[SQUEAKING]

[RUSTLING]

[CLICKING]

So the thing about an expected value of information, it's an expected value. That is, we're always dealing in expectations here in the world of uncertainty. So you may have the information that says that it's really good, and it turns out that it's not so good. So you're not something that is absolutely sure, but it's an expected value.

So now let me talk about the way one would do this in a full analysis. And I think it's important as a baseline-- thank you for the word-- it's a baseline for how we think about it. So the calculations are complex. First of all, any test, you can have many different results. For example, a prototype plan might work very well, well, so-so, poorly, fail. So you don't get necessarily a yes/no answer, you get a range of answers.

Now, these answers don't prove what will happen. Why is that? I've run it. I've got a result, it works well. Do I know that it's going to work well, or don't I?

Well, the test results will not prove what happens. They are samples, just like if I go through a test for TB, or contemporaneously, if I go through a test for COVID and I have a negative result, it doesn't necessarily mean that I'm negative. It might be there's a false negative, or contrarily, that it's a false positive. They thought they saw something, but it's not there.

So what the new information does is not tell you what was happening. You knew this already, but I'm emphasizing it. But it says, OK, you thought it was like this. You got some new information. It made you think that it might be different. So each piece of new information, whether it performs well, very well, poorly, so-so, and so on, updates the prior estimates. The technical way to do that is using something called Bayes' theorem.

Now, this is not a particularly simple topic we get to because if I have, say, five results, as I listed before, and each test result implies a different value of the project, each with a different probability that five test results will give you five different updates for your system and each will have a different set of probabilities that you updated from the priors to the posteriors, and you have five different solutions. So the calculation of this process that is the expected value of sample information is complicated.

So first of all, what's Bayes' theorem? I imagine that many of you, if not most of you who have already dealt with this, maybe you had in a course, that had to pass quizzes on it, and so forth. But just as a recall, let me remind everybody or introduce the others to what it is.

The formula is very simple, but I'm arguing for you this is what I'm talking about because if it comes up is it's impractical use for a system designed on a regular basis. But let me tell you what it is and you'll see what-- I hope you'll see what I'm coming to.

So the probability, the posterior probability of something, A, say, that the product will sell well, after the observation, B, basically called A, probability of A given B. That is, I had a prior probability, maybe 50% it was going to sell well. I took my tractor to the state fair. They gushed over it. It made me think, oh, it will probably-- it's more than a 50/50 chance, it will maybe a 70/30 chance it will sell well. So my posterior probability, my revised probability is a simple formula. It is equal to the probability you had in the beginning times a factor.

Now, all the devil is in the details. The factor is the probability that B is correlated with A, that those kinds of responses actually lead to the market results divided by the probability of B, the prior probability of B.

Now, the issue is that although the formula is really simple, it's your probability times a factor, and I can state the factor is, that the elements are unavailable in practice. That is, if you're thinking about how well the folks at the state fair are responding to my new tractor and how does that correlate with the actual sales, well, that's something you don't have data on. And what's the probability of B? Well, you could think that you might imagine some ways of doing this, but you don't now.

If you're doing a repetitive test and have been doing this, say, agricultural sampling or test fields, or you have lots of data and so forth, you can get these conditional probabilities, as they're called, and you can run the analysis. But in general, you won't have them, so that although the formula is really simple, from the point of view of system design and management, they are really not available. But I want to show you how the thing works so that you can appreciate what's going on and why there's another approach.