Mathematical and Non-Mathematical Decision-Making

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Decision is the process of choosing a course of action though the confrontation of a number of alternatives and their respective outcomes with a determined goal or set of goals. However, if the definition of decision may seem simple, the decision-marking process is extraordinarily complex. First, we must know which is our goal, second, we must determine which is the possibility of measuring these goals, of measuring the degree of desirability of each goal; third, we must find which is our decision area and which are the possible alternatives; fourth, we must discover the outcomes of each alternative and their respective probabilities; fifth we establish the specific desirability or undesirability of each outcome in relation to the goal or hierarchy of goals previously established. Only then we will be reaching some kind of decision, but in this moment we will be already aware of the difficulties and uncertainties we must overcome in our decision-marking process.

In order to overcome these difficulties philosophers, economists, psychologist, mathematicians, statisticians, etc. tried to set up decision-making models. Naturally, in special the mathematicians and statisticians tried to apply mathematical tools in creating their models. As a consequence, people began to make a distinction between what was called mathematical and non-mathematical decision-making. But, does actually exist a basic difference between mathematical and non-mathematical decision-making? My answer to this questions is “no”.

On the contrary, a fundamental similarity exist in both types (let us use word "type", since we do not have another) of decision-making process.

A typical temptation in this moment would be to say that is a basic distinction: Mathematical decision-making is a process which deals with measurements, while non-mathematical decision-making does not. But we can not accept such affirmative. The similarities are dominant. Both decision-making processes are evoked by environment; both compare a set of alternative courses of action, having as criterion of comparison a value system; both take in consideration the probability of each outcome and evaluate their respective desirability or undesirability. In reality in both cases the probability and the desirability aspects of each outcome are measured. This measurement may be explicit in the mathematical decision and implicit in the non-mathematical one, but it is clear that without measurement it is impossible to make comparisons, and so, it is impossible to take decisions.

But, if there is basic similarity between mathematical and non-mathematical decision-making making deals with verbal, generally less precise measurements. Both try to measure quantity and quality (notice that one does not measure quantities while the other, qualities), but both use different tolls in this measurement. Certainly non-mathematical decision-making may use also numerical measurements in some occasions, and mathematical decision-making may verbal measurements, but this does not destroy the distinctions we are trying to establish. The numerical measurement is essential to the mathematical decision-making model. As Bross says, "like the Prediction System, the Value System also assigns a number to each possible outcome but this second number reassures the desirability rather than the chance that the outcome will occur" (p. 85)

This distinction is particularly important to this short analysis because it permits that we set up a further differentiation of the two processes though their respective limitations. The basic weakness of non-mathematical decision making is its lack of precision. The decision-maker must use a verbal scale of probability and desirability, and words area not very much precise tools in order to build a measurement scale. Besides this, the process of integration of the probability and desirability of each course of action will be much more complicated to achieve, than use of numerical tolls. These limitations naturally do not occur in mathematical decisions, but it is exactly this necessary numerical precision which constitutes their basic limitation. This fact limits the applicability of mathematical decision-making. The mathematical decision-making model does not say anything about the decision area, the determination of the alternatives and the values which will be taken in account. Only after setting up the area of decision, the various alternatives and their outcomes, and the goal to be achieved, will be possible to apply the mathematical tools, in order to determine the probability and desirability of each outcome. Even then, however, we will find that, if the attribution of a numerical quantity to probabilities is al ready difficult, the attributions of numerical quantities to values is much more difficult. Generally the decision-maker is yet restrained to measure the desirability in terms of dollars and cents. In many cases it not yet possible to resume values to cardinal or ordinal numbers (indifference curves).

In conclusion, the lack of precision of the basic weakness of non-mathematical decision making, while the need of numerical measurements limits the applicability of mathematical decision-making may properly be used, without oversimplifications (a certain degree of simplifications is always necessary and even recommendable) it should be used, and the task of broadening its field of applications is a challenge to the researchers in this area.

Before finishing we must underline that we did not say anything about the psychological and social conditionings in the perception of the alternatives and goals of each decision because these conditionings are common to mathematical and non-mathematical decision making.