[SQUEAKING]

[RUSTLING]

[CLICKING]

RICHARD DE NEUFVILLE: Decision analysis provide a structured, efficient way to help people recognize this complexity, to recognize the probabilities, and to deal with it. So what are the general features of this method? First of all, it offers a simple way of defining the choices.

Indeed, it assumes that everything is a discrete choice that is either yes, no, or yes, somewhat, a lot, maybe, not at all. But it has discrete-- it forces you to think in terms of discrete choices, not a continuum. It also enables you, but generally compels you, to look over several periods. That is, it's not just what you do in the first period, but then what you do.

Just like going to a course at MIT, you have your choice of first semester courses. And the choices you make then enable you to do certain things or prevent you from doing other things because you didn't take the prerequisite course and so forth so that you want to think about it over several periods. The third element, which is key to the whole reason we even discussing it, is because it deals with uncertainties.

And it is also a standardized method. So there are tools available to do this, to do decision analysis. And so if you are into decision analysis, there are a lot of other people who do it the same way, they do it in a standard way. So it's a structured process. It's like Excel. It provides a widespread language to think about certain things.

And finally, which I think is relevant here, is that it can include not just a numerical result in terms of the income or the present value, but also can deal with risk aversions, your consumer satisfaction, some kind of notion of utility. We'll talk more about that in a later session in the half semester course.

But for the moment, it allows you to say, well, yeah. We could have on average our outcome is good, but the bad outcome is-- I really don't like it at all. If, for example, if I'm saving for my pension, I don't just think on average I might have $1 million to retire on, but it makes a great deal of difference for me if that million is-- for an extreme, it's either $2 million or nothing.

That would be an average of a million. But if I had nothing, I'd be feeling very unhappy about my retirement and so that I would weight against that possibility. So it allows you to think about utility assessment.

Now, all right. The central element of the decision analysis is the decision tree. It shows the choices over several period. And it has basically four outcomes, four elements. It has the choices, the structure, the way you draw it-- it has the choices and the possible outcomes. I'll show you those in a moment.

And secondly, it has data, the data both about uncertainties that may occur and the value of the outcomes. So four elements-- choices of the structure and the data. So here is the structure.

So basically, it's a disciplined way of present alternatives. And it has two elements. It has the decision points. So over on the left-hand side here, I'm starting, and I have a choice to make. And in this, I'm going to have a very simple case just to illustrate it.

I can either do choice one or choice two. I have these two branches. Of course, I could have five or six, but or-- I have a point. Then, having done something, say I decided to take-- whatever, I decide to build a plant somewhere, then I have a result, a chance outcome of it performed well, not so well, it was a disaster, whatever it might be. I have possible outcomes.

And for each of the choices, typically known as a branch, you will have a possible outcomes. And they will lead you to another place where you say, all right, I build this plant. It was a success. Now, do I build up some more or stay put?

Or I build this plant, it was a failure. I can now decide to sell it or renovate it, whatever. So we got sequences-- decision, chance, decision, chance is the basic structure of this. Now, the data, then, has-- all right.

So I have elements about the outcomes. So given all this, I've made a decision. I observe what happened. I made another decision. I observe what happens.

And I have an outcome one, outcome two. And in this particular case where I have two choices, two outcomes, at each stage, I have, in this very simple two-stage process, I have 16 outcomes. Now, you might ask, well, where is the decision tree? Well, basically, you've got to think that this tree is lying on its side and that this is the root here, and the branches go up, and leaves and so forth.

And what I invite you to consider, first of all here, is when does this decision tree become a messy bush? Because realize that I've only had two choices, two decisions here. I could have had five. And I could have five outcomes. And now, I'm going to have 25.

And I repeat this, and I'm going to have 25 squared. And I have 600-some outcomes, et cetera. It can really easily get very complicated when I haven't looked at a particularly difficult problem. So for example, if I were trying to represent a game of chess here and I could move basically something like eight, 10 moves at the beginning with my pawns, and my castle, and my rooks, I would have 10 possible choices or 12 possible choices here, and then I could have what my opponent does.

And a realistic problem can explode on. So one of the issues here, again, back to my emphasis at the beginning or my remark at the beginning is that decision analysis is good for simple problems. For complicated problems, it just gets too messy.