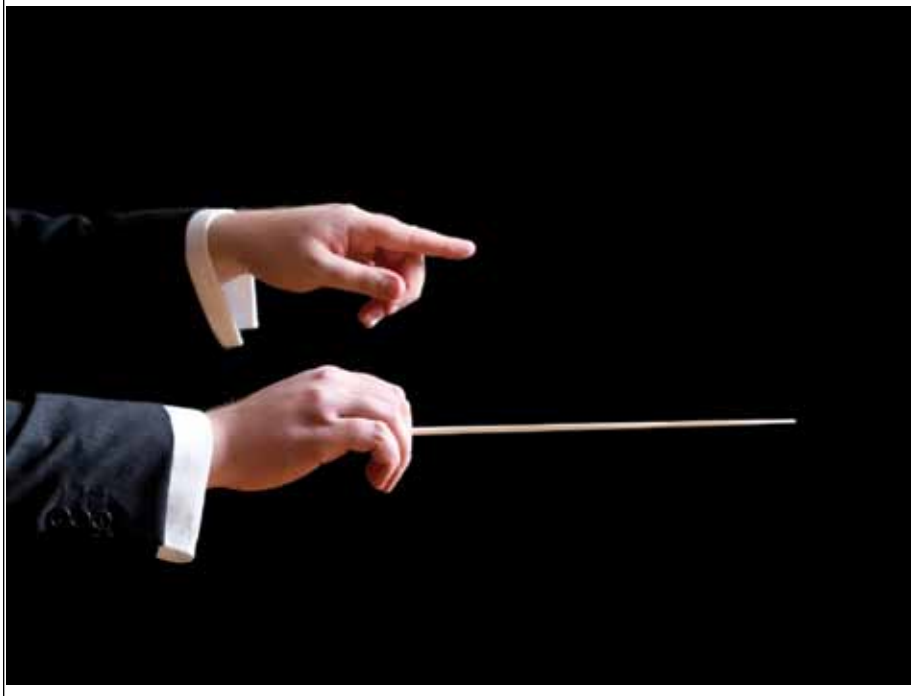
Champagne or Beer?

Sometimes finding a solution just requires hard work and focus

SEVERAL YEARS AGO, during a difficult Bach passage, our conductor stopped the chorus and addressed the bass section: "Gentlemen, I ask for champagne, and you give me beer."

"What's wrong with beer?" I remember thinking. You probably drink beer. I used to, but not anymore (Not after last night! Just kidding). But I do remember the conductor's remark helped shape us up. He knew we could do better, and so did we. We just needed to focus and to work harder.



The episode came to mind recently when I was asked for my views on a report intercepted on its way to a member of the top brass. It contained tables of C_{pk} indexes by plant, month, product and response.

Recall that C_{pk} is the distance from the mean to the nearer specification limit divided by three times the capability, or within-group, standard deviation. To aid interpretation, the C_{pk} values greater than one appeared in green in the report, while those less than one were in red. The implication was that attention should be focused on areas with red C_{pk} values.

It's difficult to argue with that. Attention probably should be focused there. But, while the report called attention to areas in need of improvement, however, it also took the heat off some other areas, assuming we are content with C_{pk} greater than one. Some say it should be greater than 1.3.

I said a lot more in an earlier column, ranting about having realistic specifications—having a process that is in control generates normally distributed data and has at least 100 observations.[1] These are all prerequisites to using C_{pk}, and they are resoundingly ignored in practice.

Always plot the data

It's true that nobody put me in charge of quality indexes, but maybe I can illustrate the point. From the intercepted report, I noticed for one plant, one product, one month and one response, the C_{pk} was 1.09. It was in the clear—no problem. Look elsewhere. But wait a minute. I recalled someone saying, "Always, always, always—without exception—plot the data, and look at the plot."

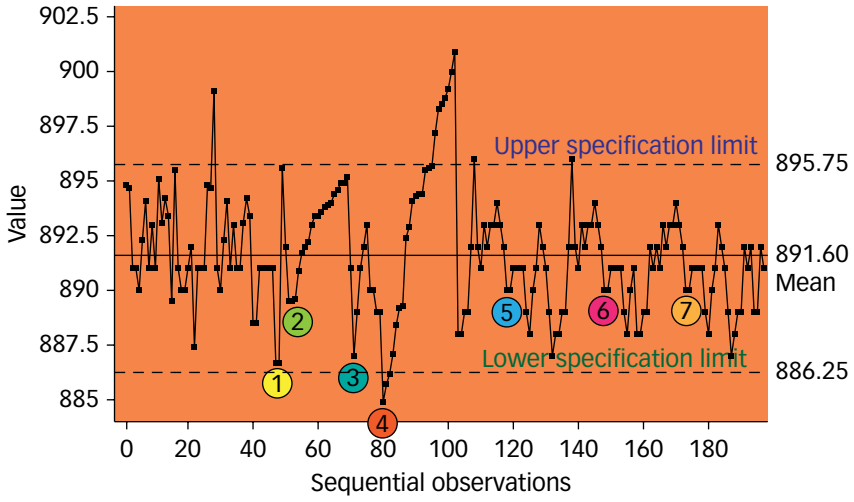
Well, the computer program that generated the C_{pk} also drew a histogram. That's a plot, isn't it? Besides, the data look roughly normal, and there are 187 points. True, the specifications came off a ceiling tile, but that's the best we can do. We're sticking to it.

Maybe I should have said, "Always, always, always—without exception—plot the data more than one way, and look at the plots (plural)." No rule works for everything. But one plot that's always worth a look is a time plot which shows all the raw data in sequential order. Figure 1 shows the time plot with the mean and upper and lower specification limits. As Yogi Berra said, "You can observe a lot just by watching." So watch Figure 1 carefully.

At (circled) point one, there is an extreme low value. Maybe someone made an adjustment after seeing it because the next value is very close to the upper specification limit.

It is possible this new high value

Data in time order / FIGURE 1



was countered with another adjustment because two observations afterward, the observed value is below the mean. Then, starting at point two, there is a steady run upward. Did someone make another adjustment two steps before point three to bring the process downward?

Whatever happened at point three, the process started to creep up and was brought downward again. But after point four, there is another steady run upward.

It is fun to imagine what might have happened. Do you suppose the operator had a fight with his wife the night before? His thoughts drift from the process to the argument until suddenly he sees a value in excess of 900. "Holy Toledo, I have to act quickly! I'll show her," he thinks as he grabs the wheel and adjusts down hard.

Then you come to points five, six and seven. Do you see something unusual? The values repeat. Was there a data transcription error? Did some well-meaning soul copy values to build up the data set? Repeats like that don't happen by chance alone. We'll probably never know the true cause of the repeated observations, but it is clear they don't represent the real process behavior.

Forget C_{pk} for now

Oops—wait a minute. We forgot about C_{pk}. Instead, we got caught up in detective work. And while we did that, we didn't worry about specifications, the process being in or out of control, the normality of the data, or the number of observations. Instead, we saw an opportunity to mend an undisciplined process, and we have something with a little more value for quality and productivity improvement.

We did this by forsaking the routine, by focusing and by working a little harder. Our working harmony produced champagne, not beer. QP

REFERENCE

1. Lynne B. Hare, "The Ubiquitous C_{pk}," *Quality Progress*, Vol. 40, No. 1, 2007, pp. 72-73.

LYNNE B. HARE is a statistical consultant. He holds a doctorate in statistics from Rutgers University in New Brunswick, NJ. He is a past chairman of the ASQ Statistics Division and a Fellow of ASQ and the American Statistical Association. He sings in the bass section of the Pro Arte Chorale in Ridgewood, NJ.