

# Q&A about Smart Charts

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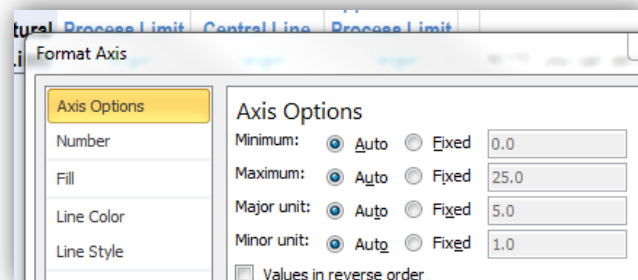
## Using the Smart Chart template

### Q: My data doesn't show up in the mR chart.

*I put my data in the template, but the mR (moving range) graph doesn't appear. What went wrong?*

It could well be the default scaling of the vertical axis in the mR chart not matching the scaling of your data. Check that the vertical axis is formatted so that the maximum and minimum values are set to "automatic".

This way they will rescale automatically when you use the template for other KPIs too.



### Q: How to you add a Lower Natural or Upper Natural Limit target to the Smart Chart?

*Even when I add the target value to the appropriate column in the spreadsheet template, I cannot seem to get it to appear in the Smart Chart.*

There are a couple of reasons this can happen.

Firstly, check that the vertical axis scale range includes the value you have chosen for your target. For example, if you set a target for the upper Natural Process Limit of 20, you want to make sure your vertical axis scale goes at least as high as 20.

Secondly, check that the horizontal axis scale range includes the date at which you set the target. For example, if you set your target for June 2013, then make sure the horizontal axis includes June 2013. If it doesn't, then edit the data range for the chart, and make sure the full range of dates (or rows) is included.

Thirdly, make sure you didn't inadvertently delete the target data series (column) from the chart.

And finally, check the formatting of the data series in the chart that corresponds to your target. If you don't have symbols, it won't show up. If you have it coloured the same as the background of your chart, it won't show up.

## Calculation of the Central Line and Natural Process Limits

### Q: How do you stop outliers/special causes from skewing the Central Line and Natural Process Limits?

*When you have an outlier (a single point above/below limits) and you know what caused it (something abnormal to the process), how do you keep that point from skewing the data? For example, one month sales are terrible because there was a snow storm the whole month. That is not normal.*

As a rule, you *never* recalculate the Central Line and Natural Process Limits just because you got an outlier or special cause. And you leave outlier or special cause points *out* of any recalculations of the Central Line and Natural Process Limits.

The only exception is where that outlier or special cause actually turns out to be part of a short run, a run of 3 out of 4 points close to the Natural Process Limit. In this case, it's technically not an outlier or special cause. It's part of a short run near the limit. In this case, you wait until you have 5 points from the start of the run and then recalculate the Central Line and Natural Process Limits using those 5 points.

## Deseasonalising your measures

### Q: You said in the course that we need 2 full cycles to deseasonalise. What happens when you start adding data beyond those 2 cycles, but you don't have another full cycle yet?

*As an example – say we wanted to construct a chart using data for 2010-11, 2011-12 and the first few months (Jul-Oct) of 2012-13. The average monthly values/seasonal relatives/seasonal factors will be skewed based on the incomplete 2012-13 data. Should we instead construct the data set so that we always have full cycles of data – e.g. instead of using financial years 2010-11 and 2011-12, use Nov 2010-Oct 2011 and Nov 2011-Oct 2012, then keep shifting the 'cycle' by one month every time we add another month of data?*

You are only using the first two or three cycles of data to calculate the Seasonal Factors for your seasonal measure. You do that once, just before you start using a Smart Chart. You don't keep updating the Seasonal Factors as you get new data.

Once you have deseasonalised your data, you can interpret signals in your Smart Chart. When you look for the causes of those signals, one thing to check is whether the

pattern of seasonality has changed. All you need to do is look at the actual (not the seasonalised) values of your measure in a simple line chart.

If it looks like the seasonality is changing behaviour, then you can use the most recent 2 cycles of your measure data to compute new Seasonal Factors. Otherwise, you don't need to change them at all.

## When to use Smart Charts (and when not to)

### Q: Do Smart Charts work for financial KPI's?

Absolutely, yes. In fact, we would get far more value from our financial KPIs and measures if we used Smart Charts. Traditional financial reporting methods may actually be at the root of the misleading analysis and interpretation methods I mentioned during the course. For example, comparing this month to last month.

### Q: What are the general rules to ensure that a XmR chart (Smart Chart) is appropriate for the data?

A measure needs to have these qualities for a Smart Chart to be a useful and appropriate way to help us see signals of change:

- The monthly values need to be independent of one another. That is, last month's value shouldn't have a direct impact on this month's value. So using a 12 month rolling average (or any rolling average) is not appropriate. Nor is using average year to date values.
- You need to have consistent definition and calculation of your measure values. If you change the data source, data scope, or calculation formula, technically you have a different measure now, and it's best to start the Smart Chart from the start of the new method of calculating your measure.
- Your measure needs to be calculated over regular and consistent time intervals. So if you sometimes measure it monthly, sometimes every two months, sometimes every two weeks, all this data cannot be meaningfully interpreted using a Smart Chart.
- You need at least 5 consecutive values of your measure before it's worth starting a Smart Chart.
- If your measure is seasonal, you need to deseasonalise it first.
- If your measure has an underlying steady trend, you need to use slightly different calculations for the Central Line (so it slopes in the direction of the underlying trend).
- If your measure is counting rare or infrequent events, you need to convert it to a rate first.

That's essentially it.

## Beyond Smart Charts

### Q: Any thoughts how Smart Charts could apply to “Big Data”?

*I don't know much about Big Data, but my understanding is that we use different methods for visualization. It would be very interesting with your perspective on Big Data!*

Big Data, to me at least, just means that we have more data than we've ever had, and we generally have much easier access to that data. The term 'Big Data' isn't anything super special.

It's kind of like the term 'analytics'. As a statistician, we used to call it 'analysis'!

Analytics is something you do to Big Data. Or in everyday speak, you analyse data to find insights and answers to your questions.

Analysis takes on different forms, depending of course on what your questions are, or what areas you are looking for insights. Some analysis therefore is designed specifically to answer questions, like Smart Charts. Other analysis is designed to explore data and find insights that aren't driven by specific questions. Most analysis is a combination of both.

The important thing is that the visualisation (or graph or chart) that you use to display an analysis has to be appropriate to highlight the signals or insights you want to focus on. It's not just about choosing the prettiest or most popular or favourite method.

One thing I've found is a shame about analytics and Big Data is that it is driven by the business intelligence field, and so few of the professionals in business intelligence have sufficient statistical know-how. It's a branch of mathematics, and does require more than reading a few books or copying what others do.

### Q: As a company, can I freely use the term “Smart Chart” (in commercial purpose when we conduct our projects using Smart Charts), or do you want us to make some kind of reference/copyright statement?

You might want to explain where the term came from, because 'Smart Chart' is a term I invented to sound more engaging and friendly than 'XmR Chart'.

If you use the term in software or products that you develop and provide to your clients, then please include a copyright notice: © Stacey Barr, 2012

But other than that, use the term freely and widely. It would be great if more people were aware of these charts!

### **Q: I'm interested in deeper knowledge around the statistical theory behind Smart Charts. How can I find out more?**

There are two books I strongly recommend.

The first is *Understanding Variation: the Key to Managing Chaos*, by Donald Wheeler. Don kindly assisted me in reviewing the material I put together for the Using Smart Charts course, and he certainly is my guru.

Another great book that goes into more depth is *Making Sense of Data* also by Donald Wheeler. This covers the seasonality, rare events and steady trend measure challenges.

But if you really want to go nuts with the theory, Donald Wheeler's book *Understanding Statistical Process Control* is the hefty reference manual, covering so much more than just XmR Charts.

### **Q: What literature regarding visualisation do you recommend?**

Stephen Few is my guru when it comes to data visualisation (or vizualisation if you use American English). Here are Steve's great resources:

*Show Me the Numbers*, a great book about designing tables and graphs.

*Information Dashboard Design*, excellent for – you guessed it – the visual design of dashboards.

*Now You See It* is a practical resource for how to make sense of information and analysis.

All these *books are listed and described on Steve's website*.

Steve's website and blog is at [www.perceptualedge.com](http://www.perceptualedge.com).