5	1.6
1993	1.8	1.6	1.7	2.0	1.4	1.7	1.7	1.7	1.5	1.5	1.5	1.2
1994	1.3	1.1	0.9	0.6	0.2	0.2	0.4	0.5	0.2	0.8	0.8	0.6
1995	0.9	0.5	0.4	0.7	1.2	1.2	1.1	0.9	0.6	1.2	1.2	1.0
1996	1.3	0.9	0.8	0.9	1.2	1.2	1.4	1.3	1.8	2.0	2.2	2.4
1997	2.1	1.9	1.6	1.8	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.1
1998	1.6	1.8	1.9	1.5	1.0	1.2	0.8	0.4	0.1	0.3	0.2	-0.2
1999	0.5	0.2	-0.1	0.0	0.0	0.1	-0.1	-0.3	0.0	-0.6	-1.3	-1.5
2000	-1.4	-1.4	-1.5	-1.1	-1.1	-0.7	-0.7	-1.1	-1.0	-0.9	-0.2	-0.3
2001	-0.5	-0.4	-0.3	-0.7	-0.6	-0.4	-0.4	-0.7	-0.7	-0.6	-1.0	-1.1
2002	-1.2	-1.4	-1.1	-1.2	-1.1	-1.4	-1.8	-1.8	-1.3	-0.5	-0.6	-0.4
2003	-0.9	-0.5	-0.6	-0.5	0.1	0.4	0.3	0.1	0.3	0.0	0.2	0.2
2004	-0.1	0.1	-0.4	-0.4	0.1	0.4	0.5	0.9	1.2	1.4	1.6	1.2
2005	1.3	0.8	0.4	0.5	0.4	0.4	0.2	0.2	-0.5	-0.1	-0.2	-0.3
2006	-0.2	-0.7	-0.8	-1.0	-1.3	-1.0	-1.1	-0.8	-0.3	0.3	0.3	0.3

Source: http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/

You can also take your highlight table a step further, and visualize the same time data on a map to reveal the driest regions over time, like the *New York Times* did in this visualization.

Conclusion

For time-based data, the right chart is the one that reveals the most important insights for the audience at hand.

Keep exploring additional ways to visualize your time-based data in bump charts, connected scatter plots, and small multiples. Armed with so many ways, you'll never miss an insight. If Benjamin Franklin had known about all these ways to explore time, perhaps he wouldn't have been so worried about losing it.
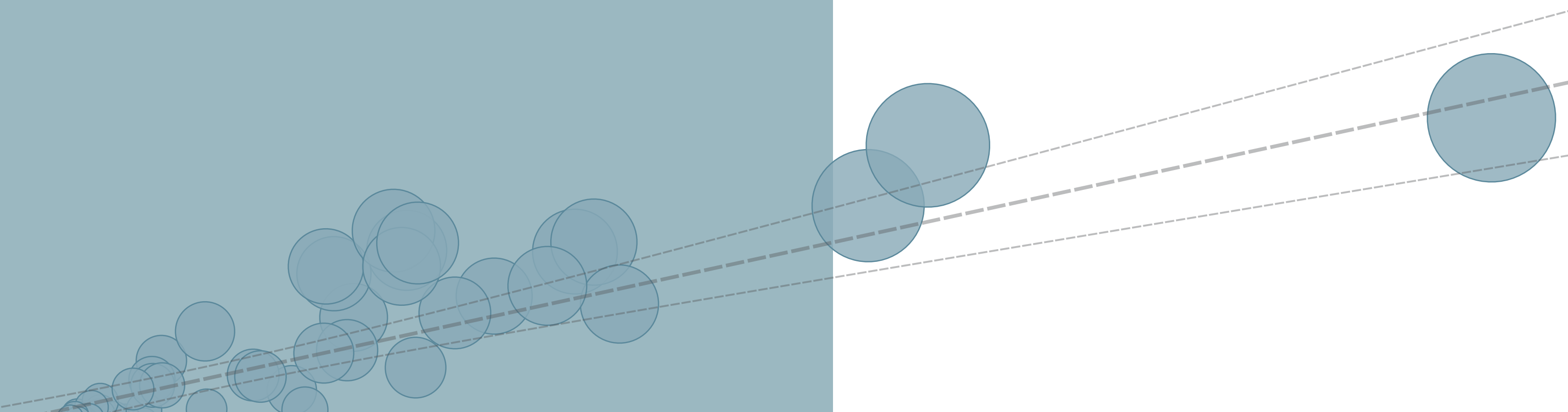
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