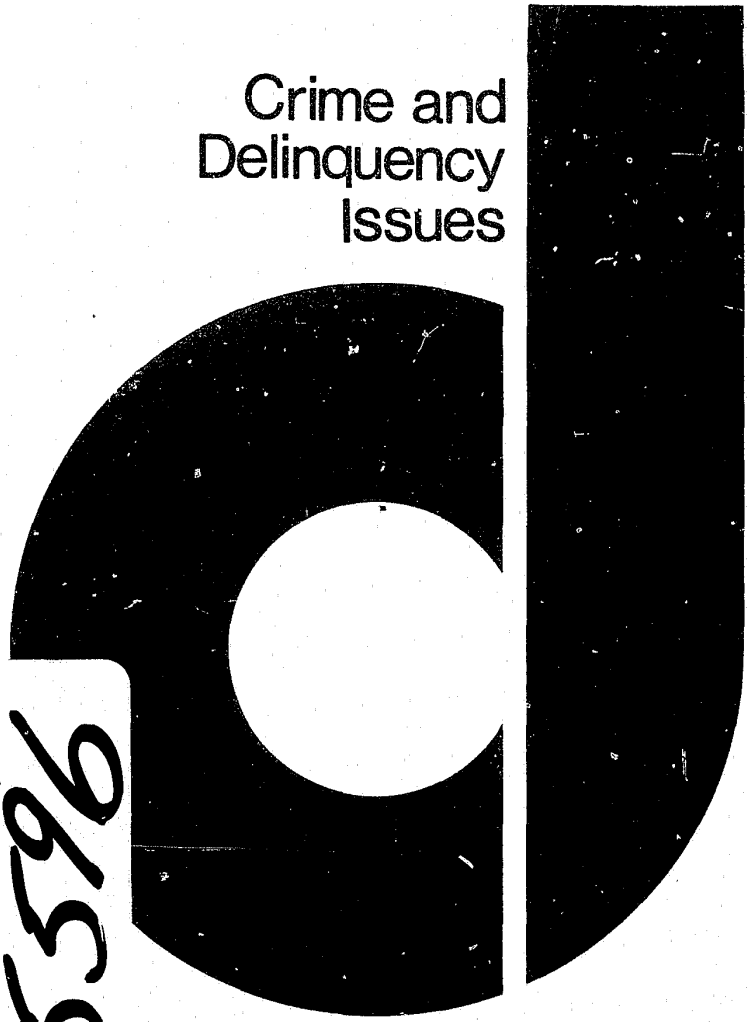
Decision-making in the Criminal Justice System: Reviews and Essays

Crime and Delinquency Issues



NATIONAL INSTITUTE OF MENTAL HEALTH

CHAPTER VII

Modern Decision Theory and Corrections

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Corrections are a subsystem of the criminal justice system if, that is, we agree to call the chain of agencies involved in the public administration of criminal justice a "system." Some contemporary criminologists prefer to refer to "the criminal justice process" for the very reason that the features necessary for a sequence of events and procedures to be defined as a "system" are absent from the criminal justice world. I start with this point because its relevance to this chapter is more than that of an idea which is academically interesting, but in practice unimportant. For any consideration of decision-making in the correctional system must consider how this relates to, and differs from, decision-making in other sectors of criminal justice work, unless it is to be merely a descriptive account of current practice in certain respects; and this chapter is intended to be other than that.

In some respects the decisions that are to be made as a matter of routine within the correctional process are parallel to those considered elsewhere in this book. They deal with persons who have relatively little control over their immediate fate and are made by persons who have little involvement in that fate, if only on account of the numbers involved. They are made to maximize two formal objectives, which may be conflicting: The probability of "rehabilitating" the prisoner, and the dispensation of "justice" (a notoriously complex concept). These may be combined under the term "the protection of society." While these are the only objectives to be maximized, at least in formal theory, and openly professed in most of the other aspects of criminal justice work, in corrections there is a third overt objective, which again may conflict with either of the other two—the maintenance of the internal stability of the system. All who have worked in correctional or prison settings will know that the question of whether inmate X is allocated to an open institution or to a given training program depends upon the number of places available, at least as much as upon his own personal claims or needs for inclusion.

Countless examples of variations on this theme can be given, and there is no need to belabor the point here. In all sectors of criminal justice work there are many more objectives which it may be intended to achieve by a given decision or decisions, but these are largely covert, and sometimes deliberately so. The recent writings on the sociology of punishment, law-enforcement and corrections provide plenty of instances, but for the moment we should simply note the point (to which I return in the proposed theoretical approach), and turn to three respects in which decision-making in correctional environments differs significantly from that activity in other criminal justice environments.

SPECIAL FEATURES OF CORRECTIONAL DECISION-MAKING

First, and already mentioned, there is the very strong effect of system constraints and requirements. All prisons are, in several senses, run by their inmates, and a regular supply of these to essential jobs, such as kitchen and the laundry, must be maintained. Thus there are two types of decision usually collapsed into one. (1) "What is the appropriate disposition for this particular inmate?" (in terms of which institution, which work assignment, which training program, etc., is the most suitable for him), and (2) "Which inmates are to be used to provide the manpower for the following essential tasks?" The problem emerges in the collapsed form as (3) "Is this inmate suitable for what he requests, and does it suit system requirements for him to be so allocated?" or more simply (4) "Can we allow him to do what he wants?" In version (4), the factors involved in "allowing" refer to both the personal qualities of the inmate (e.g., offense, violence record, intelligence, aptitude test scores) and vacancies, either open to be filled or which must be filled. Although parallel considerations may intrude occasionally into some other aspects of the system, they are exceptional and not, therefore, to be considered as a permanent and important parameter, with respect to which decision-making techniques are to be analyzed.

Second, the sheer number of decisions is different. For each passage through the system, each inmate usually is arrested once, tried once, sentenced once, paroled once, and so on. In the correctional stage, he is subject to frequent decisions which affect where he lives, what he does, and other issues which matter deeply to him. Thus in one respect correctional decision-making impinges more on an

inmate's life. But in a more important way, it matters less—for most of these decisions are reversed with relative ease; and thus, as well as having less far-reaching implications for the subsequent system career path of the individual, they are not so final. In general terms, we can characterize criminal justice decision-making, perhaps as being infrequent but momentous (for the individual), except for the correctional process wherein final importance is traded off for frequency, and a sequential for a one-off nature.

The third main difference is in the amount and type of information available to the decision-maker. The arresting police officer, the district attorney or whoever brings the charge, the court which tries, and the judge or jury who sentence will often have, or probably feel they have, a shortage of data upon which to base their decision. But what they do have is significant. Once an individual is in the correctional system, however, data about him are accumulated very rapidly, so that a great deal is known; but much of it is seemingly trivial and uninformative with regard to the particular decisions required.

INFORMATION AND DECISION THEORY

I should make clear at this point that I am following the standard information theory/decision theory practice of distinguishing between "data" and "information" by the criterion of uncertainty reduction. That is, all bits of potential knowledge which reach the decision-maker or whoever are referred to as "data." These can be classified into "information" which is that which genuinely reduces uncertainty in the decision or problem under consideration, and "noise," which is the residue. As information is defined as being specific to a particular decision or problem, any single datum, therefore, can change state from "information" to "noise" or vice versa in a change of context. No datum is ever one thing or the other by virtue of any intrinsic quality; only the use to which it is put determines its status for that moment. It will be familiar to all experienced correctional workers, again, to consider that one of the greatest problems in correctional decision-making is to distinguish between the information and the noise in the abundance of data available; in other words, to determine which are the significant data, from all available, for any specific decision.

By the middle 1960s, it had been realized by certain correctional and other criminal justice administrators, and by certain research criminologists led by Leslie T. Wilkins, the author of another chapter

in this book, that these factors required a specifically-designed response to the problems of rationalizing, or attempting to rationalize, decision-making in corrections. This requirement was, inter alia, to design an information and decision system which would enable a rational sequence of decisions in the specific correctional environment to be taken with optimal outcome and also to provide for the most effective and suitable interface with the information and decision systems of other parts of the criminal justice system. A detailed study of certain parts of this general problem was undertaken by the Correctional Decisions Information Project, with the help of NIMH grant RO1 MH1 4787, and the results were published in 1972 (Hill 1972).

One aspect of that study, undertaken by the present writer, was the development of a theoretical basis for constructing a rational case decision system in corrections. The results of the empirical testing of the proposed system are published in appendix E to *Correctionetics*, but the theoretical background was not included as that publication is primarily for direct practical application. However, the theoretical study revealed a great deal of highly significant information concerning the structuring of decision-making systems and the information flow with which they work, and a summary of that study is what follows. Its application and relevance, therefore, are not specific to any one correctional setting, nor is the solution proposed the only one possible. Indeed, it is very likely that for certain, perhaps even most, circumstances alternative solutions are preferable; only experience will reveal that. The significance of this chapter now is that any proposed system which does not take account of the factors which are regarded as important by this theoretical study will probably encounter severe, perhaps disastrous, practical difficulties later. Thus, too, the following analysis is normative, and not descriptive; it attempts to point out what we should do to improve, and not what anyone actually does now. Likewise it is exploratory; there is no claim that this is definitive or final. Indeed, by the nature of the study, I am committed to the view that continuous inflow of information will lead to revision of our views as to what is appropriate. In the case of individual prisoners this process has to be cut off fairly quickly and some dispensation made; in the case of developing a system, not only can the continuous revision go on, but it should. What is written here in early 1974 should contain the seeds of not perhaps its own destruction, but at least its own replacement or considerable refinement within the next decade or so.

The bulk of this material is derived from the empirical research of others, mostly psychologists, and the analyses of decision theorists. It

can be dangerous to transfer the results of one experimental situation to another without qualification, and therefore I have attempted not to build extreme positions on the results of a few people working in another field. Most of the claims made have been substantiated by several workers, and the exact standing and degree of support for each assertion can be found in the original full version of this study (Burnham 1969). This study also represents what may be a growing trend in social science, that of secondary scholarship. By this I mean the practice of some social scientists, instead of pursuing individual research on a limited topic "at the frontiers of knowledge," of attempting to perceive patterns and information at the macro level in collections of micro studies done by others, perhaps in fields not normally related to the one in question and which have no obvious significance when considered in isolation.

The material to be considered consists therefore, of two different types: A summary of the empirical findings of research psychologists concerning the interaction between human decision-maker and the mode of provision of information to him and a brief summary of the most relevant parts of modern decision theory.

The summary of the findings is concerned as much with the retrieval and perception of information as with actual decision-making as such. We must appreciate, therefore, that any distinction between these two processes can be a dangerous one, as they are, psychologically, so inter-related that they can be considered one process. For if it can be shown, as I think it can and will be below, that the way in which the information is presented can and often does affect the reaction to it of the decision-maker, then we cannot consider solely the latter part of the process—the formal production of the decision. For the decision may already have been made. In turn, this has implications for the style of data presentation throughout a correctional or any other system, so that we shall consider information systems and decision-making procedures as components of a process which, except for accuracy of detail and conceptual clarity, will not be decomposed more than necessary.

VARIABLES AFFECTING DECISION-MAKING

The study of the variables which affect the decision-making process, in this wide sense which I have defined and defended the term, and in which I propose to use it henceforth, highlighted two clear dimensions along which the variables could be grouped. These are labeled "operational variables," being those variables within which

behavior appears reasonably consistent across subjects, but dependent upon the environment in which they are operating, and "personality variables," being those wherein behavior varies among subjects with the operating environment held constant.

Operational Variables

The consideration of operational variables, where we are looking at the effects of change in situations external to the judge, begins with information search and the predecision processes of the decision-maker. It seems that decision-makers rarely take all the data available to them, and postexperimental discussion with my own subjects led me to believe that one of the major factors responsible is the widespread belief that to take all data is in some way a sign of a poor decision-maker; a good decision-maker is to some extent one who can manage on the smallest amount. If this belief is indeed widespread, it could be dysfunctional, perhaps severely, in many decision situations. Despite this, decision-makers do search quite extensively for information before making a decision, and the largest single determinant of the extent of the search is a feeling of uncertainty. As long as there is no predisposition on the part of the decision-maker to prefer one decision to the other (i.e., he has started to choose one alternative over the other already), this search for information will be nonselective. That is, the decision-maker will take data items he regards as most likely to have high information content, and not those most likely to support a particular outcome, no matter how weakly.

The effects of the style of presentation of data to the decision-maker have not yet been very fully researched, but one or two things seem fairly sure. First, the assumption that data should be presented sequentially, i.e., item by item discretely, may not be valid, at least for all persons and all decision situations. In some experimental situations not totally dissimilar to correctional environments, summary presentation of data led to an improvement in decision quality for a majority of the subjects. If sequential presentation is used, and this seems the most likely especially if computer-based electronic information systems become general, then the so-called "order effect" is important. To complicate matters more, it can work in one of two, mutually contradictory, ways. In some situations or with some people (this is not yet known), the decision indicated as appropriate by the earliest data items is then adhered to in the face of later counterindicative data with higher information value. At other times, the data which are given a weighting in excess of their information value are

those which occur last, immediately before the information search and/or data input is terminated. Thus, although we cannot say for sure how the style of data presentation will affect the outcome of a decision, we will be well advised to bear in mind that it will do so and it will be necessary at some stage to investigate this further.

When we move from the style of data presentation to the amount to be presented, we find a much more developed state of knowledge. This derives above all from one study done for the United States military some years ago, (Hayes 1962) and to show its relevance for the correctional situation, I will quote part of the introduction:

> This report will be concerned with decisions similar to decisions involved in choosing which one of a number of cars to buy and which of several apartments to rent. Most usually in such decisions, the alternatives will differ from one another in several characteristics, and these differences must be taken into account simultaneously in making the choice. For example in choosing among alternative apartments, one may consider cost, size, appearance, convenience of location, quality of neighborhood, and possibly a number of other characteristics. The difficulty in making such decisions arises in trading the advantages of an alternative in some characteristics against its disadvantages in other characteristics. Such decisions might be described as multidimensional judgments.
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> It is commonly assumed that the more relevant data one takes into account in making a decision, the better that decision will be. It is clear, however, that as one takes more relevant characteristics into account for comparing alternatives, the opportunities for confusion increase. If confusion were to increase rapidly enough as the number of characteristics increased, it is conceivable that decision-makers would perform better if some of the relevant data were eliminated.

One important point to notice is the wording of the last line. The author is not merely distinguishing information from noise, but suggesting that there can be an overload of information in the strict sense.

Extensive testing, both by Hayes and others, has suggested that the maximum number of data items along different dimensions which can be processed profitably at the same time, without any formal decomposition and restructuring of the decision process, is about eight. Above that number, confusion does set in resulting in a decline in decision quality. However, it has been demonstrated also with some reliability that decision-makers seem to have a psychological need to take more than this optimal number, probably for reasons of

confidence. If this is so, perhaps what is required is extra data of a nondamaging kind, which can provide the increase in confidence necessary to bring the decision-maker to delivery without inducing confusion. At very least, we must be aware that information overload is real, likely, important, and damaging.

The number of data items required by the decision-maker before he feels himself ready to make or announce a decision is called in the technical literature the "decision criterion." There is evidence to suggest that not only does this vary with the difficulty of the decision—a borderline decision requires more data items, that is, has a higher decision criterion, than one in which all the evidence points the same way—but also with the method of information presentation. Following a period of uncertainty, where data conflicting in respect of the decision outcome they support are intermingled, any introduction of unidirectional data, all supporting the same outcome, will produce a marked drop in decision criterion. The decision-maker becomes, in fact, very ready to be persuaded.

"Feedback" is a word which has become a part of the vocabulary of every man who wishes to claim even nodding acquaintance with the world of social science and modern business methods. As with all such trend words, it has become rather diffuse in meaning. I use the term here, however, in a fairly narrow sense, as in its original cybernetic sense, as referring to the provision of information to a decision-maker as to the outcome of his previous decisions and/or effect of his previous tactics. Whenever decisions are to be made in a situation where not all the independent variables are known, that is a probabilistic one, there are two senses in which a decision can be right. It can be the decision which gives the highest theoretical probability of achieving the desired outcome, although occasionally it will fail just through being probabilistic, like backing a hot favorite which loses; or it can be the decision which in this instance gives the actual desired outcome, irrespective of the theoretical odds, like backing a rank outsider which wins. Feedback with respect to these two meanings of the term is called "correct-answer" feedback and "outcome" feedback, respectively. The first is geared to some kind of decision theory and is predicated upon an assessment of probabilities, while discounting the effects of intangible or unknown factors, such as luck. The second gives direct empirical observations without recourse to theory, and no guidance as to whether the result was achieved (or not achieved) because the chosen alternative was theoretically a good (or bad) choice, or whether this instance was an atypical minority occurrence.

Experimental evidence suggests that, although the provision of both types of feedback is helpful to decision-makers, it is correct answer feedback which is essential if decision-makers are to learn by their mistakes and so improve their performance over time. Also, it seems that, if correct answer feedback is not supplied routinely whenever the decision-makers are following an inappropriate strategy, an excessive and unnecessary amount of contraindicative information is required to persuade them to change this; and sometimes more is required than is available. Thus any system which hopes to be evaluative and self-improving must incorporate a regular correct answer feedback component.

One of the most complex, and largely unresolved, problems in the theory of decision-making concerns the level of confidence in his decision, or ability to make a good one, held subjectively by the decision-maker. The experimental evidence on it is often conflicting, and sometimes ambivalent in its significance even when not conflicting. There is no doubt that the confidence level of an individual both waxes and wanes, in various patterns, during the genesis of a decision. It is almost certain that this is affected by the style of data presentation, although the details of this are complex and unknown. Certainly, too, it is strongly affected by, and perhaps dependent on, personality factors, which are to be discussed next.

Confidence seems to correlate positively with the sample size of information taken as a proportion of the data available; but it does not correlate very much, either positively or negatively, with decision quality. That is, the degree of confidence felt by the decision-maker in his judgment is a poor indicator of the quality of his likely decision. This is not to say that high confidence necessarily increases the probability of a poor decision, but merely that it is no guide one way or the other. High confidence levels do apparently entail an inertia effect—an unwillingness to change one's mind and revise the decision, which persists long after this change should be made in accordance with the arrival of fresh information disconforming to the original choice.

Personality Variables

Personality variables are those factors which affect the resulting decision without there being any significant change in the environment. It has been suggested that there are four main dimensions along which the workings of the minds of decision-makers can vary. Internally stored information, which is the equipment which a deci-

sion-maker brings to bear on fresh data in a problem-solving situation, can be broken down into: "data"—facts, opinions, or impressions which are traceable to identifiable sources and subject to consciously controlled analysis, "intuition"—past learning and experience, plus perhaps instinctual inheritance, which cannot be analyzed in practice, and "bias"—emotions, unconsciously compiled attitudes, etc., in no way subject to conscious control. Fourth, all men have their own cognitive styles, that is habits of intellectual manipulation and thinking in its different respects. Although researchers have found a lot of difficulty in establishing knowledge in this area, they are largely agreed that any formal models or systems of decision-making which ignore personality variables are inadequate for predicting behavior or consistently optimizing outcome. It does seem that changing one's mind and reversing a decision are more functions of personality than of operational variables; this, of course, is in agreement with the previous remarks on confidence.

There is considerable difference between the styles of data gathering used by individuals. Some ask for all, or many, items in quick succession and then ponder over the collection. Others take the items slowly and consider each one with some thoroughness before passing on to the next. There are theoretical reasons for believing that the second procedure is slightly preferable in the types of decision situation with which we are concerned in corrections.

It is only common sense to expect that the ability to make good decisions, as investigated in controlled situations where quality can be measured, is correlated with intellectual ability. Nothing can make men with poor cognitive powers outstandingly good calculators. But it seems that emotive variables, the way in and degree to which individuals are dominated by their emotions, do play an important part. They do this particularly in that they appear to control the degree to which an individual performs up to his intellectual potential; the presence of certain emotive variables may result in his falling considerably short of his intellectually optimal performance. So emotive variables, while not affecting the role of cognitive/intellectual variables as necessary condition for high decision quality, prevent their being a sufficient condition. This suggests that any information/decision system should aid the logical use of cognitive powers as much as possible while minimizing effects which may activate deleterious emotive variables.

The most important personality variable is that of abstractness or complexity of cognitive style as contrasted with concreteness or simplicity. Research workers have established without much doubt that men do vary along this dimension very significantly. Abstract think-

ers are those who have the ability to construct a conceptual approach of some subtlety and sophistication to any decision problem, considering several dimensions in probabilistic terms. Concrete thinkers are those whose conceptual structure in a decision uses few dimensions in a rather deterministic, definitely yes-or-no way. Not surprisingly, for decisions of the sort encountered in most criminal justice areas, complex decision strategies produce an overall higher level of decision quality.

It has been shown also that abstract environments, that is, a situation in which the data are so presented, and the decision-maker is prompted, to encourage a complex conceptual approach, do definitely stimulate concrete subjects. Such people will tend to regress to their simplistic approach if this stimulus is removed. Complexity of cognitive style appears to be correlated negatively with authoritarianism, dogmatism and (perhaps not too surprisingly), high decision confidence. Concrete persons use narrow information categories, require guaranteed information, and ignore incongruent, disconfirming information. They claim to need more information, but in practice use less. They cope less well with changes in the information load, and it seems probable that they suffer more quickly from information overload, without realizing it.

This chapter is concerned primarily with decision-making as an individual exercise. But a lot of correctional decision-making is performed by groups, and while all of the above is thought to have equal relevance to the group situation, there is one important difference. It seems that functioning in groups stimulates an abstract approach to decision-making and also leads to more risky decisions being taken. This could be either because the members of the group feel that their collectiveness in some way reduces their own responsibility, so that they are less pressured to play safe by taking a cautious decision, or because the members disseminate more information to each other than an individual takes alone, and more information usually leads to riskier decisions.

Training in decision-making techniques, especially in groups, apparently helps an individual to become more complex in his conceptual approach. In particular, it has been shown that training can bring a realization of greater complexity to a concrete individual who had previously not been aware of all the variables, and it can help him to construct a complex decision strategy to cope with it. By encouraging an understanding of the concept of probability, training can help individuals overcome what has been called the conservatism phenomenon. This is the fact that decision-makers are often unwilling to alter their estimates as to the probable outcome of a decision to

anything like the same extent that new information theoretically supports. For instance, if a decision-maker estimated that a desired outcome was 60 percent (or .6) likely to occur as a result of a decision to follow one of alternative strategies, and new information became available which, if analyzed theoretically, justified an increase of up to 85 percent probability of success, the decision-maker may well raise his estimate to only 75 percent. Clearly this implies that the significance of much information is likely to be missed, and our system should try to counteract this, provided that it does not lead to excessive and wild over-estimates of probability change.

The introduction of probability estimation has brought us, at the end of this section devoted to a consideration of the main operational and personality variables involved, to a brief look at one or two key concepts of decision theory.

DESIGN FOR RATIONAL DECISIONS

One of the ambitions of most contemporary social support, organizational, or control systems now is to be able to claim that they are rational—or at least to describe themselves as such. Rationality is a quality which applies, in strict logic, to sequences of action with a view to achieving a desired (though not necessarily permanent) state. One can be rational only if the boundary conditions, and range of possibilities open, are known, at least roughly. Within this framework, the decision theorists have argued fairly convincingly that the decision-maker concerned must know which of the possible outcomes he prefers, be consistent both internally in his order of preference and in considering only the outcomes which depend upon his decision, and be able to separate completely his objectives, or utilities, from beliefs, or estimates of likeliness. It is not all that surprising that empirical research has found individuals to lapse from these high standards in all but the most simple decision situations. Therefore, if a decision system in corrections, or anywhere else, is to claim itself to be rational, it must encourage those who operate in it to be consistent in their preference scales, to have a definite choice or preference, and to keep their estimates of probabilities as little influenced as possible by their preference scale, while extracting all possible information from the data.

I have introduced both the terms "utility" and "preference" because both are used by decision theorists, but they can be regarded as synonymous for our purposes. I will stay with "utility" from now on, and elaborate just a little on the concept. It may be defined

roughly as the importance we attach to a given state of affairs which could be attained, as contrasted with the importance attached to all other states which are relegated to not being as a result of choosing this one. The economic concept of opportunity cost is exactly parallel. Thus, utilities are concerned with goals, ends, or aims, and most decision situations entail the comparison among various goals. Decision theory is basically concerned with carrying out this comparison in an orderly, logical manner, and therefore will turn as far as is practicable in any given situation to the appropriate tools: numbers and quantifying techniques.

In theoretical discourse, it is easy to talk rather blandly about quantifying utilities, or estimates of probability, but in real life things are a bit different. The following quotation from a social scientist will illustrate that even academics sometimes appreciate this point (Gore 1964).

> In reality, goals are always surrounded by a thick, sticky coating of ambiguity. They are presented to us in a number of different forms: regulations, aversions, concerns, purposes, and commitments are only a few examples . . .The expectations and concerns of power centres outside the organisation are also virile goals if accepted or enforceable. Permeating almost all goals are the subtle, unarticulated assumptions of society, i.e., that an agency should eventually show a social profit.

A look at even the outlines of goals in the correctional field will support this view.

The utilities involved in correctional decision-making will, inevitably, differ in detail among decisions: but they do have some features in common and these are the important ones. They are also very good examples of that class of dimensions which seems quite unsuitable for any quantification procedure. The three main utilities which are implicit, and sometimes explicit, in most policy statements by correctional agencies are justice, protection of society, and constructive treatment of the individual prisoner, or some paraphrase of these. The implication intended is that what happens to one man should be roughly parallel to whatever befalls another who has a similar transgression or record—all men should be judged by the same standard; that convicted men should be restrained from harming general society at least for the length of time spent in custody and that as much as possible should be done to bring about the resocialization of the individual prisoner, usually within the constraints of the first two concepts.

Decision theorists have pointed out how soon the maximization of one outcome reaches a point where it can be accomplished only at the expense of another outcome. These utilities are no exception. For instance, it is now widely believed in correctional circles that the more humanely and less oppressively a convicted man is treated, the better his chances of resocialization. So far there has been only a moderate amount of sound evidence to support this, but more or less none to refute it. The practical implications of this are that offenders should be placed in the community; such as on parole, or in minimum custody so far as possible. But this certainly creates problems in respect to the second utility—"dangerous" offenders may be "free"; and it is quite possible that if sufficient differentiation is made among cases, the first utility is also violated.

In addition to these overt utilities, there are secondary ones which in specific instances can be equally significant. Public opinion must be observed and perhaps respected and this becomes more pressing the more immediate the link-up of the correctional and political systems of any given country or state. There are also, as mentioned at the beginning of the chapter, utilities internal to the system—bed spaces available and requirements for prisoners to do specific skilled jobs. Thus, there will be a cut-off point where the negative value of other utilities involved exceeds the positive value of the treatment utility.

This cut-off point is a function also of the probabilities involved of a prisoner's acting in a certain way.

Another important theoretical consideration is "optimality." We want our system to help make optimal decisions, but what exactly does this mean? First of all, it does not mean that the right decision is necessarily made every time; for that to occur, and every choice produce the desired outcome, we would have to be operating in a deterministic world from which all uncertainty can be eliminated. I do not feel it necessary to argue in any detail that the correctional world is very much probabilistic, and that in it uncertainty is the one thing more sure than death or taxes. Optimality, therefore, is concerned with obtaining the decision which, on theoretical grounds from the information existing at the time, has the highest probability of producing the desired outcome. Unforeseeable factors may intervene, and the result may be different—the whole concept is parallel to the difference between correct answer and outcome feedback discussed earlier. Optimality, therefore, is like rationality in being most appropriately ascribed to a whole series of decisions over time, and an optimal decision system is that which produces the theoretically best decisions overall. Note that if we do consider a series over time, the optimal decision strategy will produce the actual greatest number of

desired outcomes compared with any other strategy. If it does not, this is one indicator that the system is indeed suboptimal.

If we are prepared to talk of optimality, however, it does have one implication for any individual decision. It asserts that, in any given decision situation, there is one choice which can be declared, on theoretical grounds, to be superior to all possible alternative decisions. That is to say, it is a claim that the decisions in question matter; that it does make a difference to select disposition A over disposition B or vice-versa. I emphasize this because there is, generally, a mood of indifference in the correctional world emanating primarily from the studies of recent years which tend to show that institutional corrections are a failure in terms of recidivism rates. That is, whatever we do to people in prison, however therapeutic the regime or constructive the training, it has no effect in terms of later criminal career. If this is the case, correctional systems should come to terms with it and either accept it, or attempt to change themselves to alter it. In either case a rational, optimal decision system is required. In the first instance the bogus goal of reduction of recidivism should be removed from the decision objectives and replaced by realistic, appropriate terms such as considerations of humanity or system requirements, and the emphasis placed on reducing commitments to institutions. In the second, such a decision system is necessary in order to monitor the effects of such reforms as may be introduced and to isolate the features of them which are responsible for any change for the better (or worse) which may be detected. Although (and this is still probably an open question) it may not matter much for recidivism what dispositions are made, it matters on other grounds. It may well be that in corrections all decisions are bad decisions. But some are worse than others, and if we are dealing with a choice-of-lesser-evils situation, the least evil is the optimal decision.

If different people make different decisions on the same case, and we accept the notion of optimality, all but one of the decisions must be nonoptimal, unless we allow that the different decision-makers are using different utilities as they have different goals. But if we do allow this, then we have removed the question from the context of a single system decision and substituted a situation of personal opinions as being equally valid, and thus no longer have a true decision situation at all. Thus optimality entails some form of consistency or agreement across decision-makers, and we wish to have as high a proportion of them as possible reaching our theoretical optimal decision.

The impact of personal values is critical. Another decision theorist has written (Hoffman 1958):

> . . . the one great and troublesome task that must be attacked before decision theory has any general usefulness at all is that of developing a scheme by means of which people entrusted with policy in an organisation can reveal their value system for these outcomes . . . and in such a way that the system is quantifiable and trustworthy.

It is very difficult to get at these values. If we simply ask the decision-maker to state what his values are, he may be prevented from answering truthfully by any of the following factors suggested by Hoffman:

1. He may have values of which he is unaware.
2. He may not have sufficient insight into his own value system to be able to state it clearly; and he may not be willing to acknowledge this, even to himself.
3. Value systems can be complex, and there may be two or more interacting in his system, which, in turn, he may not be able to communicate.
4. He may have as working values ones of which he is ashamed, and will not admit.

Thus, the decision system must do what it can to reduce the effect of distorting or hidden values in the selection of outcomes; and it has already been said that values and estimates of probabilities should be kept separate.

Therefore even a quantifying procedure involves some element of values which may not be consciously expressed; the important thing at this stage is to emphasize that decision theory invokes no more subjective evaluation than any other method of arriving at courses of action. So that, although the evaluation of outcome may seem, and be, arbitrary and subjective and lead one to question whether any of the conclusions from decision theory can be trustworthy, this is no more the case than in orthodox, feeling, intuitive decisions. It is just that the rigorous fashion in which the remainder of the problem can be handled makes this haziness stand out and perhaps reduce the likelihood of mutually concealing errors. The fact that objective techniques have been introduced to try to obtain maximum benefit for minimum cost does not entail any lack of concern for the subjects' welfare.

The main rival to a utility criterion for optimality, although not the only one, seems to be a minimax strategy and criterion. This is the strategy of minimizing the maximum loss or disadvantage which could result from a given decision outcome. The theorists have pointed out that this strategy is so conservative that it can easily be demonstrated to be suboptimal in any case except when for some par-

ticular and curious reason, no loss of any kind can be risked. Correctional systems tend to revert to a minimax strategy after any startling adverse publicity, and it is never without its advocates in the world of criminal justice; but on theoretical grounds it cannot really stand as a serious rival. The decision strategy adopted here, therefore, is a utility theory, and that forms the criterion for optimality. By this I mean specifically the proposition that a good set of decisions is a set which over a long run can be counted on to maximize the utility of the outcomes according to the values of the decision-maker, or the rationally optimal decision is that for which the expected utility is greatest. The expected utility is the product of the probability of a given outcome's occurring and its subjective utility to the decision-maker. When, as will be the case in what follows, the estimate of probability also is subjectively determined, the model is known as the Subjectively Expected Utility (SEU) model. It must be emphasized that this is intended as a normative model, structuring how decisions should be carried out, and not a descriptive one, detailing how they are (as which the SEU model is not without its critics).

The terms "probability" and "probability estimates" will occur with increasing frequency, so that some brief account of their meaning for our purposes is necessary. "Probability" is practically a subdivision of mathematics, and our concern here is with just two details. First, a rough definition: An assessment of the chances that some event x will occur. For convenience and by convention this ratio is expressed as a decimal of unity, so that a probability of 0.1 means that there is a 1 in 10 chance of the event happening; or, of the 10 units which make up the certainty of occurrence, 1 is positive and 9 are negative. This is hardly a mathematician's definition, but this paper is not written for mathematicians.

Second, where do these estimates come from? What is the guiding logic behind the choice of figures for an assessor in any given problem? There are three main types of such logic. These can be based on observations of what has happened in the past in identical cases (the frequentist school); a theoretical calculation of the relativity of various partitions of the total universe in question, which is essentially confined to mathematical situations (the symmetrist school); and individual opinion, or hunch, which may be a frequentist model modified to allow for small differences among cases, or be much less structured (the personalist school). This third form is the one which I shall be following hereafter.

Although its acceptance by statistical theorists is not complete, there exists in Bayes theorem a mathematical formula for the revision of opinion in the light of further probabilistic information. The

theorem has been best explained, perhaps, for our purposes by Ward Edwards (1963, 1965*a*, 1965*b*), upon whose analyses and proposals in a different field of information and decision problems much of the following is based. Bayes theorem deals with revision of probabilities in the light of fresh information and does so by means of odds and likelihoods. In Edwards' words:

> The odds in favor of a hypothesis is simply its probability of being true divided by the probability of its being false. The likelihood ratio is the ratio of the probability that the datum would be observed if the hypothesis were true to the probability that it would be observed if the hypothesis were false.

It would not be appropriate in what is intended to be primarily a paper directed at practice, even if in theoretical terms, to go further into Bayes. Sufficient to say that the technique exists, is mathematically respectable and is appropriate for handling sequences, or separate items, of probabilistic data. Some experiments have been conducted to see whether men can be reasonable generators of probability estimates for use in a Bayesian procedure, and the results have been encouraging, although we should note that different subjects value different predictors equally, or the same predictors differently, in the situation. They also apply different weights to utilities, as we may guess. The implication here is that if a decision system is to become more rational and better-structured as it is used, it is a prerequisite that some good, rigorous assessment of how the data items used in it are valued by different decision-makers, and which items are valued with any consistency.

There are one or two points to be amplified, and one potential criticism of the conceptual basis outlined to be met before all the material is synthesized into some coherent whole. To deal with the possible objection first, this takes the form of the argument that "the concern of the decision-makers is to give what they believe to be the best decision for the particular case," and though plausible, is untrue. For the true concern of the decision-makers is to give what is the best decision in the case, as we assume there to be such a choice, and they give what they believe to be the best for only one reason: They have no other means of discovering what is the best save their own imperfect beliefs, based on whatever information, calculations, and prejudices the particular individual indulges in. Thus, the main task of any rational system is to bring it about that the estimated best decision of the decision-makers corresponds as often as possible, and more often than not, with the "real" best decision.

It may be objected that this is a false position, because in a human judgment situation there can be no "real" best decision, and each decision's optimality can be expressed only in terms of the views, utilities, and probabilities of each decision-maker. But if that is the case we do not have a genuine overall decision situation, but merely a series of personal preference scales; and time, effort, and money put into a modern information and decision system are wasted. This objection fails, however, in that there is an external, rather than personal, value scale by which all decisions are measured, and this is an undefined one emanating from society. The personal aspect of the decision problem arises only from the fact that the decision-makers are not only the individual estimators of personal probabilities, but also the individual interpreters of society's values, as its appointed representatives.

Thus, in our estimation of utility and probability, these are two quite separate elements. To some extent, all decisions are predictions; the decision to play cricket or read a book is most often a simple prediction of a meteorological future state for those to whom the personal utility, or pleasure, of the two is approximately equal. But not all decisions are only predictions, and so we have in the correctional decision situation, not a sliding scale and a constant, but two sliding scales; and yet still a criterion, however theoretical, of one best decision and inferior alternatives.

I have mentioned the desirability of having a system which is capable of some kind of self-evaluation and self-improvement, on a cybernetic model. At the moment there is no body of material which derives from the decisions made in a correctional system other than a simple statement of what they are. One substantial side-benefit of any quantification scheme, that is one which requires individual estimates of separate probabilities and/or utilities in numerical form, will be that a large and ever increasing amount of raw data will be generated on decision behavior. It should be possible to work out by moderately sophisticated research which items are most correlated with correct and incorrect decisions, in the senses of successful or unsuccessful outcomes, and which with liberal or conservative decisions. Perhaps most important, these quantifications will highlight what has been called "secondary disagreement," both in a particular situation of disagreement over a decision and in an analysis of which items overall receive the most varied weightings from individual decision-makers. Thus, a much more sharply defined area of disagreement can be specified; and this is often the first step to the resolution of such disagreement.

The end product of this collection of theoretical analysis and empirical research results, of which the above is a brief summary, is to be a series of design directives. These lay down the conditions to be met by a rational decision system, particularly if it is to take full advantage of a modern electronic data processing (EDP), i.e., computer-based, information system.

Design Directives

These design directives merely state what specific minimal performance characteristics are required of a system to the best of our knowledge at the moment. There are several alternative solutions, presumably, and the one which follows is merely the one considered to be the best example at the moment. With feedback over time, both the directives and the solution may change comprehensively or in detail.

1. The system should de-emphasize the effect of personality variables, especially emotive personality variables, in the decision process.
   Because:
   Personality variables are known to affect the decision process, and so produce a variety of decisions. This is not consonant with the optimality criterion.
2. The system should encourage the use of the cognitive and intellectual powers of the decision-makers, by encouraging an abstract conceptualization of the decision.
   Because:
   a. Abstract environments seem to stimulate concrete personalities to perform abstractly.
   b. Concrete decision strategies are positively correlated with dogmatic and authoritarian conceptualizations.
   c. Concrete personalities use too little information in too narrow a category width.
3. The system should be able to be used to train decision-makers in a further understanding of the complexities of their task.
   Because:
   a. There is evidence that subjects do respond to formal mediation training and improve their decision quality.
   b. On-the-job training has usually been found to be the best method of evaluating expertise and refining its usage.
4. The system should rely as little as possible on the subjective confidence of the decision-maker.
   Because:

a. There is evidence that low-confidence decision-makers may produce the highest quality decisions. Subjective confidence is known to correlate more closely with personality type than with the appropriateness of the decision, as justified by the quantity and quality of information processed.
b. Subjective confidence is known to correlate more with data sample size than decision quality; but the extent of both these correlations, and especially the latter, is unknown.
c. Judgments will be distorted by the unwillingness to change decisions when that is called for—the inertia effect—if dependent on subjective confidence.
d. Subjective confidence is hard to measure, so that improvements in the system would be made more difficult.

5. The system should provide large enough data inventories for the decision-makers.
   Because:
   a. It seems likely that if a decision-maker has access to only a few data items, this influences his estimates of probabilities.
   b. Men desire more information than they strictly need by Bayesian theory, and to some extent it may be psychologically helpful to supply this, provided that directive 6, following, is not violated.
6. The system should be able to avoid the effects of information overload.
   Because:
   a. It is known that the number of information items which can be processed by human decision-makers is low—almost certainly no more than eight—before a decline in decision performance commences.
   b. With relatively low-value information items, as is usually the case in correctional decisions, as many potentially helpful items as possible should be considered.
7. The system should allow for the presentation of data to be either sequential or nonsequential, or both. At least this is true at the start, before further research can establish which if either of these presentation styles is preferable.
   Because:
   a. There is evidence that a summary presentation has some advantages.
   b. The order effect, i.e., the question of whether the way in which the order in which the data are presented affects the decision will have to be considered.

c. Most data systems do use sequential presentation, and most correctional personnel are used to some version of this at the moment.

8. The system should be able to diminish the strength of the order effect, if sequential presentation is used.
   Because:
   This has been shown to have a marked effect on decisions, both ways, i.e., both early and late data items, especially if clustered with respect to indication of decision (significance), can in certain circumstances receive more weight than is their due. Again, this is a question about which relatively little is known at present.
9. The system should arouse the uncertainty of the decision-maker, at least, to start with, but diminish his vested interest in one decision at an early stage.
   Because:
   a. Only in conditions of uncertainty will the decision-maker search at all extensively in the data provided. That is, the system must not encourage him to decide very quickly.
   b. Once a tentative decision has been reached, or a reason for preferring one exists, information search may become selective in a disadvantageous manner.
10. The system should generate data as to the agreement among decision-makers, among different individuals and over time, on the weighting of factors.
    Because:
    a. The accumulation of such material will provide an excellent raw data base for future research necessary for further improvement in the system.
    b. The material so collected will be useful in the training of future decision-makers, particularly when combined with a multiple regression type analysis of the actuarial predictive value of the data.
11. The system should reproduce formally, so far as possible, the underlying informal structure of everyday decision processes.
    Because:
    Any structured decision process will seem strange and discomforting to decision-makers. It will be easiest to convince them of its present value if it can be shown to be parallel to their present style of decision-making.
12. The system should produce and utilize probability and utility estimates by the decision-makers in numerical form.
    Because:

a. Only in this way can these estimates be combined mathematically.
b. Only in this way can they be recorded and analyzed as required by directive 10.
c. Any noncontrolled interaction between the two dimensions violates the principle of rationality.
d. The almost inevitable conflict of utilities in real life will be made clear.
e. Such a process produces a specific area of secondary disagreement among decision-makers, which can then be more rigorously examined.

13. The system should employ the weighting of pay-offs, that is utilities, and personal probability estimation, perhaps based on frequentist experience, and revised by an appropriate procedure.
Because:
a. This will allow individual judgment to the decision-maker.
b. Game theoretic (frequentist) models seem to be the most appropriate only where much is known and much is at stake.
c. Bayesian statistical procedures are now generally accepted as the appropriate formal methods for the revision of probabilities in the light of new evidence.

14. The system should encourage decision-makers to improve their estimation of probabilities and utilities
Because:
a. It is through such estimation that their expertise is brought to bear.
b. It is known that for untrained personnel this estimation is likely to be biased and naive, whether knowingly so or not.

15. The system should discourage any tendency not to be as influenced by fresh information as much as is theoretically warrented (the conservatism effect) or at least have the capacity to check for that built in.
Because:
The conservatism effect is known to be a distorting factor in probability estimation.

16. It may turn out to be preferable eventually for the system to use estimates of likelihoods rather than orthodox probabilities.
Because:
There is evidence that men tend to be better at deriving the former than the latter.

17. The system should provide considerable feedback, preferably of a correct-answer type.

Because:

a. It is known that this type of feedback produces the greatest improvement in decision quality in controlled decision situations, where the provision of such feedback is possible.
b. This type of feedback is essential to any cybernetic, self-improving decision system.
c. Over many outcomes, this will also be outcome feedback. If this is not so, this fact is evidence of a failure or weakness in the estimation of the quantities.
d. This will provide decision-makers with information about other decisions, and thus, hopefully, improve decision consistency across decision-makers.

18. The system should encourage consistency across decision-makers in the hierarchy of decisions, and especially in respect of the decision criterion.
Because:
a. This is a necessary condition for a rational system, and so for any "just" system.
b. It is known that untrained personnel are erratic in their choice of decision criterion, as well as of probabilities.
19. The system should have a criterion of optimality, which entails both measurement across many outcomes and consistency across decision-makers.
Because:
a. In a probabilistic world, individual outcomes are too open to unpredictable, perhaps random, influences.
b. For optimality to be genuine, there must be one decision better than the alternatives, and for a system to be better than others, the decision-makers within it must choose correctly more often than those in other systems.
20. The value of information extracted from the data in a system is to be defined as a measure of its ability to reduce uncertainty.

Decision System Design

The search for leads to devising some kind of decision system to meet all or most of these requirements brought me, again, to the work of Ward Edwards and his associates. Specifically, the Probabilistic Information Processing (PIP) system proposed by them (Edwards et al. 1968) for use in a military decision situation—the

decision as to what defensive measures to take under conditions of uncertainty as to whether an enemy attack was imminent—seemed to have many features which one would expect in a system meeting our requirements. The basis of this is that the system structures very carefully the way in which decision-makers handle and process their information, and in the case of man-machine systems, the way in which the machine accepts estimates on individual data from the man and combines them according to set rules. Thus, the human element is not excluded, but limited to that function which it alone can perform, while irrationality in calculation is minimized. I have suggested above that eventually correctional decision-making will take place in the context of computer-based information systems, such as that in which PIP is designed to operate. But the principles of PIP can, in fact, be applied even if the information system is the traditional tatty bulging file with all the pages in the wrong order, and the rational calculation device is a pencil and paper.

One source of significant support which can be found for such an approach is the work of several eminent decision theorists (Shephard 1964), (Pratt et al. 1964), who have emphasized the fact that such a structuring is remarkably close to the way everyday decisions can be, and often are, taken. Pratt and his colleagues write:

> The *essential* point is simply that the decision-maker can solve any decision problem, no matter how complex, by merely expressing his basic preferences and judgments with regard to very simple problems and then performing straight-forward computations. Whether he will feel that he can express his preferences and judgments more effectively by intuitive analysis of complex problems is another matter; but even though there is a good deal of empirical evidence to show that many practical decision-makers instinctively want to avoid the rather awful clarity that surrounds a simple decision, we nevertheless believe that most responsible decision-makers who take the trouble to train themselves to support this clarity will end by preferring to make decisions in such a way that they can see what they are doing.

Edwards and his co-authors describe the functioning of their system, and the way it handles data, as follows:

> A PIP system has no advantage over a more traditional deterministic information processing system unless its special capability, the ability to accept and generate explicit numerical probabilities, is necessary to successful performance of the system mission. It is therefore an improvement over a deterministic system only if the input information is fallible, or the *relation of input*

information to output diagnostic categories is ambiguous or uncertain (my emphasis, see below), or the output is required to be in expressly probabilistic form. If one or more of these three characteristics obtains, a PIP should be superior to a deterministic system. The extent of that superiority will, of course, depend on specific matters which vary from system to system and time to time. Under some quite plausible circumstances, a PIP should be able to produce quite usable outputs, while a deterministic system would be completely baffled.

It is perhaps useful to point out that the strategy of information processing used by PIP differs in an important way from that used by deterministic information-processing systems. Most deterministic information-processing systems begin by performing an operation which might be called "cleaning up the data." In this clean-up operation, information judged irrelevant or likely to be incorrect is excluded, and a tidy, orderly display of relevant information plus first order deductions from it, (e.g., identity) is prepared. Thereafter, a deduction of the meaning of this cleaned-up information is made.

PIP works differently. It does not achieve order by throwing out information which may or may not be irrelevant or incorrect. Instead it assesses the correctness and relevance of every item that comes its way and processes them all by means of an orderly mathematical process which takes formal account of the degree of correctness and of relevance of each item of information. This orderly mathematical process produces an orderly display. But that orderly display already contains an evaluation of the meaning of the information because that evaluation was applied to each incoming item of information in the course of assessing its relevance to desired system output. So the two stages of operation of deterministic information-processing systems are completely mingled and cannot be separated in PIP.

The sentence which I have italicized in this extract seems to me to describe exactly the situation of the correctional decision-maker: We do not know the predictive or diagnostic value of any data precisely, and for quite a lot of them not at all. This suggests a priori that PIP or something similar may have a lot to offer us. It was my encounter with this proposal of Edwards that first turned my thoughts to the possibility of a system wherein human decision-makers, especially in correctional classificatory or placement decisions, provide a series of sequential assessments of the significance for good or bad of each datum, expressed in numerical terms and then these are summed and expressed as an overall probability decision by a machine.

A description of the PIP here would be inappropriate for space reasons, and it can be found in the reference given. The adaptation of it which I propose for correctional decision-making is the following sequence of stages. The parts within parentheses are explanatory comments, or discussions of points of remaining uncertainty, as distinct from the system description proper.

1. The evidence available to the decision-maker should be presented to him sequentially. (I believe that a brief summary beforehand will be helpful, and that it is still uncertain whether he should be fed the information in a set order, or be allowed to choose the order himself. On both these points further research is needed.)

2. The decision-maker should be asked to record his estimate of the significance of that piece of evidence relative to the decision in question. This estimate will first be based on the extent to which the decision-maker regards the evidence as information, and so by definition reducing his uncertainty, or "noise" and so of no further relevance. The second criterion for the estimate will be the value-judgment, or utility, content of the datum. That is, the decision-maker will express in numerical form his estimate of whether the case deserves, on moral, legal, social, or political grounds, a favorable or unfavorable disposition, and whether he deserves this strongly or only just. The third criterion will be the predictive content of the datum. That is, the decision-maker will express in numerical form his estimate of whether the case is likely to succeed in the more liberal of the dispositions for which he is being considered.

All of these estimates will be made on a scale from 0-10, with a score of 5 the neutral figure. The logic of this is that these estimates are essentially probability weightings for a Bayesian revision procedure, so that a prior probability of x is unaltered by a score of 5, which represents the ratio 5:5 and not a decimal of 0.5. Thus a favorable estimate to the prisoner is 7, 8 or 9, which stand for 7:3 8:2 9:1. It will be remembered that the posterior probability of an event was defined as the prior probability multiplied by the probability of the hypothesis being correct from the new datum over the probability of the hypothesis being incorrect.

The first criterion will merely decide whether the estimate is to be an extreme or a central one. If the datum is estimated to be of no great relevance, i.e., is mainly "noise," the estimate will be 5. If it is estimated to be moderately relevant and significant, the estimate will be 4 or 3, if adverse to the case, and 6 or 7, if favorable. If it is estimated to be very relevant and significant, the estimate will be 2 or 1, if adverse, and 8 or 9, if favorable. It is important that the first criterion be understood to have no directional signpost; it gives

guidance only as to the magnitude of the estimate, and the degree of its placing away from or at the center of the scale, and no guidance as to which end of the scale it should be.

The second and third criteria will decide the direction of the estimate. For many data items, both criteria will affect the estimate, and for some only one. (I left undecided whether it will be better to use two separate figures, or ask for a combined weighting. I have followed the latter course in my practical research because I wished to keep the structure of the decision task as simple as possible on a first run-through. In the light of subsequent research this may prove to be the poorer choice, and it certainly is not as theoretically pure.)

The score of 0 will be used only if that item, in the eyes of the decision-maker, is totally swamping in its implications, for once a zero is introduced into a multiplication process, the product is zero. Therefore a zero score implies that for some reason, moral or predictive, the decision-maker thinks it right to rule out any chance of a decision favorable to the prisoner. The converse of this is slightly different: No one factor can prove, finally and beyond all doubt, that a prisoner must morally be given and will in practice succeed in the more liberal disposition. Therefore, the score of 10 is never used, and except in quite exceptional cases, the scale to be used is 1-9.

3. These weighting estimates will be made for all the available data items which the decision-maker feels could be relevant, one after the other. (There is no need for the decision-maker to consider more than one at a time, and so he can cope with many items without information overload and has no need to feel confident to decide to stop information search.)

4. These weighting estimates, in the form of a long fraction, as which the series of ratios can be regarded, will then be multiplied out. If an EDP system is in use, the machine can be programmed to receive each estimate and revise the prior probabilities accordingly. (In a probability revision process which is essentially the multiplying of one fraction by another, the multiplication can be done as each new estimate arrives or in one long process at the end. This procedure is one reason for my using a ratio/fraction representation of probability, rather than the more normal decimal representation.)

5. In the survey of utilities in a correctional system, earlier, I wrote that it was generally considered desirable to have as liberal a disposition as possible for the prisoner, within the boundary conditions of the values of society and the probability of his succeeding therein. For each two-way decision, therefore, the decision-maker is to make his estimates relative to the more liberal alternative. Should the result of the calculation come to more than unity, the optimal decision

will be, on theoretical grounds, to grant the more liberal disposition. Should the result be less than unity, the less liberal disposition becomes the correct decision.

In cases where there are more than two dispositions, the process should be started for the most liberal, and repeated for each successively less liberal disposition, with altered weightings as the disposition becomes more severe, until a product of greater than unity is first encountered, and this disposition will be the theoretically optimal one. (In practice I think that this will not be as clumsy or long a process as it sounds.) Owing to the fact that the most conservative dispositions will always have the highest prediction for success, as one can always guarantee, for instance, that a prisoner will not misbehave on parole if he is not paroled, we are interested not in the decision which produces the highest fraction, but in the cut-off point at which the element of risk involved becomes acceptable.

Such is the system. When it is measured against the design directives, it emerges reasonably well from the comparison.

Directive 1 is satisfied, as the only respect in which personality variables could have any effect would be in the actual quantified weightings. Any personal prejudices would thus have to be aired and declared publicly for them to have any influence on the decision.

Directive 2 is reasonably satisfied, as it requires the decision-maker to consider many different data items specifically from more than one perspective and to be nondogmatic in his combination of the inferences from these.

Directive 3 is satisfied in that, with an EDP system, simulation training runs, with feedback and discussion, would very easily be possible.

Directive 4 is satisfied, as the decision-maker continues estimating until he has used all the information he considers relevant, whatever his confidence level.

Directive 5 is satisfied, for all the available evidence is presented, as in a PIP system.

Directive 6 is satisfied, for the decision-maker has to evaluate each item separately and record this weighting. After this he can forget that item and carry on, so that he does not have to carry the impact of any ever-growing number of data items in his head all at once.

Directive 7 is neither satisfied nor violated. This really concerns the information display system, but my proposed modus operandi is capable of use in either environment, and to that extent satisfies the directive.

Directive 8 should be satisfied, as, although the estimation of each weighting is bound to be influenced a little by what has gone before,

and perhaps desirably so, there is no cut-off point and each datum is considered in some isolation from the rest. This condition is brought about by the fragmentation of the decision process.

Directive 9 should be satisfied, as vested interests should not appear in an estimation situation as compared with a direct choice, and subjective uncertainty is not lowered by the weighting estimation process.

Directive 10 is satisfied as all the weightings can be recorded and verbally or statistically analyzed, especially if an EDP system provides automatic access to a computer.

Directive 11 is satisfied, as I argued with the support of the theoreticians, when describing the PIP.

Directives 12 and 13 are satisfied by the description of the system.

Directives 14 and 17 are together capable of being satisfied, in that the comparison among decision-makers, and the analysis of recorded past experience, should act as correct-answer feedback to improve decision performance.

Directive 15 is not satisfied intrinsically by the system and further research will be needed to discover whether the conservatism phenomenon is indeed a serious problem in practical, as distinct from psychophysical, situations.

Directive 16 is not satisfied and is in fact violated. It seems likely to me that the greater difficulty of understanding the concept of likelihoods rather than the more straight-forward odds, which are the terms in which correctional personnel are accustomed to think, will produce a greater decline in decision quality than the more theoretically sound likelihoods will produce improvement. This requires careful research, for it may well be either that I am wrong and considerable improvement may be possible, or that in the end it will transpire that in a situation as unrefined as correctional decision-making, this is not a significant variable.

Directives 18 and 19 are satisfied in theory, as shown in the system description and by analogy with the PIP: The system proposed is above all an attempt to render these directives in a practical form. They remain to be demonstrated satisfied in practice.

Directive 20 is satisfied by the first estimation criterion of step 2 of the proposed system.

I suggest, therefore, that this proposed system has some claim to be considered, on theoretical grounds, a rational system for individual correctional case decision-making, which satisfies most of the requirements of a normative decision theory while absorbing or avoiding a good proportion of the hazards discussed in the earlier part of the paper. Even if it is accepted as such, it will inevitably require refine-

ment, revision, and remodeling in some respects before it is operationally satisfactory.

The operational hypothesis which can be derived from this theoretical material may be expressed as follows:

A simple quantification procedure of probabilities of success and social value utilities, combined in a Bayesian manner, can be shown to produce a higher degree of consistency of decision among correctional decision-makers than the normal unstructured decision process; and for theoretical reasons, this achieved level of decision agreement will favor the optimal decision.

This hypothesis was tested through the good offices of the Adult Authority and the Department of Corrections of the State of California on three important correctional decisions. The results are published in appendix E to *Correctionetics* cited above. In brief, we can say that the change to a formalized structured method produced no deterioration in consistency across decision-makers, and it was the opinion of most of the subjects, that, given time to get used to the new system, it would both improve their own understanding of their decision processes and contribute to clarity and consistency in the decision over time and among different personnel. The short time required to begin to adjust was also very encouraging. The smallness of the sample prevented much meaningful analysis of the significance attached to different data items, but the results were encouraging enough to stimulate further research along these lines, which is now being planned in England.

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