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 prob-
abilities 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 assign-
ment of probability, but it is not our intention to explore this topic in
this paper. Here we simply assume that these probabilities are avail-
able 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 circum-
stances, 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.