[SQUEAKING]

[RUSTLING]

[CLICKING]

RICHARD DE NEUFVILLE: So now, what if there are many stages? So you just had a 2-stage problem. And the general idea here is, all right-- I mean, a 2-step and one choice that is outcomes.

If I want to do more, so for example, in the same question, suppose that you are in-- as a student, you were wondering whether to take the raincoat. Suppose you decide to consult The Weather Channel. So again, for simplicity, let's suppose it has a yes/no answer, it's going to rain or not.

In practice, of course, they give you a percentage of, it will have a 40% chance of rain or something, which means you can never tell if they're right or wrong unless you study their results over a long, long period. So it's a yes/no answer. And of course, now, these forecasts say it rains are wrong. That is, they can be wrong.

But if they do say rain, you're saying, hmm, I thought it was a 30% chance of rain, but now, hmm, they say rain, so I'm going to bump it up. Just because they said it will rain doesn't mean it will rain, but it's likely to change it. So you're going to have to have new probabilities. After you have the information, you revise your prior probabilities.

So let me show you what this looks like. So I've now set it up on a spreadsheet kind of basis here. And I either have I don't-- I don't look at The Weather Channel and I have no news, so that was what I had before, my best choice at a value of 0.8. But if I look at The Weather Channel, it will be, say, a forecast rain or not, in this simple case.

Now, you have to say, what is the probability that the forecast is correct? Well, to do that, you're going to have to have some kind of estimate of the performance of that information. So you don't really know what the chances are they will say rain or not rain, so that's an unknown.

But then, you come back to where you were before, but now, this is the setup for the basic problem before you had The Weather Channel. You now have, all right, yeah, I still have rain or no rain, but this time, the probabilities of rain or no rain depend upon the forecast. So if I looked at it was a rain forecast, the probability of rain or no rain has been changed.

It's more likely to rain. You believe it's more likely to rain. So this is now different than if it said it's going to be a clear day, in which case, you'd have different ones. So the problem, given that you have a second stage here, some further information gathering, you're going to have to calculate all these probabilities.

And therefore, the new expected values of difference, and then if the outcomes here are different, and the probabilities are different, so that you have-- adding on a section will change a lot, basically. It changes all your information. Technically, it's called that you had the prior probabilities, what you started out with, the 0.3 and 0.7 here, and then, you had what's known as the posterior probabilities.

And this doesn't refer to your tush. It's just the after the fact part. After the fact, the fact being that you had some kind of information, in this case, The Weather Channel report, which revised your prior probabilities and made you go through.

So now, what you have to have is that changes your decisions, of course. That's expected. And the calculations get complicated.

In general, you have to go through something called a Bayesian update, which I'm not going to explain here, because that's not the point of this and we're not going to go into that detail. But this is a complicated process. That's the point I wanted to mention.

The second aspect is, given that you have all these probabilities, how do you solve the problem? Well, I'll just outline it for you. And it's an example of what is known as dynamic programming, which is not part of the course. But for those of you who may have heard about it, it gives you a hook to go on. If not, let me just-- you haven't heard of it, that's fine.

But it basically says that the approach is to say, if I were at the last stage, and I knew what these values were, I could find out what would be the better one under this circumstances, and I would choose the better of these and use that to calculate the outcome here. In other words, you'd work your way back through the tree, starting at the end, and step by step, phase by phase, step by step, you'd-- OK, if I were at the end, I would choose, say, the raincoat. The other case, I might not.

And derive the outcome, and now, I would be able to calculate it. So it's the term of art used, it's folding back. It starts at the end and works your way through the analysis to find out, what is your better choice?

Why am I telling you this? I'm telling you this because what the message is, that in order to do the decision analysis for anything but the simplest case, it isn't a simple thing. You have to go through a lot of calculations.

And in order to do it, you have to have a lot of more information on the relative accuracy of The Weather Channel forecast, for example. And you have to go through a Bayesian analysis to figure out the answers to these unknowns here, and so forth. It isn't easy to set up.

I can teach this stuff, how to do it. I've done it before. But it's a painful process. And here, I've only shown a most trivial situation, that is, only have two choices, two possible outcomes, two possible responses from The Weather Channel. It gets quite complicated.

So just imagine that instead of-- this is for two choices, two outcomes, two stages. Just a match extension of three of each, and you're now talking about a really, really complicated. And I have, just to set up-- and I haven't deliberately. I haven't tried to show you the way to calculate the revisions or the prior probability to learn about the future.