AN ISSUE OF EXPERIMENTAL DESIGN

If you have tried reading books on "experimental design", you know what a pain it is. Sometimes, you need to ignore these rules. The world is messy.

A central underlying theme of many experimental designs is:

1) Get the area for the experiment (in our business, tracts of land) as equal as possible. Use your judgment, the judgment of others, and data.
2) You can't do that perfectly, so stop *after a making a good effort*.
3) Now, randomly assign experiments to the areas. This lets you get unbiased averages. and *unseen* differences in the areas will "cancel out" in the long run – eventually leading to correct differences and rankings between those processes.

As always, it is not this simple on the ground. A colleague recently had a machine trial, and choose 3 areas that were nearly alike visually – then randomly chose the area assigned to each machine. He had a traditional machine, a slightly smart one, and a very smart machine. The intent was to see if a smarter processing into logs would justify the extra expense for the smarter machines. It was a typical situation, really, and as sometimes happens you could only get a sample size of one in each area. In this case, the one observation in each area was the total value of the processed logs.

How would you *convince* anyone that the best outcome in this trial was not just due to the random selection of an area with better material to begin with? They did a cruise, and used all the information they could, but still had some area differences in size, species and the opportunity to optimize the tree-into-log process.

The value results were in the order they expected. The amount of difference was enough to justify the better machine - but there is always the nagging suspicion that the leading method *just got lucky* because of the area it was assigned. One of them will always be best, even if there is no real difference in the machines. There is no simple statistical solution to this situation. It is as much a psychological issue as a statistical one.

One of their scalers had a suggestion – and it was a great one. As far as you can tell before the trial (and hopefully any additional information afterwards will verify this) you could assign the *worst* area to the method you expect is *best* able to optimize the field situation and give a good result. If it is the best even with the worst material and circumstances, it certainly would really appear to be the best choice. The opposite would be done for the dumb machine – give it the best opportunity to shine.

Such an assignment is not statistically typical, because it will not give the right average *in the long run* – but there is no long run here. You get one shot, and you have to justify an expensive decision to an executive group that is risking real money. You don't need nagging doubts in a case like this. The question here was "is there evidence enough to make this decision?". A conservative (too small) estimate of any differences between the machines can still answer that question, and this approach has a great deal of psychological merit.

K.I.

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