

Quick Assessment on Your Knowledge of Variation

By Timothy J. Clark

The following six people were selected and trained to perform a specific series of tasks over a period of four days.

They were provided the same amount of training, given the same equipment and materials to perform the tasks, were provided comfortable working conditions and were adequately supervised.

You want to recognize and encourage the top performers (the lower the number the better) with the intent of maintaining and improving performance. Below are the results.

Performance Report – Common or Special Cause of Variation?

Name	Day 1	Day 2	Day 3	Day 4	Total	Grade	Stoplight
John	14	10	9	10	43	F	Red
Pat	17	5	8	5	35	B	Yellow
Mary	11	6	5	9	31	A	Green
Steve	8	8	9	6	31	A	Green
Karen	12	11	12	8	43	F	Red
Dave	9	11	7	10	37	C	Yellow

If this process represented the cumulative results of wrong answers on a daily 50 question test in school and the teacher was grading on the curve, the distribution of grades would be: 30-32 = A, 33-35 = B, 36-38 = C, 39-41 = D and 42-44=F. A column that provides status by color-codes is also provided to help assess performance.

Who would you select as the top performer (s) ?

Wrong Answer: Applying the traditional view of variation, choosing the “top performers” - those with the lower numbers or higher grades, would be the wrong answer.

Right Answer. Applying the new perspective on variation, the correct answer is that based on the results, there is no significant difference between the people performing the tasks, or in other words, there are no top performers. The variation in their performance is normal or common. Taking action, such as recognizing "top performers" represents tampering – spending time or money on a non-valued added action with tends to make things worse and not better and reinforces the status quo. (Personal Story: [Are Grades Effective and Fair?](#))

Explanation

Since the outcomes from the process represent common causes of variation, the process is stable or predictable. In other words, *If you always do what you always did, on average, you will usually get what you always got.* Stable does not necessarily mean good, it just means that given all of the variables, results from the process are predictable. Other terms for a stable process would be routine and habit.

Imagine tracking the amount of time it takes you to brush your teeth every day. Would it even occur to you to reward yourself for a “top performance”?

If you want to improve the result from any process, you must make a permanent and fundamental change. Indications of special case variation would provide feedback on the results of the change. For example, fad diets can represent tampering. They often result in a temporary weight loss but often do not result in a fundamental change in diet and exercise routines.

Applying Some New Methods

These methods can be applied to assess the results from any system or process (habit, routine) that can settle into a steady state. Media headlines that refer to numerical information provide another source of examples. Most of the headlines are misleading if not totally wrong.

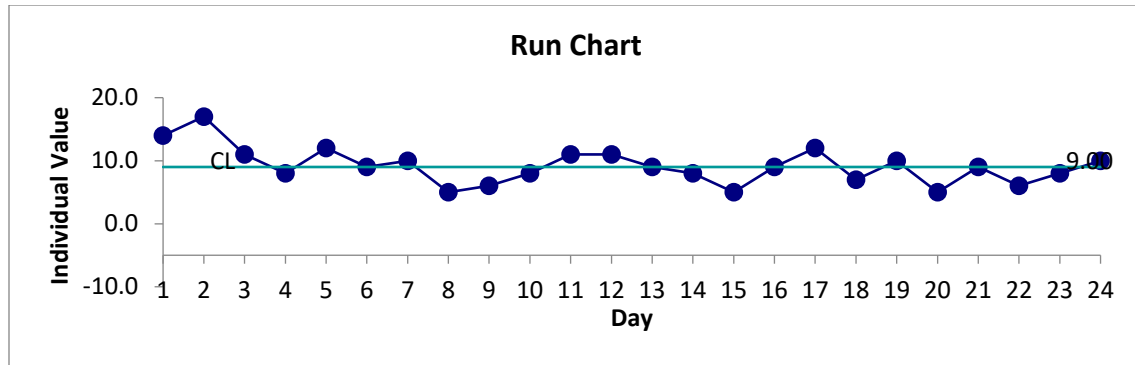
Application examples could include:

- **Sports:** [Basketball Free Through Shooting](#), Field goal kicking,
- **National:** Budget deficits, unemployment and employment rates, crime statistics, suicide rates, health care access rates, car accidents
- **Personal:** Savings, individual weight, travel times.

[USAFacts.org](#) has examples of trends on national issues. When looking at the run charts, try to visualize the center line (median) passing through the middle of all the points and determining if things are getting better, worse, or staying about the same.

Identifying the two causes of variation – Run Chart

The data from the Performance Report above is plotted below on a run chart and identifies that the variation only includes common causes. A run chart is a line graph of data plotted over time. Generally, 20-25 data points are needed to arrive at an accurate judgement. The Center Line (CL) can be calculated using the average or median. In this case, the median was used. The median is value separating the higher half of a data from the lower half. For instance, if you were to plot the results from a personal routine or habit such as the time it would take to commute to school, work, friend or relative’s house or your favorite store, the results may look similar to the chart below.



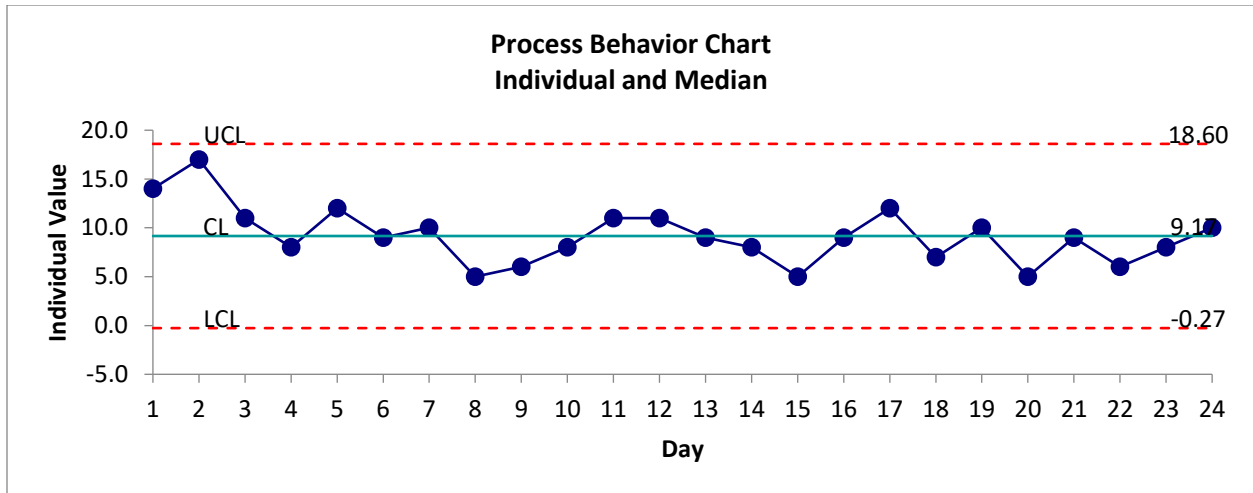
Indications of Special Causes of Variation

A special cause of variation could indicate a temporary or fleeting event or a change (positive or negative) in the process. Depending on the application, the number of data points could range anywhere from 5-8 data points: Indicators of a shift in the process include the following:

- 6 Consecutive Points in a row rising or falling.
- 8 Consecutive Points in a row above or below the center line.
- Points (*outliers*) that appear farther away from the center line; A outlier could indicate a special cause of variation.
- Nonrandom patterns – too close or too far from the center line or repeating cycles. The people closest to the process may be able to provide an explanation of the patterns.

Given that there are no indications of special causes, the variation is assessed to be common and the process is determined to be stable (predictable).

An additional and a more advanced tool that that can be developed is a Control (Process Behavior) Chart. This is a run chart with upper and lower limits. In this example, the upper limit is 18.6 and the lower limit is zero. No points (outliers) fall outside the limits nor is there any nonrandom patters or indications of cycles which would indicate a special cause. Control charts are not appropriate in all cases. In the case of COVID related data for example, run charts help identify how the system is changing.



Conclusion

This example was inspired by Dr. Deming's [Red Bead Experiment](#). I had the opportunity to attend a four-day seminar conducted by Dr. Deming in 1988. He spent about half the day on this exercise to reinforce the point that rewarding or punishing the “willing workers” did not improve the process and just demoralized the workers. The link to the video is just 30 minutes.

Deming estimated that failure to understand the difference between common and special causes of variation resulted in decisions where 95% of changes resulted in no improvement. For an individual example, consider New Year resolution. What percent of your resolution have been successful – how many have resulted in a permanent and fundamental improvement?

Deming also considered the common practice of annual performance appraisals (and grades in school) as one of the [Seven Deadly Diseases of Management](#).