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Volume 7. Sage Criminal Justice System Annuals

MODELING THE CRIMINAL JUSTICE SYSTEM

STUART S. NAGEL, *Editor*

SAGE Publications *Beverly Hills* · *London*

Chapter 12

JURY DECISION-MAKING MODELS

BERNARD GROFMAN

The dynamics of the jury process have fascinated social scientists for well over a hundred years (see, e.g., Condorcet, 1785; Poisson, 1837), and their fascination has been enhanced, no doubt, by the secrecy of jury deliberations. Furthermore, in the United States, despite the quite low percentage of (non-federal) cases today (either criminal or civil) which ever actually come to trial, trial by jury seems to be, as a leading scholar put it, "a test of the larger society's commitment to a just legal order for all" (Tapp, 1976:359).

We shall review recent work on jury decision making, focusing on modeling the implications of changes in jury decision rule and/or jury size for (1) verdict outcomes, (2) the nature of the jury deliberation process, (3) the achievement of

AUTHOR'S NOTE: *This chapter was written while the author was a visiting faculty member in the School of Social Sciences, University of California, Irvine. I wish to acknowledge my thanks to Professors Murray Krieger, R. Duncan Luce, Louis Narens, and William Schonfeld for helping make possible this appointment–which provided me with an environment conducive to both productive scholarship and pleasant living. Particular thanks also go to Mrs. Helen Wildman and Mrs. Sharon Maier, who translated my handwritten scribbles into finished copy. This research was supported by National Science Foundation grant no. SOC 751 4091, Law and Social Sciences Program.*

A considerably longer version of this paper, in which arguments are developed in more detail, is available upon request from the author.

and appearance of substantive justice, (4) savings in time and manpower, and (5) jury representativeness.

We shall also briefly discuss models of the voir dire process and of jury decision making in cases involving multiple verdict options. Since ours will be a highly compressed and selective review of jury related studies, we recommend that the interested reader consult Davis et al. (1976a) for a more general overview of the relevant literature.

I. VERDICT OUTCOMES AS A FUNCTION OF JURY SIZE

In two recent decisions permitting six-member juries—*Williams* v. *Florida* (1970) 399 U.S. 78, which dealt with state criminal trials, and *Colgrove* v. *Battin* (1973) 413 U.S. 149, which dealt with federal civil trials—the U.S. Supreme Court claimed that the reduction in jury size would not affect trial results and cited empirical data as proof for this claim. Zeisel (1971) and Zeisel and Diamond (1974) have, in my view, clearly shown that the Court was wrong: the studies cited by the Court neither singly nor in toto substantiate the conclusion (reiterated by the Court in *Colgrove* v. *Battin*, n. 15) that "there is no discernible difference between the results reached by the two different sized juries."

To determine the verdict impact of changes in jury size, we need to know the relationship(s) between the predeliberation distribution of opinion and the expected final verdict in juries of differing sizes and decision rules. We shall not pursue this issue, except briefly, here, since it is dealt with at length in Chapter 13 by Alan E. Gelfand and Herbert Solomon. (See also Grofman, 1974a, forthcoming-a, forthcoming-b.)

It appears certain that *the size of the predeliberation majority largely determines the verdict outcome* (Kalven and Zeisel, 1966; Davis, 1973; Davis et al., 1976b; Grofman and Hamilton, 1976; Nemeth, 1976). At issue, however, is whether it is the *absolute* number of jurors in the minority that is crucial or whether it is the *relative* proportions of the minority and majority factions which determine minority resistance to majority persuasion. Some authors (e.g., Zeisel, 1972; Lempert, 1975) have strongly argued for the former view.

We believe that the available evidence from 6-person and 12-person juries and mock juries offers inadequate data for a definitive specification of the relationship between predeliberation preferences and expected final verdict and thus renders impossible a definitive judgment of the numbers versus relative proportions controversy. Our reading of the limited evidence, however, argues in favor of the proportionality thesis. (See Grofman, 1974a.)

II. VERDICT OUTCOMES AS A FUNCTION OF JURY DECISION RULE

A simple model to predict the impact of changes in decision rule and size is one which postulates that jurors have some mean probability p of voting for conviction.[1] The binomial theorem can be used to determine, for any given value of p, the likelihood of any given number of first ballot votes for conviction. Thus, it is straightforward to calculate the probability that, for any given p, any particular required verdict majority will be obtained on the first ballot. Furthermore, it can be shown that some rules are more likely than others to give rise to certain first ballot verdicts, regardless of p. For example, Saks and Ostrom (1975:170-171) note that juries with a 9/12ths rule will *always* be more likely to deadlock on the first ballot than will juries under a 5/5ths rule. Nonetheless, unless we know the nature of the group conformity process in juries of different sizes and decision rules, we cannot conclude from the above finding that 5-member juries under unanimity are less likely to deadlock—in the end—than 12-member juries operating under a 9/12ths rule, a point which Saks and Ostrom (1975:173) clearly recognize.

Elsewhere we have argued that *"because of the group conformity process which has been observed to operate in jury decision-making, it is very likely that shifts from unanimous to nonunanimous verdicts will have minimal impact on verdict outcomes as long as jury size is held constant"* (Grofman, forthcoming-b). The only caveat we would wish now to add to that judgment is the reminder that sharp decision-rule effects may occur in large juries when unanimity requirements are lowered below the 2/3rds point.

III. NATURE OF THE JURY DELIBERATION PROCESS

In looking at jury decision making, one must look at both the outcome of deliberations and the process of deliberation. The U.S. Supreme Court—in *Johnson* v. *Louisiana* (1972) 406 U.S. 356 and *Apodaca* v. *Oregon* (1972) 406 U.S. 404—has recently held that juries' verdicts need not be unanimous, with the court majority arguing that neither verdict outcomes nor the deliberative process would be significantly affected by the elimination of the unanimity requirement. Similarly, in *Williams* v. *Florida*, the Court held that size reduction would not affect the deliberative process. However, available evidence (see, e.g., Nemeth, 1976; Grofman and Hamilton, 1976) suggests that jurors under nonunanimity conditions do not deliberate until a full consensus is reached. In 3-person, 5-person, and 6-person mock juries, groups assigned nonunanimous decision rules deliberated on the average for a somewhat shorter time period than similar sized juries under a unanimity condition (Nemeth, 1976; Grofman and

Hamilton, 1976; Padawer-Singer and Barton, 1975). Only in 12-person juries (12-0 versus 10-2) were no such differences found (Padawer-Singer and Barton, 1975). However, we might expect nonunanimity rules to have a greater impact in smaller juries.

When juries are allowed to reach nonunanimous verdicts, the probability that the jurors will have already achieved sufficient consensus for a verdict before they begin deliberations is extremely high in smaller sized juries. For example, we may show that in a jury of size 6, even if the juror pool is evenly split in the predeliberation phase there is a 22% probability that the jury will have a predeliberation majority of 5 or 6 and a 60% probability that the jury will have a predeliberation majority of at least 4-2. On the other hand, if the jury pool is evenly divided, the likelihood of drawing a 12-member jury with at least 9 members in agreement is only 49%, and the probability of obtaining at least 8 members in agreement is only 39%. However, for high levels of consensus among the jury pool, the differences between 6-member and 12-member juries virtually vanish. Indeed, for very high levels of preponderance coupled with low unanimity requirements (e.g., $p \geq .9$, unanimity requirements of 5/6ths or less), larger sized juries are marginally more likely to walk into the jury room in agreement than are smaller sized juries.

There are three other aspects of jury deliberation worth mentioning. One is the claim that smaller sized juries will tend to be less factionalized and that verdicts will "represent a greater consensus of the group" (Rosenblatt and Rosenblatt, 1973:629). This claim is buttressed by the conclusion of Hare (1952) that groups of 12 are more likely to break into factions than groups of 5 and by the work of Hawkins (1962), who found some juries deliberating en bloc and others deliberating in factions, with the latter groups exhibiting lower postdeliberation concurrence with the group verdict than did the former.

A second claim about the impact of size on group deliberations is that the larger sized group will be more likely to reach a "correct" verdict. This issue is an exceedingly complex one on which we have written at length, and here we shall only touch on one aspect of it—group memory. (See Grofman, 1975a, 1975b, forthcoming-b, and the discussion in section IV below.)

In general, we may expect groups to be able to recall facts better than any individual in them because of a group's ability to draw on the recall facilities of all its members (Lorge and Solomon, 1955, 1960, 1962). Yet group procedure may lead to inaccuracies of recall as well—as "false memories" are planted into the group's consciousness by some members. Unfortunately, we are aware of no formal work which considers this possibility. Hoppe (1962) proposes a simple binomial model for group recall. If we let P_1 = the probability that an individual juror will recall a given item, then the probability, P_K, of a jury of size K

recalling the item = $1 - (1 - P_1)^K$. In this model, the marginal impact that increases in group size have on the probability of successful group recall diminishes rapidly. Thus, we might expect that, if P_1 is reasonably large, then increases in group size above a certain level will not visibly improve group memory. (Compare Grofman 1974b for a discussion of a related issue.) Padawer-Singer and Barton (1975), who have videotaped 92 mock trials, are investigating jury recall phenomena as well as "brainstorming" (the number of independent arguments put forth pro and con)[2] in juries of different sizes and with various sized predeliberation minorities. Their data should shed considerable light on important aspects of jury discussion processes.

A third question as to the nature of jury deliberations is the extent to which minority viewpoints are heard. Hawkins (1962) examined data from 22 12-person juries in which a vote polarized the jury into proacquittal and proconviction factions.[3] He considered two simple hypotheses about the percentages of speaking acts initiated by minority and majority factions. The first is that initiations should be proportional to faction size—the proportionality model. The second is that initiations should be equally divided between proacquittal and proconviction factions, regardless of faction size—the equity model. He found that his data lay in between the predictions of those two models. Grofman (1972, revised draft 1976) has considered a number of models of group discussion. Two quite different models fit the Hawkins (1962) data extremely well. One is inspired by the operant conditioning approach of Gray et al. (1968), and the other involves a first-order difference equation in which all jurors seek to participate equally, but some are prevented from doing so because of limited channel capacity, while others are compelled to do so to end periods of silence. Grofman (work in progress) finds that both of these models lead to the prediction of essentially no difference between (factionalized) juries of size 6 and of size 12 in the ratio of majority-minority speaking acts initiated, when the size of the minority (in percentage terms) is controlled for.

IV. JURY DECISION MAKING AND NOTIONS OF JUSTICE

U.S. Supreme Court rulings allowing for reduced jury size and unanimity requirements have generated considerable outcry from constitutional scholars and civil libertarians who have expressed concern that the rulings may, for example, lead to an increased probability that defendants who are innocent will be *wrongly* convicted. (See, e.g., *New York Times,* 1972; Zeisel, 1971, 1972; Saari, 1973.)

Several authors have rediscovered and further developed binomial trial models first investigated by such early scholars as Condorcet (1785) and Poisson (1837)

to deal with the relationship between jury size and the likelihood of "correct" verdicts,[4] under various assumptions as to the nature of the underlying group conformity process.

One common formulation is the two-parameter model analyzed at length by Gelfand and Solomon (1973, 1974, 1975) and by Grofman (1973, 1974a, forthcoming-b). In this model P_G = probability that the accused is guilty, and P = probability that a juror will not vote for an incorrect verdict. Gelfand and Solomon (1973, 1974) use this model to assess, from a societal standpoint, the implications of varying jury size for the expected percentage of "correct" verdicts and for the expected percentage of convictions. (See Chapter 13 in this volume.)

In an extension of the two-parameter model, Grofman (1974a, forthcoming-b) has examined the consequences of varying jury size and "effective" majority requirements in terms of a criterion parameter which is used to differentially weigh the desirability of "convicting the guilty" and "freeing the innocent." Grofman (1974a) shows that unanimity may be desirable as the effective decision rule even for cases where "convicting the guilty" is regarded as more desirable than "freeing the innocent," provided mean juror discrimination capability is low and/or the pretrial screening process is extremely ineffective in "weeding out" the innocent. Grofman (forthcoming-b) has also shown that, for jurors who would be willing to see as many as r guilty defendants set free rather than allow one innocent person to be convicted, the decision rule which minimizes expected juror disappointment in the verdict outcome is an $\frac{r}{r+1}$ rule.[5]

Parallel to this work on jury decision making has been work by scholars in the public choice area on very similar models and related (although somewhat more general) questions (Rae, 1969; Taylor, 1969; Schofield, 1971, 1972; Niemi and Weisberg, 1972; Badger, 1972; Curtis, 1972; Kazmann, 1973; Grofman, 1975a, 1975b). Generally, the estimation of an "optimum" jury size and decision rule can be conceptualized in cost-benefit terms provided that we can (a) specify the appropriate trade-off ratios and (b) meaningfully identify the relevant variables. Several authors have dealt with the closely related problem of specifying an optimum degree of certainty, such that one should be prepared to vote guilty if one's certainty as to verdict exceeded that cutoff point (Cullison, 1969; Simon and Mahan, 1971). Space does not permit us to treat these issues here. We suggest that the interested reader consult Tribe (1971), who offers an insightful and carefully reasoned article on the use of probabilistic reasoning and cost-benefit calculations in the legal process–an article which we recommend highly, although we do not share his quite skeptical views as to the limitations of mathematical tools for the law.

One last point: if we wish to optimally represent the majority sentiment of the pool of potential jurors, we may easily show (Auchmuty and Grofman, 1972) that we wish juries to operate under simple majority rule and that we wish them to be as large as possible. However, as one leading scholar has put it (Barton, 1975), "the policy question is whether *that* is what we want jurors to do, and, if so, how much money we want to spend achieving this result, since from this viewpoint 24 is better than 12, and 48 than 24." (For further discussion of these issues, which space limitations prevent us from dealing with here, see Grofman, 1974a.)

V. SAVINGS IN TIME AND MANPOWER OF REDUCTIONS IN JURY SIZE

The 6-member jury is "widely assumed to be standard equipment for the streamlined court of the future" (Pabst, 1973:6). The presumptions of many authors (see, e.g., Thompson, 1974:14) are that switching from 12-member to 6-member juries would involve savings in trial processing time and considerable savings because of reductions in the number of juror man-days served, which could come close to a 50% reduction in jury manpower requirements. However, both these presumptions have been challenged. (See, e.g., Pabst, 1973.) We believe there to be no good evidence for shorter deliberation times for smaller juries, at least for juries operating under unanimity requirements.

Grofman and Feld (forthcoming) have developed a probability model to analyze the case where constraints are imposed on the jury selection processes to prevent jurors from serving together on more than one jury. Such a requirement might be desired to prevent the formation of cliques whose previous jury service together might lead to patterns of allegiance or antagonism which could impose biases on the jury decision process in succeeding trials. (In most states, jurors are called for an extended period of jury service with the possibility of serving on more than one jury during their period of jury duty.) Grofman and Feld (forthcoming) show that approximately 4.2 times as many 6-member as 12-member juries may be drawn from a fixed manpower pool when subject to the constraint that no two jurors ever serve together on more than one jury.

VI. JURY REPRESENTATIVENESS

There are two important aspects of jury representativeness. The first is whether or not jury verdicts can be expected to be consistent with the views of the majority of potential jurors. This issue we have touched upon in Section IV. (See also Grofman, 1974a.) The second is whether the jury can be expected to

contain representatives of all segments of the community. For a minority segment of the population, the probability of going unrepresented is, in general, considerably higher in juries of size 6 than in juries of size 12.[6] Lempert (1975, Table 1, note 84, Table 2) presents results drawn from the binomial theorem that show, for example, that a minority which is 20% of the population has 27% probability of going unrepresented (in a random draw) in a 6-member jury while only a 7% probability of going unrepresented in a 12-member jury; while the probability that it will have not more than one representative is 55% in 6-member juries and only 28% in 12-member juries. Clearly, the larger sized jury is a more faithful mirror of the juror population. But, to repeat an earlier point, if a mirror image is our concern, "Why 12 and not, say, 24?" Furthermore, if indeed it is the proportion of minority representation that is important (rather than the number) then smaller sized juries may under some circumstances be preferable for minority representation because just as they are more likely to lend to underrepresentation of minorities so, too, are they more likely to lend to overrepresentation of minorities. Hence, if a jury minority of less than 1/3rds will, with virtual certainty, succumb to majority persuasion, then a minority is often likely to be more successful in achieving verdicts consistent with its view in 6-member juries than in 12-member juries.

For a minority with 20% representation in the jury pool, the probability of its being represented by two or more jurors on a 6-member jury is .345; the probability of its being represented by four or more jurors on a 12-member jury is only .205 (Lempert, 1975, Table 2). Thus, contra Lempert (1975, especially pp. 671-673), we do not regard it as clear-cut which way the argument for minority representation cuts. We are, however, extremely sympathetic to the probabilistic approach that Lempert has taken for calculating the implications of jury size. We concur with him completely, moreover, on the need for "systematic analysis of the way minorities behave in the deliberative process" (Lempert, 1975:677). To again repeat an earlier point: at issue is whether it is the relative or the absolute size of the minority representation which is more significant in determining the likelihood of minority resistance to majority persuasion.[7] *Without knowledge of this relationship we cannot meaningfully evaluate the impact of jury size changes on either minority representation or expected verdict outcomes.*

VII. MULTIPLE VERDICT OPTIONS

Vidmar (1972) conducted an experiment on the effect on verdict choice of limiting the number of verdict options open to jurors. Let F = first degree murder, S = second degree murder, M = manslaughter, N = not guilty. Vidmar

ran groups of 24 jurors through each of seven option conditions: F or N; S or N; M or N; F or S or N; F or M or N; S or M or N; F or S or M or N. Vidmar (1972:215) hypothesized that "under conditions of restricted decision alternatives, the more severe the degree of guilt associated with the least severe guilty alternative, the greater were the chances of not obtaining a guilty verdict." This hypothesis was confirmed–indeed, confirmed rather dramatically. For example, in the choice between first degree and acquittal 54% of the jurors voted for acquittal; in the choice among all four verdict options, only 8% voted for acquittal.

Larntz (1974) reanalyzed Vidmar's data on the assumption that the relative proportions of verdicts in any restricted case will be proportional to their occurrence in the unrestricted (for verdict options) case, and he found reasonable fit for this model.

Grofman (1974c) has postulated that jurors rank verdict outcomes along a continuum with respect to severity of punishment and that they choose among verdicts by comparing them to their ideal point on this continuum. He shows that, if jurors' preferences for verdict satisfied this unidimensionality assumption (more precisely, the assumption of "single-peaked" preferences–see Grofman, 1969), then we may predict verdict choices in the restricted cases from those in the unrestricted cases (or vice versa) with a high degree of accuracy. Furthermore, Grofman (1974a:10-13) shows that his model completely subsumes that of Vidmar's (i.e., is identical in all overlapping predictions as to verdict choice and makes a number of additional predictions), but is incompatible with that of Larntz's. If Grofman's "single-peaked" assumption is justified, it has important consequences for jury verdict. When preferences are single-peaked, there always exists one and only one alternative which can receive a majority in a paired contest against each and every other alternative. This verdict option, we would expect, would be *very* likely to become the jury verdict, even though there might be several possible verdicts and even though this option might be the *first* choice of not even a plurality of jurors.

VIII. VOIR DIRE

A number of scholars (see Kairys et al, 1975) have been concerned with the implications of the voir dire process for "fair" trials. There is, however, only one formal model of the voir dire process of which we are aware. Brams and Davis (1976a, 1976b) postulate that lawyers for each side are able to evaluate a prospective juror in terms of P_G (his probability of voting against the defendant) and also are able to evaluate the likely distribution of P_G values in the jury pool. They assume also that you cannot know for sure who the most extreme

veniremen will be until they are actually examined as the selection process proceeds.[8] They show, as a function of the distribution of P_G and of jury size and the number of peremptory challenges available to each side, that each side possesses an optimal strategy[9] for exercising its peremptory challenges; in particular, they show that there exists a cutoff threshold such that only jurors who fall above (below) this threshold should be challenged. The Brams and Davis (1976b) model permits us to evaluate the probability, when each side optimally exercises its peremptories, that those potential jurors representing the "extremes of partiality" will have been eliminated–a condition which Brams and Davis (p. 2) offer as the sine qua non of an "impartial jury."

NOTES

1. Note that p need not bear any necessary relationship to the defendant's quilt or innocence on the count(s) charged.

2. A model analogous to that proposed by Hoppe (1962) applies to the "brainstorming" case as well. Let P_1 = the probability that an individual juror will propose a given argument.

3. Because of repeated balloting in some juries, Hawkins (1962) has 45 distinct factional groupings.

4. By correct verdicts we mean ones in which either the innocent are acquitted or the quilty convicted. For a discussion of the meaningfulness of such terminology see Grofman (1975b) and Gelfand and Solomon (1973 and Chapter 13 in this volume). The reader who is made queasy by this terminology may simply substitute for "correct verdict" "a verdict which represents the majority sentiment of the pool of potential jurors."

5. In this model, hung juries are treated as acquittals. If $\frac{r}{(r+1)}$ is not an integer, we take the upper integer bound.

6. This is a function of the "law of large numbers." (See Chapter 13 in this volume.) A related result applies to damages in civil cases. Zeisel (1971) points out that verdict variance (measured in monetary terms) would be less in the larger sized juries; i.e., the larger sized jury would be more likely to award similar damages in similar cases. (See also Lempert, 1975:680-681.) The same argument applies to verdict variance in general, i.e., two 12-member juries hearing the same case are more likely to reach the same verdict than two 6-member juries hearing the case–where all juries are drawn from the same juror pool.

7. Of course, this question may turn out to be answered differently for different minority groups and may also depend on other factors–such as the nature of the case.

8. "Only under the struck jury system, wherein peremptory challenges are exercised just once after the examination of a panel of veniremen equal to the sum of the number of jurors to hear the case plus the number of peremptory challenges allowed each side, can one assuredly eliminate all veniremen–up to the limit of one's peremptories–whom one views as least favorably disposed to one's side. For, under this procedure, one does not have to worry that one will let pass a more extreme venireman, or challenge a less extreme venireman, than appears later in the sequence" (Brams and Davis, 1976a:3).

9. An optimal strategy for the defense (prosecution) is one which minimizes (maximizes) the probability of conviction.

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