To decide what one should do to obtain a good or avoid an evil, it is necessary to consider not only the good and the evil in themselves, but also the probability that they happen or not happen; and to view geometrically the proportion that these things have together.

*Port-Royal Logic IV, 16, 1670.*

**ABSTRACT.** We discuss several possible legal principles from the standpoint of Bayesian decision theory. In particular, we show that a compelling legal principle implies compatibility with decisions based on maximizing the expected utility.

*Keywords:* Utility, probability, law, decision theory, rational decision, penalty, actions.

**1. INTRODUCTION**

In this paper, our primary purpose is to investigate the implications of a statistical decision making model for the judicial process. The idea of relating statistical decision theory and the law is not new. Little has been done, however, to understand the relationship between legal principles and the mathematics of the model.

As is usual in Bayesian decision theory, the model that we shall discuss in the paper has two main elements: probabilities and utilities. The model is described as follows. Suppose that we are describing a trial where there is a defendant who may be guilty, say, of first degree murder, second degree murder, or not guilty. We shall call these possibilities the possible *states of the defendant.* We suppose that the trial has two parts. In the first stage of the trial the evidence is evaluated and the court is presented with a probability for each of...
these states, i.e., a probability that the defendant is guilty of first degree murder, of second degree murder and not guilty. These probabilities may be given by a jury as a consensus estimate based on the evidence presented, or by a judge.

We are aware that many questions have arisen regarding the assignment of probability, but it is not our intention to explore this topic in this paper. Here we simply assume that these probabilities are available to the court.

Also available to the court is the utility of each penalty (say, "hang", "incarcerate for 30 years", "free"), the actions in our model. These utilities are functions which assign a number of each possible state of the defendant. For instance, in the case mentioned above, the utility of hanging may be 30, -5, -100 for guilty of first degree murder, second degree murder, and not guilty. Thus, the utilities are in fact random variables. In the second stage of the trial, the expected value of these random variables is obtained, the expected utility of the penalty. In the most simple minded situation, the charge of the judge is to assign that penalty which has the highest expected utility. These notions will be spelled out in greater detail in Sections 2 and 3.

Unlike other presentations, we think it is most natural to have the utilities fixed by the law before the trial. Perhaps they should be a reflection of the mores and ethics of a society. For example, in our society the utility of freeing an innocent person is certainly greater than that of executing an innocent person. The model is flexible enough to allow other ways of determining the utility. For instance, the law might prescribe a set of possible utilities, and the judge and the jury might select one of them for reasons that are peculiar to the defendant or to the particular nature of the crime (extenuating circumstances, for instance).

Our view of the decision theory model differs from those of the literature in several respects. For example Kaplan views the individual juror as determining both the probabilities and the utilities. Having done so, each juror arrives at a verdict by a decision making process similar to the one described above. The individual verdicts are then pooled and readjusted until some consensus is reached, the jury's verdict. No further use of the decision making process is employed, and the judge assigns the penalty according to the verdict, legal guidelines, and other factors.