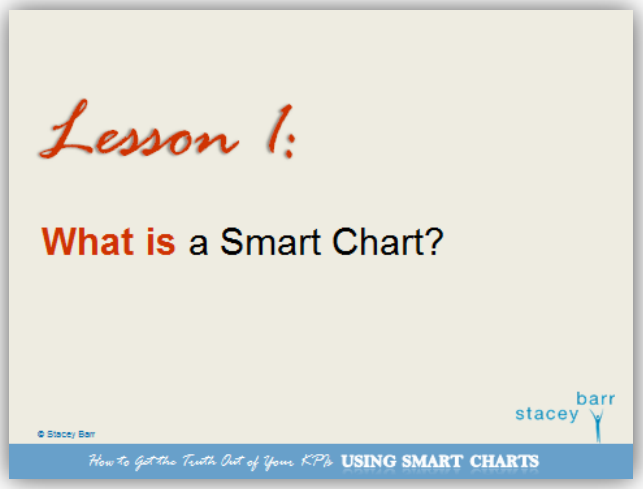
Stacey Barr Pty Ltd
the Performance Measure Specialist
ABN 57 129 953 635
PO Box 422 Samford
Queensland 4520 Australia
Phone: 1800 883 458
info@staceybarr.com
www.staceybarr.com

Lesson 1: The anatomy of a Smart Chart

Transcript

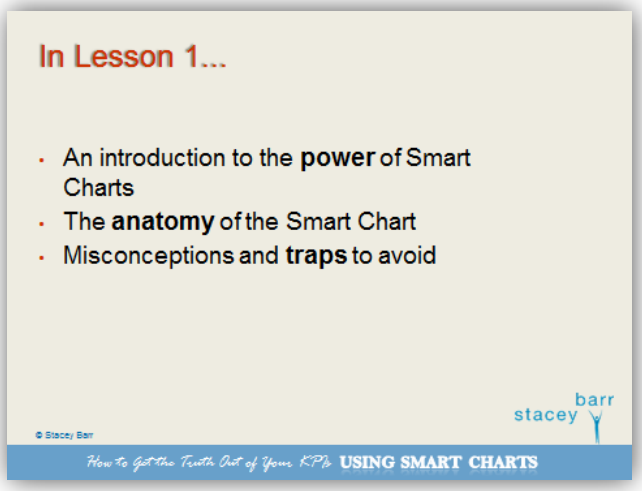
We are going to dive into Lesson 1 now and explore what exactly is a Smart Chart.



In this Lesson we are going to talk about the power of Smart Charts by looking at an example, we are going to study the anatomy of a Smart Chart.

The terminology is very, very specific and it's important that you learn it and also what that terminology means.

We will wrap up Lesson 1 with some misconceptions and traps to avoid - very common misconceptions because it's such a common chart people try sometimes to relate some of the concepts of a Smart Chart to their old way of thinking and it just doesn't work quite like that so you need to be aware of those sorts of issues.



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Example: Water quality

We are going to look at an example. This example comes courtesy of one of my lovely client, Cheryl Welch, who works with the Tualatin Valley Water District and they are in Oregon in the United States.

Cheryl did the *Performance Measure Blueprint Online Program* and she's been playing with Smart Charts for a little while so she has very kindly shared some of their KPIs with us so that we can study some of them through this course. A few of them illustrate some really interesting patterns which help us get the most out of using a Smart Chart.

This particular measure that Cheryl has shared with us is a measure for one of their performance results called 'Water Quality is Maintained at Intended Levels'. That was one of several performance results that Cheryl facilitated a distribution crew to come up with as important things for them to focus on and therefore important things for them to measure.

One of the measures that they chose to monitor that result is the number of hours per month that fluoride levels are above the maximum desired level.

Now there are a few different measures that the distribution crew and Cheryl ended up choosing for that result of water quality is maintained at intended levels, and we are going to look at some more of them, but for now this is the one we are going to focus on specifically.

Let's look at some different ways that we could typically report this kind of performance measure.

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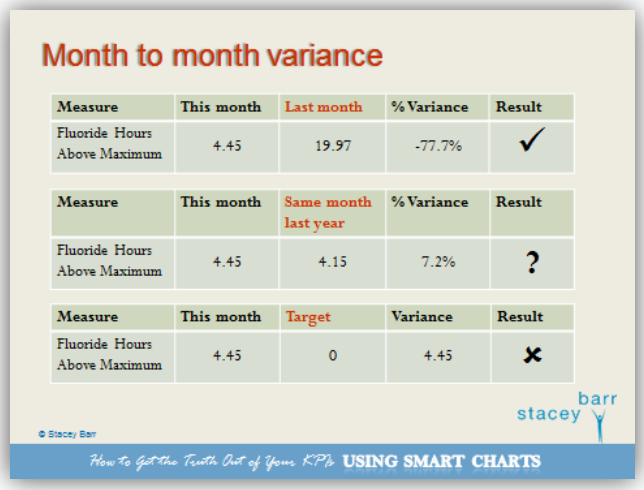
Month to month variance

The first way is the month-to-month variance and there are different ways that we could do that.



One is that we could look at fluoride hours above maximum this month and compare it to last month, calculate a percentage variance and then decide if that was good or bad.

Now in that case the current month would be 4.45 – this is probably only a few months ago in reality – the month before that was 19.97.

So what that is saying is that this month we had almost 4.5 hours where fluoride levels were above the maximum. The month before we had nearly 20 hours where fluoride levels were above the maximum. Now that represents a negative variance of 77.7% which means that this month is significantly lower than last month. So typically, or traditionally, we would say "Yeah, good result. Excellent."

But what if we were to do a different, but very commonly performed, comparison where we compared this month with the same month last year? Last year's was 4.15. Now that represents a positive variance of 7.2% variance which is a variance in the wrong direction. So this month is actually a little bit worse than the same month last year, but it's only 7% so would we say that was an acceptable result or not? Who knows?

There's another type of comparison that we typically do here too. This is where we compare the current month to target and look at the absolute variance. Now the current month as we know is 4.45 hours above maximum. The idea is that you don't want any hours where it's above the maximum. The idea of having a range is to keep fluoride levels within that range, so if it goes outside it's really outside of target. So our target is zero hours above the maximum and this is definitely a bad result.

So there you go: three different comparisons all typically done using the same set of data but we get three different conclusions from it. So you can understand why it would be really hard to get agreement and to decide when we really do need to respond and when we don't have to.

That's only one of the four comparisons that are limited or misleading.

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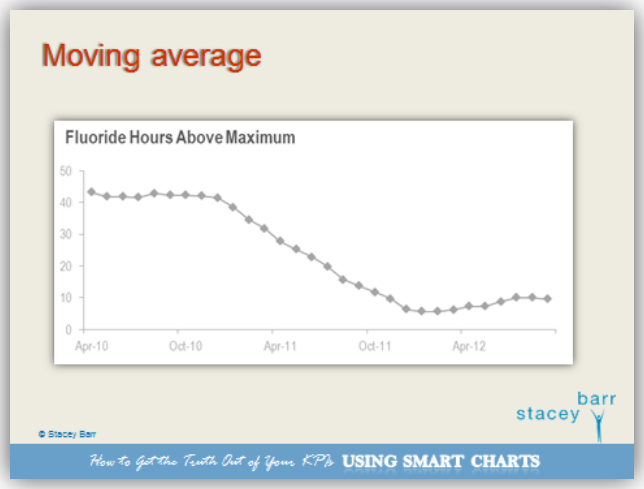
Moving average

The moving average is another one and looking at this moving average version of our fluoride hours above maximum you can see that it's kind of been stable for a little while and then it had a fairly steep decline, which is a good thing, but are we seeing a gradual incline starting to happen?

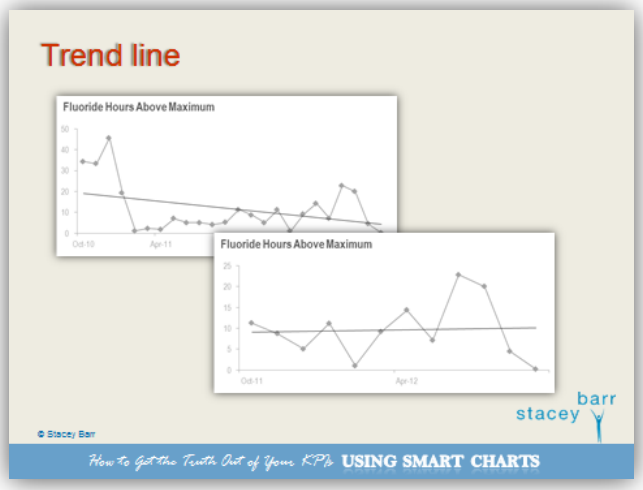
That's interesting, isn't it? So is this a good result or is this a bad result? Is this a good result turning into a bad result? Who knows?



Trend line

The trend line is another typical way that we look at our performance measures.

The first graph here is looking at the last two years and in general that looks like there has been overall a downward trend but if we look at just the last 12 months it's looking like an upward trend and again, the trend is going to tell you different things depending on which scope of data you arbitrarily decide to use.



What's the correct scope of data? Well there is no answer to that. So again, this is another reason why trend lines can be so misleading.

Besides, if you look at the trend line in the second graph, the slightly increasing one, look how much variation there is in the points around that trend line. And in fact the same is the case for the first one. A lot of variation of points around the trend line suggests that the trend line is not explaining much at all of what is going on in the data but a lot of people don't realise that so they don't ask the question.

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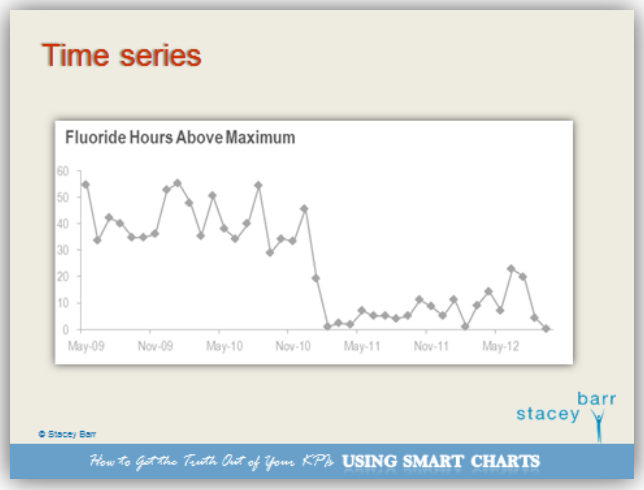
Time series

Time series is the best way to at least start looking at any performance measure.

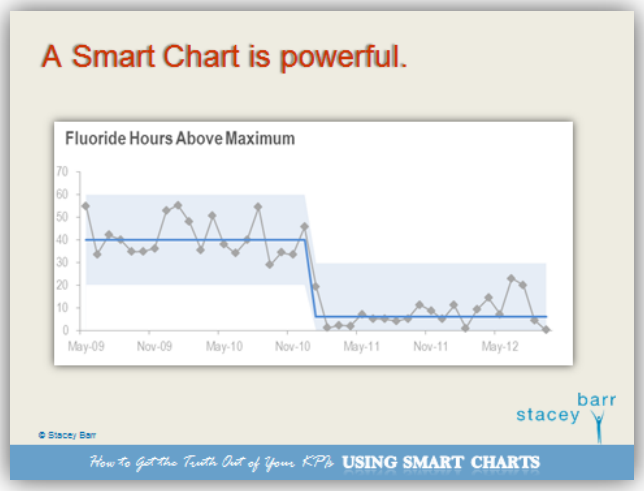


The actual values are per month or per week or per quarter – however frequently you happen to be measuring – just in a simple time series like that.

Now while in this Lesson we are not going to dig into exactly the steps to create your Smart Chart, you definitely could prepare for that third Lesson by having your KPI in a format where you can present it like this: a list of the months, for example, or the weeks, and then next to that the list of the values for your performance measure and if you want to arrange them in a chart like this.

A Smart Chart is powerful

So, Smart Charts are much more powerful than that.



They tell or reveal the true story in a performance measure and when you look at this fluoride hours above maximum in a Smart Chart it becomes immediately obvious that there is no gradual downward improvement or trend. There is no recent upward trend. There is only one signal here and that is that around January 2010 something caused a sudden reduction in the number of hours per month that fluoride would go above the maximum desired level.

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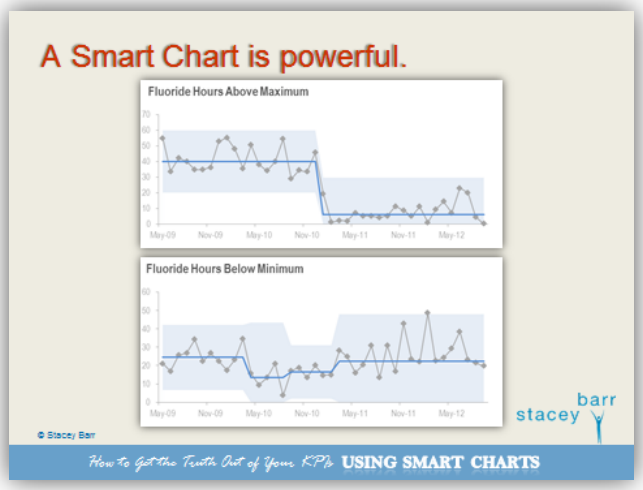
Now you might think there are a few points towards the end of that time series that look like it's heading up but under Smart Chart rules, which we'll explore in a moment, there is no evidence of a signal there. That's still part of the routine variation.

So they are powerful charts because they tell the real story of performance. They say what is really going on. This is a particularly interesting example because you naturally want to say "Well why did fluoride hours above maximum suddenly go down and stabilise then at a new low level?" We are seeing that fluoride levels are spending much fewer hours per month above the maximum limit. Well, we are talking about a maximum limit and guess what? There is also a minimum limit and when you couple the two graphs together it tells you quite an interesting story.

At the same time that fluoride hours above maximum came down, which you can see here in the top chart, it seems like it's complimentary measure – fluoride hours below minimum – started to go up.



Can you see that signal in the Smart Chart where around early 2011 we've got an upward shift? It's only slight but it's an upward shift in the fluoride hours below minimum. So it's almost like saying that overall fluoride levels were reducing – they went through some kind of reduction there.

So while we are seeing it go over the maximum far less often we are seeing it go under more often. It would be interesting to find an explanation for that. And that's brilliant because that's exactly what Smart Charts do. They cause you to ask that question – what caused that? Do we know what caused that? Was that too long ago in the past that we can't figure it out? Or can we look back at our records and say "Well why is this happening?"

Update: *I spoke to Cheryl from Tualatin Valley Water District about why this happened, and here's what she said: "I talked to our Distribution lead and it appears that EPA fluoride guidelines changed in January 2011 from 1.0 mg/L to .7 mg/L, so we therefore started adding less fluoride to the water." A change in the process is a reasonable explanation!*

Now, we've looked at a Smart Chart and you've probably seen one before at some point. Let's take a look at the anatomy and get the language right.

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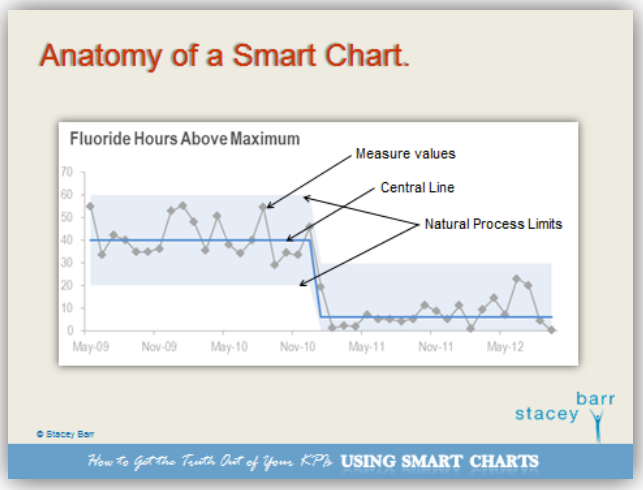
Anatomy of a Smart Chart

There are three important features about a Smart Chart and the very first one is obviously **your measure values** and they are plotted in this example in the grey line that goes up and down all over the place with those diamond symbols marking each value. So that's your measure values – they are plotted in a time series on a time series chart.



The next part of the Smart Chart anatomy of course is **the Central Line**. That's what it is technically called. In the past, and you may have done this too, I've called it the mean line or the average line and that's not technically completely accurate because with some data the average isn't the thing that you use to calculate that, so a much safer and more general way to describe that line is the Central Line.

The Central Line is calculated usually from the first five or six measure values. So those first six values there give you the calculation for your Central Line.

That Central Line, in a sense, is a measure of the **current level of performance**. So if we were to say 'Well what is our performance level for fluoride hours above maximum' down here toward the end of the time series which is pretty much current, rather than saying 'We are at zero' because that just happened to be the last point in the time series, what we would say is 'We are at about 5'. If we take that Central Line back to the axis it's probably about 5 or 6 and that's what we would say the actual level is, because next month it's not necessarily going to be zero. It's very likely that it's going to pop back up again and continue that pattern of routine variation that we've been seeing since late 2010.

That's what I love about a Smart Chart as well: it gives us a much easier way to describe what our current performance level is.

The third part of the anatomy is that pale blue shaded area which is bounded by an **upper and lower Natural Process Limit**. So those two limits, those two ranges there of the shaded area, are the Natural Process Limits.

They too are calculated from the first five or six values in the series and they generally are recalculated at the same time that the Central Line is. We're going to talk about recalculation a little later.

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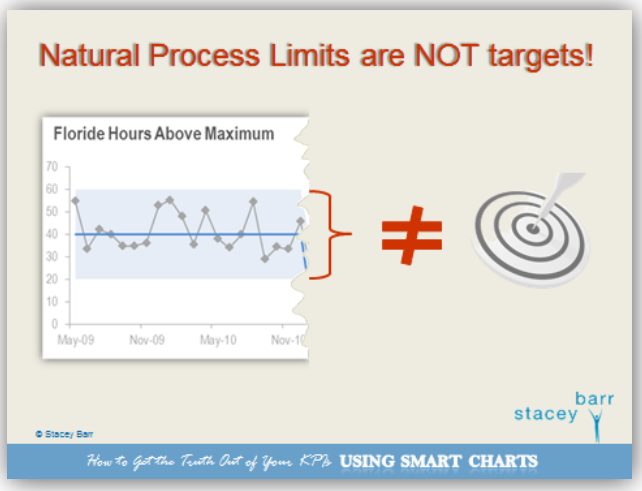
I want to come back to this choice of the words 'Natural Process Limits'. What's the 'process' part mean? The idea here is that every performance measure and KPI is measuring the result of some kind of business process or business system. Fluoride Hours Above Maximum is a measure of the process of maintaining water quality. Customer satisfaction with drinking water taste could also be a measure of that same process of maintaining water quality. But a measure or KPI like 'Customer satisfaction with water supply' which is a much more general level of satisfaction is probably a measure more of the whole system not just one core process for this organisation.

The Natural Process Limits show us where the routine variation is and in a sense those Natural Process Limits are a measure of what we call **process capability**. It's that range of performance values that you can expect from this process the way the process currently works now, without changing that process.

Natural Process Limits are NOT targets!

Now that brings us to the first of a few misconceptions people can have about Smart Charts.



These Natural Process Limits are not equal to targets.

This is a mistake that a lot of people make. They feel that the Natural Process Limits act as targets and the goal is to keep the points within them, but that's absolutely false and incorrect.

The Natural Process Limits are really the **voice of the process**. In other words, those Natural Process Limits are the process telling you what it's currently doing now; how big its current routine variation currently is now. Mistaking them for targets would be mistaking them for the voice of the customer.

Now the **voice of the customer** is really saying 'We want the process to be able to do this'. That's a very different thing to saying 'This is what the process is currently doing'. So the Natural Process Limits describe 'as is' performance or 'current' performance. Targets should describe the 'should be' performance, or the future performance.

Don't confuse the two and watch out for any clues that any of your colleagues might be confusing the two.

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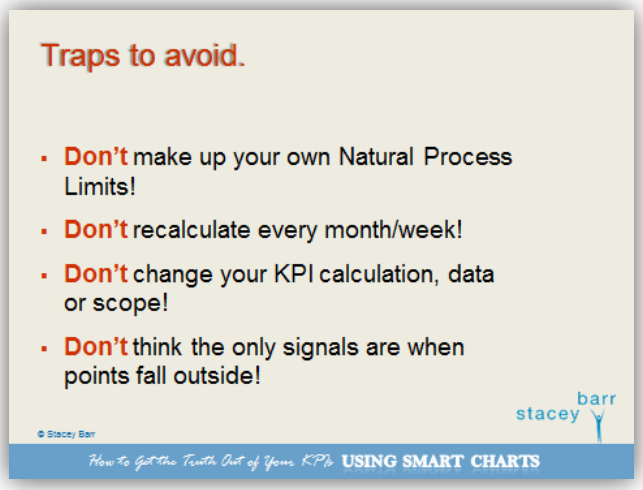
We are going to look at how you can bring targets into your Smart Charts but that's not until Lesson 5 so be patient with that.

Now, that's the biggest misconception that people have about Smart Charts, that meaning of the Natural Process Limits. There are a few traps that you want to avoid though.

Traps to avoid

The first trap is: don't make them up.



Don't just plot your Natural Process Limits on where you think they should go or by making up some arbitrary calculation to place them.

There is one specific formula for putting Natural Process Limits on your Smart Charts and we're going to learn that in Step 3 and that's the only way to put them on there, otherwise they don't have the meaning that they should have and they won't be able to reliability highlight the signals in your KPIs. You will either get signals when you shouldn't or you won't get signals when you should.

So let's not complicate things. Just accept there is one correct formula for calculating your Natural Process Limits.

Also, don't recalculate your Central Line and your Natural Process Limits every month or every week or whenever you have new data to add. This is another mistake people make a lot. You just use those five or six points to start with and then if that gives you a Central Line of 5 your Central Line stays 5. It doesn't get updated with the next months' data. It stays 5 until you get a signal that says 5 is no longer an appropriate Central Line for how this Central Line is performing.

The Central Line and the Natural Process Limits together are forming a baseline for you to compare future points as you add them to your graph to work out if those future points are suggesting that all things are staying the same or something is changing. So you need to maintain that base line and keep it steady just based on those first five or six points.

Another trap to avoid is: don't change the way you calculate your KPI or the data that you use to calculate it or the scope of the calculation. So if you change

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anything about the way you calculate your KPI you now have a different KPI and it will possibly show up as a signal on your Smart Chart when it really isn't a signal of change. It's just a signal that now you are dealing with a different sort of measure. So you need to start your Smart Chart from scratch. If you change the calculation of your KPI you treat it as a new KPI and you start your Smart Chart from its first new value.

Finally, another trap to avoid is don't think that the only signals you can get are when a point falls outside the Natural Process Limits or when a point falls outside that band of routine variation. There are specific rules for the signals and there are four types of signals you can look for and some of those signals happen within the Natural Process Limits.

So those four are the most common mistakes or traps that I see people falling into. So if you are aware of them you will be able to recognise if someone else is doing them, or for a start you won't do them yourself and you'll also recognise when somebody else is doing them and you'll be able to stop them in their tracks.

End of transcript.