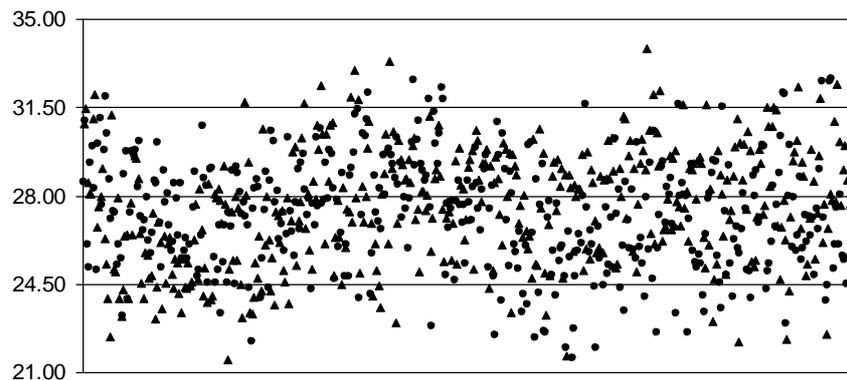


## ERRORS AND MISTAKES

In this short contribution, I shall describe a challenge I frequently observe with my consulting students. More specifically, I shall tell you how my students tend to communicate with their clients and how this can damage their credibility. I believe that such behavior generalizes to a much larger population. In order to help protect the credibility of our profession, I would like to encourage you to raise awareness about proper communication among your students and peers and to be careful yourself about how you communicate with the outside world.

Some time ago, a group of my consulting students worked for a manufacturer of surgical drapes (the sheets which cover you during an operation). The client wanted to analyze data related to the amount of glue dispensed onto the sheets before fixing pieces of rubber on them. The specifications required that the amount of glue should be between 21 and 35 g/m<sup>2</sup>. The client sent us data covering observations over more than one year.



After having received a methodological reminder on statistical methods for quality control, the students analyzed the data. They found some deviations from stationarity, a few observations which were further away from the process average than the majority, a hint that the left side received a bit more glue than the right, and that one product type had a lower average than the others. Nevertheless, all observations were within the specifications.

Then came the time for the project presentations. How did the students express what they saw? They said that the process was ‘out-of-control’, ‘not-capable’, and that there were ‘large errors’. During the presentation, the client looked at me and frowned. Fortunately, I knew him well and so I looked back

at him and smiled knowingly. And so he smiled too. After the presentations, I was able to explain to the students and the client what had gone wrong and I hope that they all understood. However, many of our students never take a consulting course and when they face their first clients, they will say things which will make them appear as overzealous fools or which are insulting to their clients.

Where does this come from? It comes from careless use of statistical jargon.

The students called the process out-of-control and meant that a statistical control chart drawn from the data showed indications of what we call 'assignable causes'. These are data patterns for which, if we investigate the process knowledge, we will probably find an explanation. Encouraging our clients to search for causes when such patterns are present help them in better understanding and running their processes.

Yet, to the process operator or owner, 'out-of-control' means 'gone out of hand' which is something much more serious. A few shifts in a process are quite normal. Sometimes a component has to be replaced or the system has to be restarted after the holidays. Such jumps create data patterns which point to assignable causes but they do not imply that the process has 'gone out of hand'.

Instead of calling the process 'out-of-control' the students should have said "we found some shifts and some unusual observations in the data, are these known to you? If yes, could you tell us the reasons for them? If no, are the sizes of these jumps big enough to raise concern?"

The students also called the process 'not capable'. They did this because its process capability index was below one. Such an index compares process location and spread with process target and specifications. It is larger than one when the interval formed by process mean plus or minus three times the process standard deviation is inside the specification limits. Capability indices above one or even two are common objectives in manufacturing. However, a process whose data correspond to a capability index below 1 is not necessarily 'not capable'. In the example, none of the more than 800 observations was outside the specifications. It was obvious that, although the process had moved over time and showed some heterogeneity (which messed up the standard deviation and hence the capability index), it was perfectly capable of remaining between the specifications.

Finally, the students spoke about 'large errors' and since the presentations were in French, they used the word 'erreur'. In French, 'erreur' means 'error'

and ‘mistake’. So, the students had told the client that there were ‘large mistakes’.

With a few poorly chosen words, the students had needlessly insulted the client and his process. Fortunately, a senior statistician was present to smooth the waves, otherwise the credibility of the young statisticians and of our profession might have suffered.

Many of our words have different or less precise meaning in the language of the outside world. Error, statistical control, capability, statistical significance and confidence levels are among them. We cannot always avoid using them, but we should make sure that they are understood the way we intend it. Let us try to avoid turning errors into mistakes.

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