Process Behaviour Charts:
The key to understanding variation and unlocking performance improvement

NEW CUYAMA
Population 562
Ft. above sea level 2150
Established 1951
TOTAL 4663

As managers we all know that we should use data to inform our decisions and guide our improvement efforts. However once armed with data (not always easy), it is our understanding and interpretation of the data that is all important. It is these critical phases that will influence the decisions that are reached and actions taken. The purpose of this document is to offer and explain a simple yet extremely powerful approach to analysing process data; the Process Behaviour Chart.

"If you were given a choice of working with processes the outputs of which were consistent, predictable and met the requirements of customers or working with ones which were erratic and incapable of reliably meeting customers requirements, which would you choose?"

As self-evident as the answer might be, many managers are unaware that it is understanding variation that is key to process improvement and therefore performance of their operations.

"Every process will always exhibit variation"

Understanding data is often made more difficult by the imposition of targets or "service level agreements" set at arbitrary values; data are often presented in accordance to these, almost binary *"measures of success/failure"*, on the basis of *"this is how you did this month"*. Increasingly the business world has developed a preference for such data to be presented as a single figure (often in the absence of historical performance on a *percentage compliance to target* basis) or worse a Red-Amber-Green "traffic light", neither of which are any help in understanding what is going on or in informing decisions to drive improvement.

To illustrate let's look at a very simple example: Derek, a manager responsible for IT repairs has been presented with the performance information of one of his teams this month; it is 92%, which is a *"green"* as the target *is "90% or more of repairs to be completed within 14 days"*. Notwithstanding a fundamental flaw in the target, (which says its OK not to worry about how you serve 10% of your customers) we could be forgiven for thinking that Derek should be pleased; after all he has met his target, but Derek knows that the performance is NOT what it should be. His team suffers low morale, they are inundated with calls from customers chasing progress, and the customer feedback is "mixed" i.e. more often than not "very poor". This in itself is very instructive; it acts as a strong signal that **"the voice of the customer"** is not represented by the target.

In helping Derek, our first step is to ask "what matters to customers?" We establish that customers want their repair completed quickly *and* to have confidence in the predicted completion time. The next step is to reveal a more granular level of detail; the elapsed time for each and every job completed in the period. The data is then assembled in **"time series"** as this helps us identify trends and to relate changes in process to changes in performance.

Figure 1
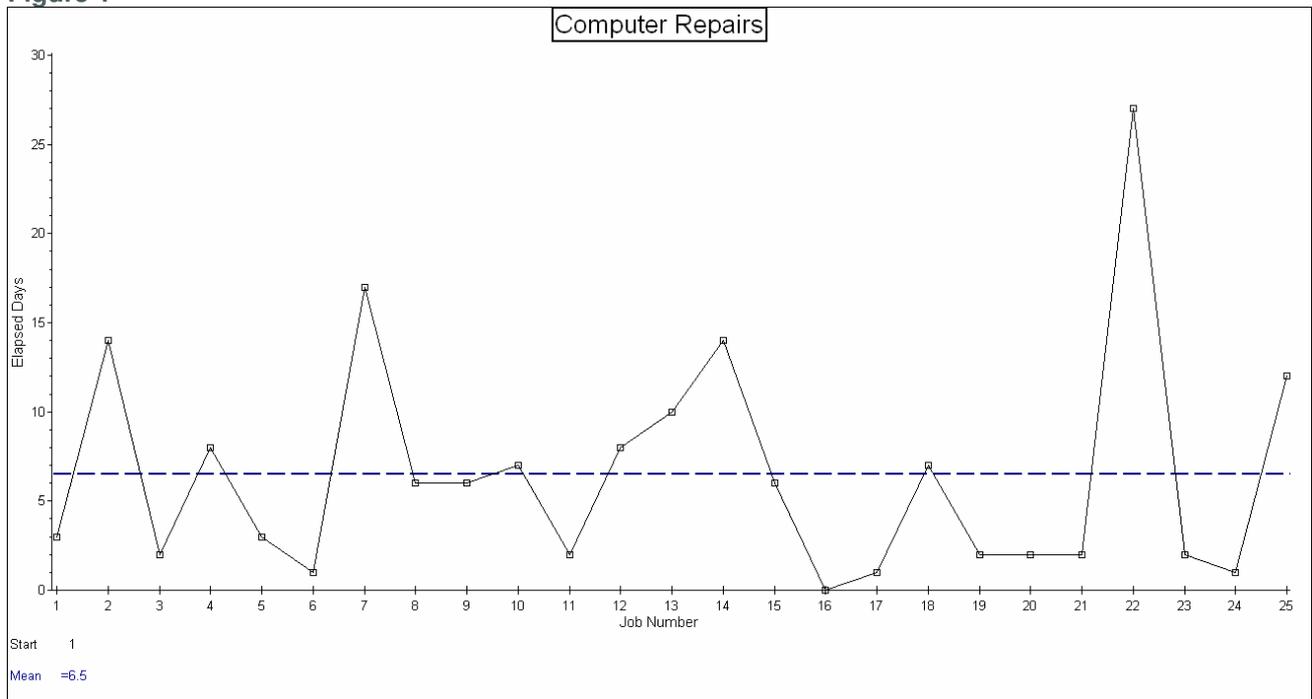
The result is a simple **"Run Chart"**, Figure 1. It shows the time taken from request to completion for the repairs, on a job-by-job basis in chronological order. The horizontal dotted line indicates the mean average turn-around time for repairs (6.5 days), but the actual time to complete varies either side of this from 0 (same day) to 27 days. It is this variance that is key to our understanding of the process.

To better understand that variance we need to make an addition to the run chart.
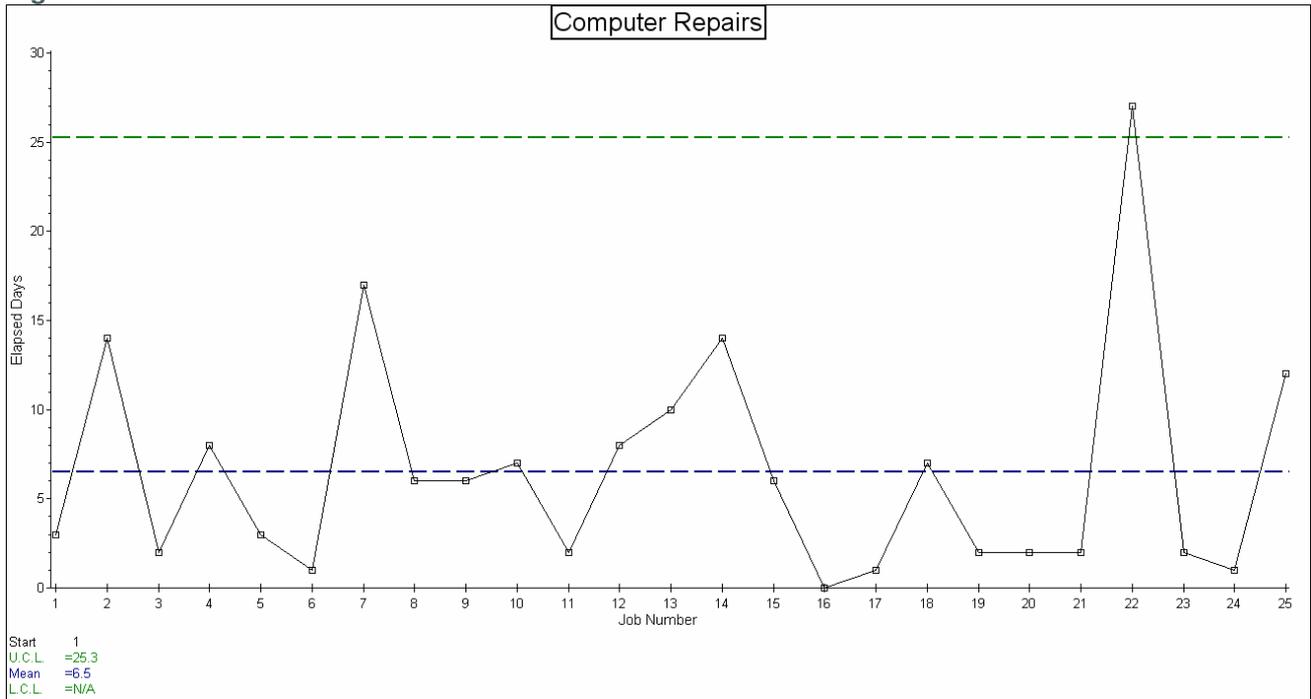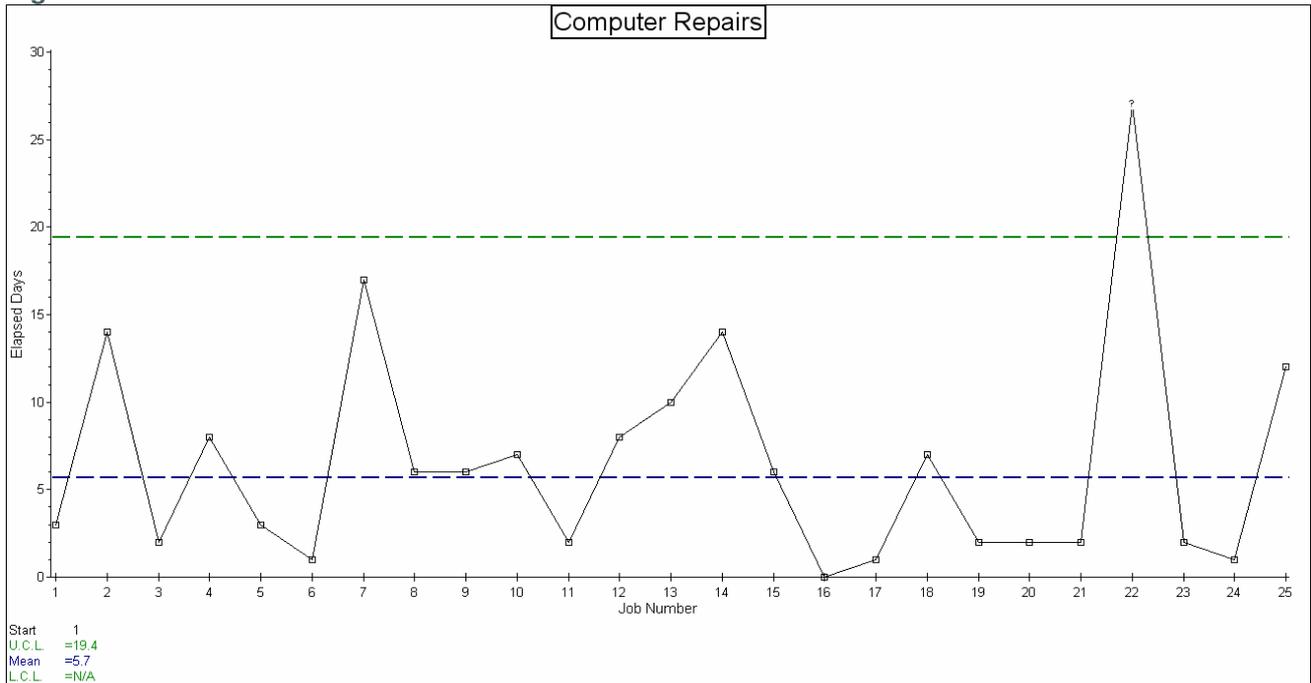
Figure 2

Figure 2 represents exactly the same data that we discussed in Figure 1; the addition is a pair of **natural process limits**, the upper limit is represented by a green dotted line, the nature of this data set means that the lower natural process limit is zero. These limits are determined by the process and the underlying data[1] and not something that is imposed on it, as targets often are. We often refer to the current "signature" of a data plot in time series with associated natural process limits as **"the voice of the process".** When all the data points fall between the limits, the process is said to be **stable or "in statistical control"**, the natural process limits describe the variation that the process can be expected to exhibit. Thus we can, with some confidence predict the outcomes of a stable process, in the opening paragraph we discussed the benefits of predictable process outcomes, hence the importance of these limits.

In this case however one data point falls outside the upper control limit, Job 22. Data points that fall outside the process limits are called **special cause signals.** These special causes are worthy of individual investigation; it is likely that they arise from specific circumstances, often outside the normal process conditions. Derek's enquires prove that in this instance this is indeed the case; a repaired unit was damaged in a courier's vehicle fire whilst being returned to the customer. As this is not a normal characteristic of the process we can recalculate our process behaviour chart having eliminated this special cause signal.

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[1] The process limits are 2.66 standard deviations either side of the mean

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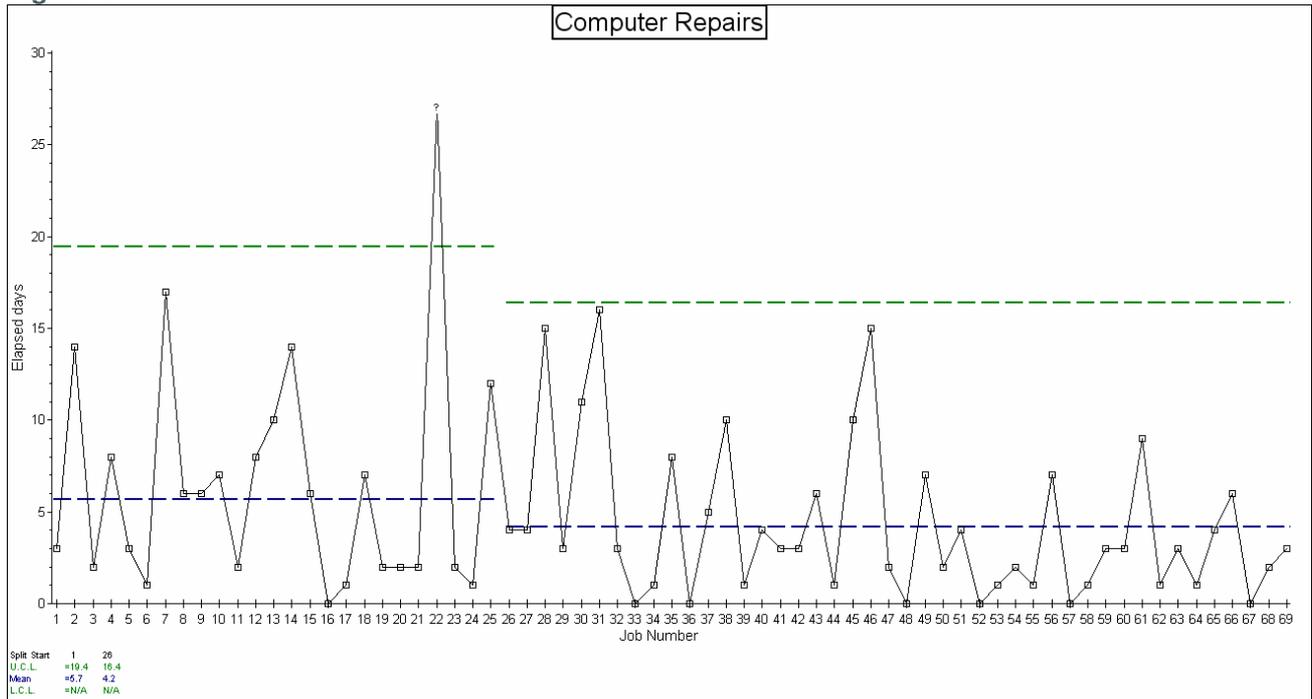
Figure 3

Based on this data, illustrated by Figure 3, Derek can now consider his repair service to be **in statistical control**, **in other words stable and predictable.** Whilst being predictable is of course desirable, it does NOT mean that the process will meet the requirements of the customer or Derek's organisation - **it is said to be stable but not capable.** You will notice that in eliminating the special cause the upper process limit has reduced to 19.4 days. This is of course cold comfort to Derek; all he can say is that he can guarantee to turn around repairs within 19.4 days – assuming there are no exceptional circumstances such as van fires.

However this is a critical revelation; Derek realises that, though his process is stable in its current form, it is incapable of attaining the target set of 14 days. For the time being Derek chooses to ignore the target; he now understands that reducing the spread of variation will be key to improvement. We refer to the data points that fall between the process limits as **common cause signals**. These are typically due to a wide range of influencing factors; unlike special cause signals, these factors have influenced most if not all the data points, i.e. they are inherent in the process. Identifying them and understanding their root cause is the next stage in the improvement process.

At this stage Derek reminds himself that it is the people in the process who really understand what's going on, not he the manager. He decides therefore not to react to his intuition but to put the data collection activity in the hands of his team and to guide them in their analysis of it. Derek explains to the team what he has learned about process improvement. He provides a graph template on a flipchart onto which they are to record the elapsed time of each job as it is closed, and another to record all the delays and frustrations that are encountered in progressing the repairs. In return for doing this extra work he informs the team that they can ignore the 14 day target, there will be no recriminations for performance against it. During the next month the team is inundated with repair work, demand is up 76% compared to last month. Derek spends time with the team, he is amazed by how much he learns about the process, and the lengths that the team have to do to get round problems.

Figure 4

At the end of the month Derek is delighted when he runs the numbers through his software (see Figure 4); it reveals that the upper natural process limit has come down (from 19.4 to 16.4). Perhaps even more encouraging is the fact that the team have filled up four flip charts with information describing the problems with the process. As he sits down to work out the performance against the 14 day target, he smiles because he genuinely doesn't care what it is; he knows that the variance has come down, he has received fewer customer complaints, the team are really fired up to make some process changes, all in a month where they have completed record levels of work.

Derek forms a sub-team to work on the improvement. They work hard at gathering data to quantify and qualify the information recovered on the flip charts; they roughly prioritise on the basis of maximum predicted impact relative to ease/effort/cost of the improvement. At a workshop with the whole team they agree the priorities, refine the ideas into timed action plans with a named responsible person for each. It emerges that it is at Derek's level that many changes need to be brokered, with suppliers, with the QA department and with logistics. Other changes are within the authority of the team. However Derek knows that it is vital to only make one process change at time and confirm that it has had the desired effect.
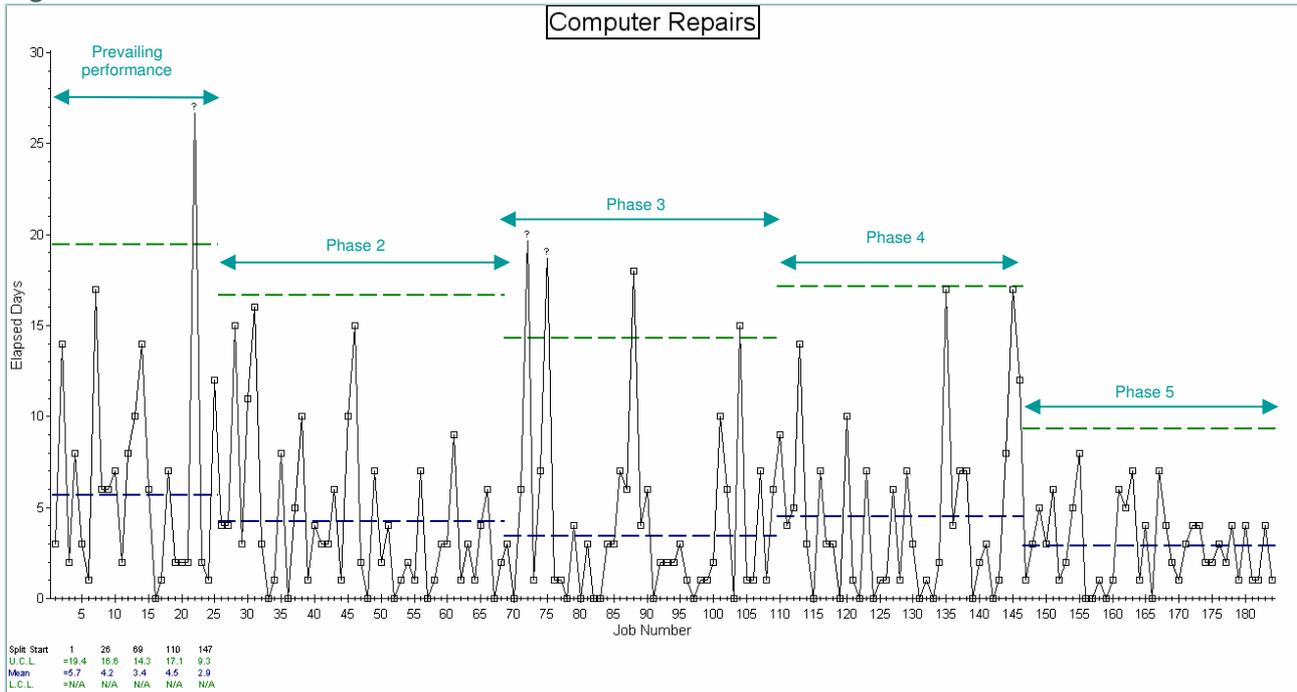
Figure 5

Figure 5 illustrates the effect of this approach. During phase 3 the team implemented their planned changes, undeterred by a couple of teething problems (job 72 and 75, which they rightly assigned to be special causes); the process exhibited improvement. However they were concerned that the process was now unstable (points 88 and 104 are outside the upper natural process limit). In phase 4 they selected the improvement activity that they hoped would bring the process back into stability; in fact it made matters worse, nullifying the previous improvement. However the team learned really valuable insights about the process through this experience and used this knowledge to design their next change.

The subsequent performance, phase 5, speaks for itself; the process is stable, variation has been halved and it is capable of meeting the target. As such, we can now refer to it as a **"capable process".** Most important of all the fact that the **voice of the process is, for the first time, consistent with the voice of the customer.**

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Let's reflect what this case tells us.

- Simply putting the measurement activity in the hands of the people doing the work in a format that revealed variation – **a run chart – had a significant and beneficial impact.**

- This service improvement required **no extra people, no capital expenditure, no fancy IT systems**, simply a little help to get those involved to think differently about their work **AND it was completed in a matter of weeks.**

- The old perspective *"conformance to 14 day target"* was comprehensively unhelpful in informing improvement work, **without an understanding of variation none of this improvement would be possible.**

- **Derek's relationship with his team has changed - forever.** What used to be a ritual of congratulating or beating-up his team leader on a monthly basis, depending on whether the target had been met (basically down to "chance" - the common cause variation in the process remember), has been replaced by a relationship where they work together, enabled by the fact that they understand what is influencing performance.

- We are often asked to work to erroneous targets, specifications etc. In addition to being unhelpful in informing improvement work, **such measures are rarely a proxy for customer experience. Derek made himself vulnerable** by instructing the team to ignore the target and work on reducing variation. **As a result the customer experience improved**, (tellingly so did the conformance to target measure).

- Before Derek's efforts the team were downtrodden, morale was low; they had been doing their best before but nothing seemed to change. By phase 5 the team had rediscovered their joy in work, they were clear about what they were responsible for and had the authority to make changes. **They have new-found confidence in their now predictable process, they are proud of their performance and enjoy receiving positive feedback from their customers.**

- The 14 day target is now fully exposed as being the meaningless arbitrary number it has always been**, it is independent of both the voice of the customer and the voice of the process;** what's more it now represents no challenge to this team.

- **Variation is at levels about half of those experienced before the changes, the team are now working with a process which is stable, predicable, capable and most important of all consistent with the voice of the customer.**

If you would be interested to find out more about process behaviour charts and other variation reduction techniques and how they might benefit your organisation, why not get in touch to arrange a no obligation visit?