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An Experimental Study of Strategic Voting and Accuracy of Verdicts with Sequential and Simultaneous Voting

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Abstract: In a model of simultaneous voting, Feddersen and Pesendorfer (1998) consider the possibility that jurors vote strategically, rather than sincerely reflecting their individual information. This results in the counterintuitive result that a jury is more likely to convict the innocent under a unanimity rule than under majority rule. Dekel and Piccione (2000) show that those unintuitive predictions also hold with sequential voting. In this paper, we report paired experiments with sequential and simultaneous voting under unanimity and majority rule. Observed behavior varies significantly depending on whether juries vote simultaneously or in sequence. We also find evidence that subjects use information inferred from prior votes in making their sequential voting decisions, but that information implied by being pivotal in simultaneous votes does not seem to be reliably processed.

Keywords: jury voting; Condorcet jury; experiments; sequential voting

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1. Introduction

Social dilemmas emerge when group goals conflict with individual interests. Olson's [1] famous collective action problem provides a classic example—a group as a whole may be better off if every member contributes to a public good, but every individual has an incentive to free-ride on the contributions of others. The result can often be inefficient in the sense that societal goals are unmet. How would this situation change if all individuals had a common goal? It seems likely that this scenario would eliminate the social dilemma. Surprisingly, if individuals lack perfect information about the true state of the world, strategic decision making might create social dilemmas even with a common group goal.

Jury voting is arguably a case in which decision makers share the goal of correctly assessing the guilt or innocence of a given defendant. The voters' task is complicated by the fact that none of them know the true state of the world with certainty. The Condorcet Jury Theorem [2] shows that if individuals see independent signals that are greater than 50% accurate, a group decision based on majority rule can be more accurate than any given individual decision. However, more recent theoretical work calls this result into question.

Austen-Smith and Banks [3] show that a social dilemma can emerge in jury voting. While voting in accordance with their own signal would improve the overall probability of making the correct group decision, individuals who think their vote is pivotal have an incentive to vote against their private signal. If all voters think strategically in this manner, the group result can be less accurate than that of letting a single voter decide for the group. Feddersen and Pesendorfer [4] extend this notion and show that strategic voting under a unanimity rule can produce a significant fraction of guilty votes, even among jurors who receive an innocent signal. This can lead to a conviction of an innocent defendant. Thus, even in the case of shared preferences, individual actions can undermine societal goals.

While Feddersen and Pesendorfer [4] focus on simultaneous voting, it is reasonable to assume that sequential voting might not lead to the same inefficient outcomes. If early in the voting sequence jurors vote consistently with their signals, later voters gain valuable information about the true state of the world. Thus, public sequential votes might help jurors avoid the "swing voters' curse", in which the realization that your vote was pivotal likely means that your private signal about guilt or innocence was an outlier. Observing a sequence of votes that are inconsistent with their private information makes jurors more aware of the possibility of being pivotal than they might be in the stark environment of simultaneous voting. However, Dekel and Piccione [5] show that it is possible in theory to obtain the same equilibrium in sequential voting that Feddersen and Pesendorfer [4] found for simultaneous voting: jurors may vote strategically, and unanimity rule may result in convicting the innocent.

We present results from a series of experiments designed to study whether these types of social dilemmas actually occur. By using a jury size and threshold of reasonable doubt that are larger than existing studies, we contribute to a growing body of literature on simultaneous voting demonstrating that strategic voting does occur, but generally to a lesser extent than predicted by Feddersen and Pesendorfer [4]. Since voters have an opportunity to share information in a sequential voting framework, it is reasonable to expect more accurate verdicts, despite theoretical results suggesting otherwise. Our main contribution to the existing literature is conducting paired experiments with sequential and simultaneous voting under unanimity and majority rule to test Dekel and Piccione's [5] extension of Feddersen and Pesendorfer's [4] results. The sequential voting framework also allows us to examine the predictive power of an information cascade model in the context of jury voting.

In general, we find that behavior is not consistent with theoretical predictions. We find significant differences between cases of simultaneous and sequential voting, in terms of both individual voting and group (jury) outcomes. Jurors were generally more likely to vote guilty under sequential voting, regardless of the voting rule (majority or unanimity) or their own private signal. The only incorrect jury convictions occurred with sequential voting, although that type of error was extremely rare.

Overall, juries were more likely to reach correct verdicts with sequential voting than with simultaneous voting because of the prevalence of incorrect acquittals in the latter case. Consistent with a cascade model, we find evidence that jurors use information inferred from early public votes to inform their own decisions. Our results highlight the notion that although it is theoretically possible for individuals to disregard the information they receive from actions of those deciding before them, subjects do not tend to do so when voting is sequential. To the extent that jury deliberations can disseminate information similar to a sequential voting process, our results suggest that the theoretical potential for a convict-the-innocent social dilemma to occur is overstated. (Jury deliberation is difficult to evaluate experimentally. Guarnaschelli et al. [6] used a straw poll to simulate deliberations. In an experimental setting with known signal quality, such as the one we use, deliberation in the form of freeform discussion would likely involve subjects revealing their private signals. This would invalidate the test of theory, which is a main objective of our research. In real jury cases, in contrast, signals are less precise, because voters have different interpretations of evidence. Thus, deliberation is not as clear cut as revealing signals. A possible extension of our work is to provide subjects with less precise signals about the true state of nature and allow freeform discussion prior to a voting sequence.).

The next section reviews related literature. Section 3 describes our experimental procedures. Sections 4 and 5 present results on individual-level and jury-level voting, respectively, and Section 6 concludes.

2. Literature Review

2.1. Theoretical Results

In the U.S., federal courts and nearly all state courts require unanimous verdicts for felony defendants. (Previously, there were two states, Oregon and Louisiana, which allowed juries to convict most felony defendants with a 10-2 vote. In November 2018, Louisiana passed Amendment 2, which eliminated non-unanimous juries in felony trials. In April 2020, in Ramos v. Louisiana, the Supreme Court decided that the sixth amendment, which entitles a person to a unanimous verdict for a conviction in federal court also applies to state courts. Thus, Oregon's law permitting non-unanimous verdicts was overturned). Most people consider the requirement of unanimity to be a protective device to avoid convicting the innocent. As noted previously, Feddersen and Pesendorfer's [4] seminal paper on simultaneous jury voting yielded the counterintuitive theoretical result that the use of unanimity rule can lead to a higher number of convictions than majority rule. (This research was motivated by the research of Austen-Smith and Banks [3] who showed that it is not always a Nash equilibrium to vote informatively in games with asymmetric information). The model assumes that each voter receives a private signal of guilt or innocence that is correlated with the true state. Voters do not communicate and thus do not know other voters' signals. A central feature of the model is that jurors may engage in strategic voting. Specifically, after observing an innocent signal, a voter may consider the possibility of being pivotal. Thus, under unanimity, a vote to acquit will not affect the outcome *unless every other juror votes to convict*. A juror who reasons in this manner may be hesitant to acquit, despite having seen an innocent signal. This outcome is compared with the simple majority rule case, in which a vote to acquit is pivotal only if half of the other jurors would vote guilty and the other half would vote innocent. In this scenario, the incentives are not as strong to vote to convict.

Feddersen and Pesendorfer's [4] surprising result has been challenged on a number of grounds. One of the more controversial assumptions of the model is that voters have no information about others' signals. Margolis [7], among others, has criticized the applicability of these results for policy purposes, because jurors deliberate, and through this deliberation, they may be able to share their private information, avoiding the strategic problems that could occur in the simultaneous case. Coughlan [8] presents theoretical evidence that a straw vote held before an actual vote will reveal the private information of each of the voters, decreasing the perception of being pivotal among unanimity voters. Additionally, there is empirical evidence that even partial revelation of other voters' signals can affect the choices of later voters (Morton and Williams, [9,10]). This stands in contrast to theoretical models of strategic behavior with simultaneous voting.

Dekel and Piccione [5] extend the Feddersen and Pesendorfer [4] analysis to the case of sequential voting. They find that, rather than serving to reveal and aggregate private information, sequential voting can lead to the same predictions presented in Feddersen and Pesendorfer [4]. Specifically, in a symmetric two choice voting game with incomplete information, any symmetric equilibrium with simultaneous voting can also be an equilibrium with sequential voting [5]. Thus, despite the fact that jurors are able to see the votes of previous jurors in the sequence, it is possible that some jurors worry about the possibility of being pivotal. If this is the case, early jurors may be reluctant to vote in accordance with an innocent signal, under concerns that their signal is unique to them. To be 'safe' they may vote guilty, but this increases the number of guilty votes seen by later jurors, who may then disregard their own innocent signals. As in the simultaneous game, with sequential voting the requirement of unanimity for a conviction can increase the chance of convicting the innocent relative to majority rule.

The intuition behind the Dekel and Piccione [5] result is similar to Feddersen and Pesendorfer [4]. When the outcome is determined by the group as a whole, all voters will assess the effect of being a pivotal voter. The sequential structure gives no advantage, since decision makers can rely only on the information of those before them in the sequence, but, as stated, early voters may err on the side of safety and cast a guilty vote. Therefore, decision makers are no better off having information from preceding votes, and will vote based on the strategy used in a simultaneous game.

It is possible, therefore, that information from previous votes will not help overcome failures in group decision-making. This possibility is inconsistent with the theoretical results of Bikhchandani et al. [11], who show that communication, even in limited form, can have an impact. In their model, agents in a sequential decision-making model use information inferred from the publicly observed decisions of those who come before them in the queue. If the information revealed by public decisions outweighs an agent's private information, the agent rationally follows the pattern of prior decisions, thus resulting in an "informational cascade." (Note that the standard information cascade model is different from jury voting in the sense that individual payoffs depend on only their own decisions and the true state, not on group vote totals. Anderson and Holt [12] present experimental evidence that cascades in this individual prediction setting generally form as predicted by applying Bayes' rule and inferring that others are doing the same.) Dekel and Piccione [5] contend that behavior that appears to be an informational cascade with sequential jury voting is actually strategic voting. Specifically, a voter who observes a sequence of guilty votes then sees a private innocent signal will vote guilty to avoid being the pivotal voter, not because of information inferred from prior votes:

> "An interesting feature of these equilibria is the presence of seemingly cascading behavior: early voters vote informatively and later voters vote for the same options regardless of their signals. Such appearance is of course deceptive since these equilibria are equivalent in outcome to simultaneous voting." [5]

They argue that the information obtained from earlier votes in a sequence is ignored because of the importance placed on the potential for a voter to be pivotal:

> "Of course, along the play of the symmetric equilibrium in the sequential game, information about the value of the alternative is revealed and later voters are better informed than earlier voters. However, these gains in information are of no use since voters evaluate payoffs conditional on the pivotal event." [5]

Dekel and Piccione's [5] result implies that sequential voting should add no information, and thus is unlikely to improve outcomes relative to simultaneous voting. Like Feddersen and Pesendorfer [4], this result assumes that voters are strategic. If sincere and strategic voters coexist, the equivalence result for the symmetric equilibrium does not hold. It is also important to note that Dekel and Piccione's equivalence result is not a unique equilibrium [13]. As just one example, Feddersen and Pesendorfer mention that, under a unanimity rule, all jurors voting to acquit is a Nash equilibrium, because no single juror can unilaterally affect the outcome [4]. Because this is an equilibrium of the simultaneous game, it is also an equilibrium of the sequential game.

As noted by Battaglini [14], the theoretical predictions in these voting models do not correspond with empirical evidence that early voting does affect the behavior of later voters. As in the case of Feddersen and Pesendorfer's [4] model, empirical tests of Dekel and Piccione's [5] results are problematic because the main variables of interest–individual voter signals, the probability that these signals correspond to the true state, the individual voter's threshold of reasonable doubt, and often the true state itself can be difficult if not impossible to verify. Thus, it is impossible to tell if voters are voting sincerely or strategically. In contrast, the features of the theoretical model (prior beliefs, signal reliability, etc.) can be induced in the laboratory. The laboratory environment sacrifices the rich context of a jury trial in order to test the model by controlling extraneous effects that could exist in an actual trial. Experimental methods make it possible to change the voting rule (majority or unanimity) and the voting order (simultaneous or sequential) while holding other factors constant.

2.2. Previous Experimental Tests

Two studies explored features of the Feddersen and Pesendorfer [4] model using laboratory experiments with simultaneous voting. Guarnaschelli et al. [6] explicitly tested for differences in behavior between unanimity and majority rule settings. They also tested Feddersen and Pesendorfer's unintuitive prediction that an increase in jury size will lead to an increase in convictions of the innocent under unanimity rule. They found clear evidence of strategic voting—voting to convict when seeing an innocent signal. Moreover, the increase in group size led to an increase in strategic voting, from 36% with group size three to 48% with size six. However, the increase is not as great as was theoretically predicted. Other results were less supportive of the predictions. The observed false-conviction rate of 19% for three-person unanimity groups was higher than for six-person groups, which only had a false conviction rate of 3%. Surprisingly, for groups of six, the observed incidence of incorrect convictions was lower under unanimity than under majority rule.

Ali et al. [13] extended the Guarnaschelli et al. [6] experiments by addressing the potential differences between standing committees, in which the same group makes a series of decisions, and ad hoc groups, in which a group (of either three or six subjects) makes only one decision before being rematched. Similarly to Guarnaschelli et al. [6], they found evidence of strategic voting. The results showed no evidence that the nature of the matching configuration (ad hoc or standing committees) affected voting behavior. As had been observed in the Guarnaschelli et al. [6] experiments, they found evidence of voting to convict when seeing an innocent signal. However, they also observed more correct decisions in terms of acquitting the innocent (between 0.81 and 0.99) than in terms of convicting the guilty (between 0.27 and 0.47).

Guarnaschelli et al. [6] also evaluated the impact of information on decision making. In particular, they tested the prediction of Coughlan [8] that straw polls held before the actual vote would reveal private information and decrease voters' perceptions of being pivotal under a unanimity rule. The experiments showed that roughly 90% of the subjects revealed their private signal in the straw poll, and that when the outcome of the straw poll was not a tie, subjects voted with the straw vote signal 83% of the time ([8]. Although these figures do not precisely match Coughlan's prediction that subjects will fully rely on the public straw vote signal, they give preliminary evidence that opportunities to reveal information before a vote can increase accuracy. In these cases, the prospect for a social dilemma is reduced.

Anderson et al. [15] studied simultaneous jury voting in experiments similar to those of Guarnaschelli et al. [6], but with some important changes. They used a jury size of 12, to be consistent with the typical jury size in the U.S. when the nature of the charge is serious. They also induced a higher penalty of convicting the innocent relative to the penalty of acquitting the guilty, which has the effect of raising the threshold of reasonable doubt above the level used in the Guarnaschelli et al. [6] and Ali et al. [13] studies. In line with predictions, subjects were more likely to vote to convict (around 80% of the time) when they observed a guilty signal under unanimity than under majority rule. Moreover, subjects in these settings (with large juries and a higher threshold of reasonable doubt) were much more likely to vote to convict after seeing a guilty signal than after seeing an innocent signal, regardless of the voting rule.

Anderson et al. [15] found very little evidence of strategic behavior with simultaneous jury voting. For example, under a unanimity rule, subjects who saw an innocent signal voted to convict only 19 percent of the time, compared to the theoretical mixed-strategy Nash prediction of 72 percent. Similarly, under majority rule, subjects who saw an innocent signal voted to convict 15 percent of the time, compared to the Nash prediction of 39 percent. They also found little support for Feddersen and Pesendorfer's [4] predictions regarding jury voting outcomes. There were no significant differences in the number of incorrect decisions under majority and unanimity rules. Their results show that, in contrast to the predicted tendency to convict, all of the incorrect group decisions were acquittals, and that only 2 convictions (both using majority rule) were obtained out of 120 periods of voting [15]. Altogether, the results found less evidence of strategic voting and no significant jury outcome differences across voting rules, with simultaneous voting. The authors posit that the assumption of risk neutrality could potentially be at issue. If, in fact, the subjects are risk averse, this change in assumption could alter predicted results that would be more in line with their experimental findings. (The interaction between risk aversion and voting rules (simple majority, supermajority and unanimity) has been theoretically assessed by Attanasi et al. [16] and experimentally detected by Attanasi et al. [17]. See also the literature review therein).

A number of other experiments also evaluate the Dekel and Piccione [5] predictions regarding sequential voting. Morton and Williams [9] designed experiments to model U.S. primary elections in which voters in different states might have different information about candidates. The outcomes from early voting states are revealed to those who vote later in the primary season. In addition, Morton and Williams [9] provided three options instead of two, in order to more closely match their primary election context. Their results indicate that the information gained from sequential voting yields a larger-than-predicted effect. They find evidence that, when voting is sequential, voters are better able to use information gleaned from early votes, and are thus better able to make choices that reflect their preferences. (Similar results are found by Battaglini et al. [18], who show that sequential voting aggregates information better than simultaneous voting.).

Ali et al. [13] also used sequential voting in some of their treatments. They noted intriguing differences between their simultaneous and sequential results. Similar to Morton and Williams [9], they found a potential for previous votes to have affected later voting behavior, which, they note, suggests the possibility that information cascades affected the outcomes:

> "Note that sequential voting results in a higher percentage of convictions in both the innocent and guilty states, possibly because later voters with innocent signals mimicked predecessors who voted to convict. Indeed, although we do not report it here, the data show that this is often the case." [13]

Hung and Plott [19] highlight the limits of sequential voting. They note that, after the first or second vote, this voting may not reveal private signals, but may instead reflect an information cascade, in which voters ignore their own signal and vote according to the public signal. Later, however, they state that information cascades need not perform as poorly in terms of information provision, as is frequently assumed. They remind the reader that cascades still have the potential to provide superior decision-making to individual decision-making, because the cascades involve some information aggregation [19]. Thus, they note the potential for sequential voting to have a positive impact on group decision-making. Their experimental results show that the public information provided by sequential voting seems to be of varying levels of importance for voters in different institutions. In institutions that reward voters more for conformity with the public vote, the public information gleaned from the sequential vote is weighted more heavily than in institutions with payoff incentives that are more individualistic.

Battaglini et al. [18] explore the potential for sequential voting to affect actions and accuracy when voting is costly. They compare voting decisions—to vote or abstain and correspondence of vote with private signal—in cases of high and low costs of voting and in cases of simultaneous and sequential voting. They find that sequential voting is more information-efficient than simultaneous voting for both types of costs, but only in cases in which voters' signals agreed.

Palfrey [20] summarizes the experimental literature on Condorcet jury decisions, stating that, in general, most voters vote strategically in ways that are similar to theoretical predictions. He concludes that there are strong and significant differences between voting conducted with simultaneous or sequential mechanisms, and sequential outcomes tend to be more accurate.

The conclusions of the Anderson et al. [15] paper differed from Palfrey's first observation about the predominance of strategic voting for many voters. In particular, Anderson et al. structure their payoffs to reflect Feddersen and Pesendorfer's concerns about convicting the innocent. As stated above, their game puts a higher penalty on convicting the innocent: they have a relatively higher payoff (USD 2) for the error of acquitting a guilty person, vis à vis that for convicting an innocent person (USD 0). As a result, their subjects were more likely to acquit than convict. Thus, rather than unanimity leading to conviction of the innocent, their subjects did the opposite under unanimity. Because their results differed from other simultaneous voting experiments, we extend their design to include sequential voting to compare to the existing literature in that area.

3. Experimental Design

The experiment was conducted at William & Mary, in Williamsburg, VA, USA, with undergraduate subjects who participated in 20 periods of voting. Subjects were recruited in groups of 13 for each of the 16 sessions. A monitor was randomly selected from each group, and the remaining 12 students served as the jury. Each voting period began with the monitor rolling a six-sided die behind a screen at the front of the room. If the roll of the die yielded a 1, 2, or 3, private information was drawn from a Blue Cup, which contained three blue marbles and one red marble. If the roll of the die yielded a 4, 5, or 6, draws were made from a Red Cup, which contained three red marbles and one blue marble. The Red cup represented "guilt" and the Blue cup represented "innocence." This context was not provided to subjects, and the group was not referred to as a jury. The description of the two cups was presented in a simple table in the instructions, which are presented in Appendices A and B.

The experimenter approached each subject privately, drew a marble from the cup and showed it to the subject. Then, the marble was returned to the cup, so the contents of the cup were the same for each private draw. In 6 sessions, subjects voted simultaneously, and in the remaining 10 sessions, subjects voted in a randomly determined sequence that varied for each voting round. Each of these 16 sessions had 10 periods with a unanimity voting rule and 10 periods with a majority voting rule. In half of the sessions, subjects voted under unanimity for the first 10 rounds, followed by majority rule voting. For the other half of the sessions, the first 10 rounds were majority rule voting and then unanimity voting.

In practice, there were not large differences in the percentage of subjects who voted to convict in the first 10 rounds compared to the last 10 rounds. While we find marginally significant order effects in the propensity of subjects who vote guilty after observing a guilty signal, the direction of the effect is not consistent across voting rules. In addition, we balance the treatments so that there are an equal number of unanimous (majority) rule voting periods that occur in the first and second half of the experiment. Because we balance the treatments, any potential order effects are absorbed within the average of the particular voting rule. At the end of every session, there were 2 additional periods of voting. In one of the periods, subjects faced higher payoffs than in the first 20 rounds, and in the other period, payoffs were asymmetric across subjects. The results from those 2 periods of voting are not included in this paper.

With 12 subjects per session, there were 120 subjects (12×10) who participated in both the unanimity and majority rule treatments of the 10 sequential voting sessions, and there were 72 subjects (12×6) who participated in both unanimity and majority voting rule treatments with simultaneous voting. Our discussion of simultaneous voting behavior is limited to a comparison with sequential voting. Other features of simultaneous voting data are explored in Anderson et al. [15]. Treatments were balanced across sessions in terms of which voting rule the subjects were first exposed to.

In the 10 sessions with sequential voting, the first voter in the sequence made a choice (R or B), and this vote was recorded and announced by the experimenter. Votes were requested until a group decision was made: under unanimity, voting ended after any subject selected B, or at the end of all subjects choosing R. For the remaining sessions we used a 5/6 majority voting rule rather than a simple majority. Specifically, under the 5/6 majority rule, if 10 of the 12 subjects voted R, the decision was R. Otherwise, the voting round ended after 3 subjects selected B, rendering the jury decision to be B. In the 6 sessions with simultaneous voting, there was a single vote taken in each round.

Any correct group decision resulted in earnings of USD 4 for each person. If the group decision was Blue and the Red Cup was actually used for the draws, each person in the group earned USD 2. Finally, if the group decision was Red and the Blue Cup was actually used for the draws, each person in the group earned USD 0. Note that subjects received a USD 2 payment for an incorrect acquittal but received nothing after an incorrect conviction. With this lower payoff for convicting the innocent, risk-neutral subjects who think their vote will be pivotal will only be willing to vote to convict if their perceived probability of the defendant's guilt is at least 2/3, which is referred to as the "threshold of reasonable doubt." (As noted above, this 2/3 threshold is higher than the 1/2 threshold of reasonable doubt when each type of outcome error is equally costly.) Based on these parameters, we use the Nash equilibrium predictions from Feddersen and Pesendorfer [4] to calculate the vote proportion predictions shown in Table 1 below. Note that the Nash equilibrium predictions are conditional on a subjects' private information and the voting rule, and the calculations are presented in Appendix C. As noted in the introduction, Dekel and Piccione [5] demonstrate that these predictions also are one equilibrium in a sequential voting scenario.

Table 1. Equilibrium predictions (under risk neutrality) on vote proportion for the experimental setup.

	Unanimous Voting Rule	**Majority Voting Rule**
Panel A: Individual Decisions		
Vote to Convict with guilty signal	1.00	1.00
Vote to Convict with innocent signal	0.72	0.39
Panel B: Jury Decisions		
Convict an innocent defendant	0.06	0.04
Acquit a guilty defendant	0.58	0.73

At the end of every period, the monitor announced which cup was actually used for the draws. At the end of each session, a die throw was used to determine whether subjects would be paid for the first 10 periods or for the last 10 periods of the session. Subjects earned an average of USD 33 in the sequential treatment and USD 31 in the simultaneous treatment, and each session lasted for about an hour.

4. Individual Voting Results

We begin by approaching the question of how the different voting rules affect individual voting behavior. In Table 2, we compare the mixed strategy Nash equilibrium predictions from Table 1 (assuming risk neutrality and strategic voting) to individual voting behavior. The Nash predictions are shown in the column on the left, and summary statistics for simultaneous and sequential voting are shown in the next two columns. Those columns also include the 95% confidence interval (in parentheses) around the observed vote proportions. Finally, in the far right column, we present the *p*-values for a nonparametric tests of the null hypothesis of no difference between the sequential and simultaneous voting treatments.

Table 2. Comparison of observed individual voting behavior (95% confidence interval) and mixed strategy Nash equilibrium with risk neutrality.

	Nash Equilibrium Prediction	Observed with Simultaneous Voting	Observed with Sequential Voting	Simultaneous vs. Sequential *p* Value [a]
Panel A: Unanimity Voting				
Vote to Convict ∣ guilty signal	1.00	0.78 (0.59, 0.96)	0.97 (0.93, 1.00)	0.00
Vote to Convict ∣ innocent signal	0.72	0.19 (0.02, 0.40)	0.56 (0.41, 0.72)	0.01
Panel B: 5/6 Majority Voting				
Vote to Convict ∣ guilty signal	1.00	0.80 (0.68, 0.91)	0.93 (0.87, 0.99)	0.02
Vote to Convict ∣ innocent signal	0.39	0.15 (0.03, 0.27)	0.35 (0.28, 0.41)	0.01

[a] The unit of observation for the Mann–Whitney tests is the session-level average proportion of voting guilty conditional on observing a specific signal for the 10 rounds of the session conducted with a particular voting rule (unanimity or majority). There are 6 sessions with simultaneous voting and 10 sessions with sequential voting, so there are 16 observations for simultaneous vs. sequential test in each of the 4 rows. By aggregating to the session-level, we allow for the possibility that decisions are not independent across subjects within a particular experimental session.

As noted above, Dekel and Piccione's [5] theory predicts that the sequential results will both match the equilibrium predictions and the simultaneous results (which should also match the theoretical predictions). First, note that in both the simultaneous and sequential columns, the *voting rule* (unanimity or majority) does not have much of an effect on the observed percentages of votes to convict with a guilty signal (78% for unanimity vs. 80% for majority with simultaneous voting, and 97% for unanimity vs. 93% for majority with sequential voting). These differences are not statistically significant at conventional levels. The *p*-value for the Wilcoxon test is 0.92 for simultaneous voting and 0.12 for sequential voting. Similarly, the proportion of votes to convict with an innocent signal is not significantly different across unanimity and majority rule under simultaneous voting (*p*-value = 0.46). There is a significant difference in the proportion of votes to convict with an innocent signal across unanimity and majority rule under sequential voting (*p*-value = 0.02). In contrast, the *timing of votes* (sequential or simultaneous) matters a lot, as indicated by the within-row comparisons and low *p* values in the right column of each row.

Contrary to the Dekel and Piccione [5] prediction, the right hand column of Table 2 shows that behavior is significantly different across sequential and simultaneous voting. Interestingly, sequential voting behavior is closer to the Nash prediction than simultaneous voting in every case. Relatively speaking, the largest mismatches between theory and behavior occur when subjects observe an innocent signal, with subjects being more likely to vote sincerely than predicted by the Nash, especially under the simultaneous voting rule.

Result 1. There are significant differences in individual behavior across sequential and simultaneous voting. Overall, the 95% confidence intervals around the decision proportions in Table 2 never include the Nash prediction under simultaneous voting, and we can reject the null that observed behavior is consistent with the Nash prediction. Under sequential voting, we can only reject the null that behavior is consistent with the Nash equilibrium for 1 of 4 cases (voting to convict with a guilty signal under majority rule).

A possible explanation for the divergence in sequential and simultaneous results is that, rather than ignoring previous votes as suggested by Dekel and Piccione [5], individuals might learn from votes cast previously. To explore this possibility, we consider our individual voting results in the context of an alternative sequential decision making model that does not allow for the possibility of strategic voting. The information cascade model assumption is that subjects vote in a manner that maximizes their payoff as if it is a prediction that will earn a payoff of USD 4 if it is correct and of either USD 0 or USD 2 if it is incorrect (depending on the direction of the error). In the event that information rationally inferred from previous votes outweighs one's private signal, a juror might cast a vote that is consistent with previous public votes, but inconsistent with their own private information. As noted in the introduction, this is known as an informational cascade. Assuming that a juror can infer private signals from public votes, we can calculate the probability of each state, guilty or innocent, for any combination of private signal and inferred signals. If voters myopically think of their own vote as determining the jury outcome, we can calculate expected payoffs for all combinations of inferred and observed information. (This is not a naïve assumption in every case. Under unanimity, an innocent vote determines the jury outcome. Similarly, under majority rule, an innocent vote following 2 prior innocent votes (or a guilty vote following 9 prior guilty votes) determines the jury outcome). An alternative motivation is that those early in the sequence tend to vote their signal in order to provide information that can be used by subsequent voters in the sequence, in the hopes that a more informed jury-vote outcome will tend to raise their own payoff, which depends on the jury voting outcome and the true state. In the cascade model, once a cascade starts, later voters will be influenced by early votes with inferred information that may dominate their own private signal. This can cause voters who are "following the crowd" in a cascade to vote against their signal.

For example, consider a juror who comes first in the voting sequence and observes a guilty signal. Recall that there are three red marbles in the cup corresponding to guilty and only one red marble in the cup corresponding to innocent. With each cup being equally likely ex ante to be used, each of the six marbles is equally likely to be drawn, and hence, the Bayes rule posterior of guilt given a red marble draw is $\frac{3}{4}$ since three of the four red marbles are in that cup. A juror who observes a guilty signal and votes guilty (thinking that their vote will determine the outcome) has an expected payoff of $\frac{3}{4}$ × USD 4 = USD 3. Alternatively, a juror who observes a guilty signal and votes innocent (thinking that their vote will determine the outcome) has as expected payoff of $\frac{1}{4}$ × USD 4 + $\frac{3}{4}$ × USD 2 = USD 2.50. Note that voting innocent guarantees a minimum payoff of USD 2. However, a risk-neutral juror in the first voting position will still vote guilty after observing a guilty signal if they perceive their vote as determining the outcome. Similarly, this juror will vote innocent after observing an innocent signal. In this way, the first voter's decision reveals their own private signal to all who come afterwards in the sequence.

Suppose the first juror votes guilty and the second juror observes a guilty signal. With two guilty signals (one observed and one inferred), the Bayes rule probability of the guilty state is now 9/10. The expected payoff of a guilty vote by the second juror is 9/10 × USD 4 = USD 3.60 and the expected payoff of an innocent vote is = 9/10 × USD 2 + 1/10 × USD 4 = USD 2.20. So the second juror will vote guilty after seeing a guilty signal. Now suppose the second juror instead observes an innocent signal, after witnessing one public guilty vote. With one observed innocent signal and one inferred guilty vote, the probability that the true state is guilty is $\frac{1}{2}$, since the sample is balanced. In this case, the expected payoff from a guilty vote is $\frac{1}{2}$ × USD 4 = USD 2 and the expected payoff from an innocent vote is $\frac{1}{2}$ × USD 4 + $\frac{1}{2}$ × USD 2 = USD 3, and the second juror will vote innocent. Thus, following one public guilty vote, the second juror's public vote will reveal the second person's private signal.

Now suppose the first juror votes innocent and the second juror observes an innocent signal. With two innocent signals (one observed and one inferred), the probability of the innocent state is 9/10. The expected payoff of an innocent vote by the second juror is 9/10 × USD 4 + 1/10 × USD 2 = USD 3.80 and the expected payoff of a guilty vote is = 1/10 × USD 4 = USD 0.40. So, the second juror should vote innocent after seeing an innocent signal. Alternatively, if the second juror observes a guilty signal, the signals are balanced, and the probabilities of the innocent and guilty states are equal at $\frac{1}{2}$. As noted above, in this case, a risk neutral juror will vote innocent. Thus, if the first juror in the sequence votes innocent, the second juror in the sequence will vote innocent regardless of his own private signal. This constitutes an information cascade, and the public vote does not reveal any information about the juror's private signal. Additionally, all other jurors in the sequence will also vote innocent and the group decision will be innocent. Importantly, because of the threshold of reasonable doubt, one innocent vote at the beginning of the voting sequence is enough to outweigh guilty signals observed by jurors who come later in the sequence.

While a cascade of innocent votes can begin with one public innocent vote, a cascade of guilty votes requires public guilty votes by the first two jurors in the sequence. With two public guilty votes, if the third juror in the sequence observes a guilty signal, the Bayes rule probability of the guilty state rises to 27/28. The expected payoff of a guilty vote is 27/28 × USD 4 = USD 3.86 and the expected payoff of an innocent vote is 27/28 × USD 2 + 1/28 × USD 4 = USD 2.07. Alternatively, if the third juror in the sequence observes an innocent signal, the probability of the guilty state is $\frac{3}{4}$. In this case, the expected payoff of a guilty vote is $\frac{3}{4}$ × USD 4 = USD 3 and the expected payoff of an innocent vote is $\frac{3}{4}$ × USD 2 + $\frac{1}{4}$ × USD 4 = USD 1.75. Thus, regardless of the signal observed, the third juror in the sequence will vote guilty after observing two initial guilty votes.

Table 3 shows some sample periods of decision making for the sequential voting experiment. Private signals are denoted by italicized lower-case letters. Public votes are listed under the signals and are denoted by upper-case letters. The top panel of the table shows selected decisions made under majority rule. For example, in period 10 of session 2, the first four decision makers saw guilty signals and voted guilty. The 5th and 6th decision makers in this period saw innocent signals, but followed the previous pattern of guilty votes, as did the 8th and 10th voters in this period. These votes are cascade decisions, since the votes were inconsistent with private signals but maximized expected payoffs for a prediction task based on Bayesian updating. These cascade decisions are shaded in grey in Table 3.

Table 3. Selected periods with sequential voting.

		Order in Voting Sequence													
Majority Rule		**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**	**Jury Verdict**	**True State**
Session 2 Period 10	*Private Signal*	*g*	*g*	*g*	*g*	*i*	*i*	*g*	*i*	*g*	*i*			Guilty	Guilty
	Public Vote	G	G	G	G	G	G	G	G	G	G				
Session 4 Period 2	*Private Signal*	*i*	*i*	*g*										Innocent	Innocent
	Public Vote	I	I	I											
Session 5 Period 18	*Private Signal*	*i*	*g*	*g*	*g*	*g*	*i*	*g*	*i*	*g*	*g*	*i*	*i*	Guilty	Guilty
	Public Vote	I	G	G	G	G	G	G	I	G	G	G	G		
Unanimity		**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**		
Session 3 Period 2	*Private Signal*	*g*	*g*	*i*	*g*	*i*	*i*	*g*	*g*	*g*	*g*	*i*	*i*	Guilty	Guilty
	Public Vote	G	G	G	G	G	G	G	G	G	G	G	G		
Session 4 Period 13	*Private Signal*	*g*	*g*	*i*										Innocent	Guilty
	Public Vote	G	G	I											
Session 9 Period 2	*Private Signal*	*i*	*i*	*i*	*i*	*g*	*i*	*g*	*g*	*i*	*i*	*i*	*g*	Guilty	Innocent
	Public Vote	G	G	G	G	G	G	G	G	G	G	G	G		

Note: Private signals are denoted by italicized lower-case letters. Public votes are listed under the signals and are denoted by upper-case letters in bold. Cascade decisions are shaded in grey.

Next, consider the case shown in the second row of Table 3. There was a cascade decision in the second period of session 4 when a subject observed a guilty signal but voted innocent. In the third row (18th period of session 5), a cascade could have rationally started after the first innocent signal. However, the 2nd voter in the period, voted consistent with their own guilty signal. The 8th voter in the period also voted consistent with private information but inconsistent with the previous pattern of decisions.

The bottom panel of Table 3 shows several sample periods with unanimity voting. A cascade of guilty votes formed in the 2nd period of session 3, with five subjects observing innocent signals and voting guilty. In period 13 of session 4, the 3rd voter in the sequence voted consistent with private information and inconsistent with Bayesian updating. Recall that a cascade of innocent votes is not possible with unanimity, since the period ends with the first innocent vote. Thus, that innocent vote ended the voting sequence for that period. The final example in Table 3 shows that the period started with two subjects observing innocent signals but voting guilty. These guilty votes are inconsistent with the cascade model, since the expected payoff from voting innocent is higher than for voting guilty given the observed innocent signals. These votes started a cascade of guilty decisions that resulted in a guilty verdict, when the actual state was innocent.

Overall, based on the distribution of private signals and random decision making order, cascades were possible in 39 rounds of voting under the unanimity rule and in 76 rounds under majority rule. Cascades formed 74% of the time (29 out of 39 rounds) under unanimity and 57% of the time (43 out of 76 rounds) under majority rule.

Table 4 summarizes cascade decision making at the subject level. Focusing on individual-level decisions and assuming risk neutrality, there were 105 instances under unanimity when a subject saw an innocent signal, but should have voted guilty because of an imbalance of previous guilty votes. Those subjects followed the cascade and voted against private information 87 out of 105 times (83%). Note that cascades of innocent decisions are not possible under unanimity because the voting round ends after the first innocent vote is cast. There were 137 instances under majority rule when a subject saw an innocent signal and is predicted to have voted guilty. Those subjects followed the cascade and voted against private information 87 out of 137 times (64%). In addition, there were 41 instances under majority rule when a subject saw a guilty signal and is predicted to have voted innocent. Those subjects followed the cascade only 6 out of 41 times (15%). Note that in the context of information cascades (when voting consistent with one's own signal is counter to theory), we observed the most sincere voting when subjects saw private guilty signals and majority rule was in effect.

Table 4. Subject-level cascade decisions.

			Incorrect Decisions			
	Correct Cascade Decisions		**Cascade Possible but Subject Followed Private Signal**		**Cascade Not Possible**	
Voting Rule	*i* signal, **G** vote	*g* signal, **I** vote	*i* signal, **I** vote	*g* signal, **G** vote	*i* signal, **G** vote	*g* signal, **I** vote
Unanimity	87	-	18	-	17	8
Majority Rule	87	6	50	35	16	26

Note: Private signals are denoted by italicized lower-case letters. Public votes are listed under the signals and are denoted by upper-case letters in bold.

In addition to the descriptive evidence of cascade behavior presented above, we formally analyze whether or not subjects rely on information inferred from others' votes. Table 5 presents marginal effects of probit models of the binary decision to vote guilty. In models 1 and 3, variables include the number of guilty and innocent votes observed by the subject and the private signal observed by the subject. Note the unanimity model does not include the number of innocent votes observed since the voting period ends after one innocent vote is cast. In models 2 and 4, we allow for history dependence by including indicator variables to capture incorrect jury verdicts made in the previous voting round.

Table 5. Marginal effects from probit models of the decision to vote guilty.

	Dependent Variable = 1 if Vote Is Guilty			
	Majority Rule		Unanimity	
	Model 1	Model 2	Model 3	Model 4
Private Guilty Signal Observed	0.393 *** (0.010)	0.387 *** (0.010)	0.253 *** (0.045)	0.244 *** (0.047)
Number of Guilty Votes Observed Before Voting	0.047 *** (0.004)	0.042 *** (0.005)	0.020 *** (0.006)	0.016 ** (0.007)
Number of Innocent Votes Observed Before Voting	−0.012 (0.029)	−0.018 (0.030)		
Incorrect Guilty Verdict in Previous Round		−0.143 *** (0.035)		−0.115 ** (0.052)
Incorrect Innocent Verdict in Previous Round		−0.044 (0.031)		−0.006 (0.053)
Number of Observations	661	639	341	326

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Delta-method standard errors are in parentheses. Standard errors are clustered at the session level. Period 1 decisions are not included in the Probit models since subjects who make decisions in the first period cannot observe any votes. We also estimated linear probability models for majority rule and unanimity and the results were qualitatively the same.

Contrary to the theory presented in Dekel and Piccione [5], we find that the number of guilty votes a subject sees before casting a vote is a significant factor in the decision of whether or not to vote guilty, even after controlling for the subject's private signal. This result holds regardless of the voting rule. Under majority rule, the coefficient on the number of innocent votes observed is negative, but not a significant factor in a subject's decision to vote guilty or innocent. On average, an increase of 1 guilty vote observed increases the probability a subject will vote guilty by about 5 percent under majority rule and by 2 percent under unanimity. These models also show that a subject's private information has a larger influence on their own voting behavior than information inferred from others' votes. As noted in the discussions related to Tables 2 and 4, we see evidence of sincere voters in the subject pool, which in general suggests that the Dekel and Piccione [5] equivalence result does not hold. We do not see evidence of the Nash equilibrium, under unanimity, in which all subjects acquit, regardless of signal [4].

Observing a private guilty signal increases the probability a subject will vote guilty by about 40 percent under majority rule and by 25 percent under unanimity in the Probit models. In addition to the probit regression analysis, we also run linear probability models with subject fixed effects to test whether the effect of seeing a guilty signal and the number of observed guilty votes are different across voting rules. In general, the results are consistent and close in magnitude to the marginal effects from the Probit analysis. However, the effect of observing a guilty signal under majority rule is larger in the linear probability model than in the Probit model. Specifically, observing a private guilty signal (instead of an innocent signal) is associated with a 52 percent increase in the likelihood of a subject voting guilty. For both variables (number of observed guilty votes and private guilty signal), we find a significant difference between the coefficients across voting rules (p-value of 0.000 for number of observed guilty votes and p-value of 0.001 for private guilty signal).

Notice (from models 2 and 4) that subjects are less likely to vote guilty in a period immediately following an incorrect jury conviction. Recall that this type of mistake results in a payoff of USD 0. Incorrect acquittals are not significantly correlated with a subject's propensity to vote guilty. This type of mistake results in a USD 2 payoff for all subjects, in contrast to a USD 4 payoff for either type of correct verdict, which might explain why subjects do not seem to adjust behavior in response to incorrect acquittals.

Result 2. Subjects relied on information inferred from prior votes to make decisions in sequential voting periods. Information cascades formed the majority of the time when they were possible based on the combination of signals and decision order. Further, the probit models presented in Table 5 show that a subject's likelihood of voting guilty was significantly correlated with the number of previous guilty votes observed under majority rule and unanimity.

5. Jury Voting (Group) Results

Next, we turn to the jury-level decisions, with summary statistics presented in Table 6. Notice that there were far more acquittals than convictions, regardless of the accuracy of the verdict or the voting rule. Given that a 2/3 threshold of reasonable doubt was factored into the payoff structure, an imbalance in favor of acquittals is not unexpected. There are also many more correct than incorrect verdicts overall (205 vs. 105), and the vast majority of incorrect jury verdicts are acquittals (104 vs. 11). Wilcoxon tests for order effects revealed no significant differences in the distribution of jury voting errors depending on whether or not the particular voting rule was used for the first 10 periods of the experiment or the last 10 periods. These results are available from the authors upon request. Comparing across the unanimity and majority voting rules, no obvious differences emerge. There are 100 correct jury verdicts under unanimity and 105 correct verdicts under majority rule. There are 60 incorrect jury verdicts under unanimity and 55 under majority rule. On the other hand, there are some differences between jury outcomes with sequential versus simultaneous voting. Most striking is the near complete inability of simultaneous voting juries to correctly vote to convict.

Table 6. Summary of all jury verdicts.

	Correct Jury Verdicts		**Incorrect Jury Verdicts**		**Total Jury Verdicts by Treatment**
	Acquit	**Convict**	**Acquit**	**Convict**	
Panel A: Unanimity					
Sequential Voting Outcomes	44 (44%)	17 (17%)	35 (35%)	4 (4%)	100
Simultaneous Voting Outcomes	39 (65%)	0 (0%)	21 (35%)	0 (0%)	60
Unanimity Total	83	17	56	4	
Panel B: 5/6 Majority Rule					
Sequential Voting Outcomes	39 (39%)	36 (36%)	18 (18%)	7 (7%)	100
Simultaneous Voting Outcomes	28 (47%)	2 (3%)	30 (50%)	0 (0%)	60
Majority Total	67	38	48	7	
Column Total	150	55	104	11	

As noted, Table 6 shows more errors in terms of incorrect acquittals than for incorrect convictions. It is possible that the sequential feature could play a role in these errors. In particular, the voting ends when either one person votes innocent, under unanimity, or when three people vote innocent, in the case of majority. Thus, errors, or even correct group decisions could result from the decisions of voters in the first few votes. For the unanimity treatments, 68% of the correct group decisions to acquit ended within the first vote, whereas 34% of incorrect group decisions to acquit ended in the first vote. For majority rule, 41% of the correct decisions to acquit ended within the first three votes, while only 6% of incorrect decisions to acquit ended within the first three votes.

Consistent with Palfrey's [20] observations, the sequential vote appears to increase efficiency. The total outcomes of the sequential votes were correct 65% of the time, while those of the simultaneous vote were correct 57.5% of the time. However, when these outcomes are broken down into votes using unanimity and majority, this tendency disappears. Using unanimity, the sequential vote was correct 61% of the time, while the simultaneous vote was correct 63% of the time. Using majority rule, the sequential vote was correct 75% of the time, while the simultaneous vote was correct 50% of the time. Thus, we conclude that although sequential voting has an effect on individual votes, it does not necessarily improve the outcome.

Fedderson and Pesendorfer's [4] model and Dekel and Piccione's [5] extension predict that the use of majority rule will improve jury accuracy over unanimity rule in terms of avoiding convictions of the innocent. Table 7 presents the frequency of jury decisions under the different voting rules, as well as the Nash predictions of these theoretical models. With simultaneous voting, juries never convicted an innocent defendant in either type of voting rule. With the use of the unanimous voting rule, 100% of the juries acquitted guilty defendants. With sequential voting, we can reject the null that observed jury errors are consistent with the Nash prediction under majority rule. The last column of Table 7 presents p-values from the Mann–Whitney test of whether the jury errors are consistent across simultaneous and sequential voting. Juries are more likely to convict innocent defendants with sequential voting under both unanimity and majority rule. Conversely, juries who vote sequentially make significantly fewer acquittal errors than those who vote simultaneously. The observed frequency of acquitting a guilty defendant in sequential voting using majority rule is less than half of the Nash prediction.

Table 7. Comparison of observed jury voting outcomes (95% confidence level) and mixed strategy nash equilibrium with risk neutrality.

	Nash Prediction	Observed with Simultaneous Voting	Observed with Sequential Voting	Simultaneous vs. Sequential p Value [a]
Panel A: Unanimity Voting				
Convict an Innocent Defendant	0.06	0.00 (-, -) [b]	0.11 (−0.01, 0.22)	(0.09)
Acquit a Guilty Defendant	0.58	1.00 (-, -) [b]	0.67 (0.53, 0.80)	(0.00)
Panel B: 5/6 Majority Voting				
Convict an Innocent Defendant	0.04	0.00 (-, -) [b]	0.15 (0.05, 0.24)	(0.02)
Acquit a Guilty Defendant	0.73	0.93 (0.80, 1.05)	0.31 (0.17, 0.44)	(0.00)

[a] The unit of observation for the Mann-Whitey tests is the session-level probability of convicting an innocent defendant (or acquitting a guilty defendant) with a particular voting rule. There were 10 sessions using sequential voting and 6 sessions using simultaneous voting. By using session-level data, we allow for the possibility that decisions are not independent across subjects within a particular experimental session. [b] In the simultaneous voting sessions with unanimity voting, guilty defendants were acquitted by all juries and innocent defendants were never convicted (the latter was also true for the majority voting rule). When all the juries behave the same, there is no variation and thus no confidence interval.

Result 3. There are significant differences in jury decisions across sequential and simultaneous voting. Innocent defendants were rarely convicted with sequential voting, but they were never convicted with simultaneous voting. On the other hand, juries were much less likely to acquit a guilty defendant under sequential voting than simultaneous voting.

6. Conclusions

Theoretical models of jury decision making have provided counterintuitive results given the actual framework used by juries in the United States. In addition to Feddersen and Pesendorfer's [4] theoretical result that majority rule improves jury accuracy relative to unanimous voting, Dekel and Piccione [5] conclude that whether jurors observe other juror voting does not affect the result. More precisely, given a symmetric environment, two choices, and incomplete information, they show that any equilibrium from a simultaneous game is also an equilibrium of a sequential game. Thus, they predict that subjects voting sequentially will ignore the information made available to them by the previous votes and will instead behave as would simultaneous voters, described by Feddersen and Pesendorfer's theory.

The experimental results reported in this paper indicate that subjects do not conform to the theoretical predictions, regardless of whether the subjects vote simultaneously or sequentially. This conclusion is clearly indicated by the differences between the Nash predictions on the left side of Table 2 and the observed vote proportions in the columns for simultaneous and sequential voting treatments. In addition, our experimental results reveal that subjects voting sequentially do not match the behavior of their counterparts in sessions who vote simultaneously. Our results, then, bear more similarities to those of Ali et al. [13], Morton and Williams [9] and to Guarnaschelli et al.'s [6] test of Coughlan's [8] theory. In particular, our results show that, contrary to the theoretical predictions of Deckel and Piccone [5], subjects appear to use the information available to them from private signals and from previous votes when voting sequentially, however, the outcomes from the sequential votes are not more likely to be correct than the simultaneous vote outcomes.

There are, however, some interesting implications of the individual vote proportions in Table 2. Recall that there are four rows in that table, which show proportions of guilty votes for each of the two signals for each of the two voting rules, unanimity and majority. In all four of these rows, the observed proportions of guilty votes with sequential voting are much closer to the Nash equilibrium than is the case for the vote proportions with simultaneous voting. The key to this difference is apparent from the probit regressions in Table 5, which indicate that the number of prior guilty votes in the sequence is significantly associated with the voter's own tendency to vote guilty. The ability to observe and respond to prior votes is not available with simultaneous voting. This difference does not matter in the Nash equilibrium where strategic behavior in a simultaneous voting round is based on the realization that the only thing that matters is a situation in which one's own vote is pivotal, e.g., when the $N-1$ others in the jury vote to convict under unanimity. This subtle strategic insight is not very credible in a jury voting setting in which people are focused on their own signals and do not observe others' votes, i.e., when the voting is simultaneous. In contrast, prior voting behavior is apparent with sequential voting, which is likely to be the reason that vote proportions are closer to Nash predictions in that case.

The "swing voters' curse" refers to the inability of voters to fully incorporate the realization that a vote only matters if it is pivotal, which conveys information about votes made by the $N-1$ other jurors. This curse is partly alleviated, at least with the individual vote data, by structuring votes sequentially. This comparison has an interesting implication for a different class of games, common value auctions. In that setting, the "winner's curse" is a failure to realize that one's bid only matters if it is the highest bid, which suggests that the $N-1$ other bidders received lower value signals. In laboratory experiments, human subjects who win in common value laboratory auctions tend to end up overpaying and losing money [21]. The partial alleviation of the swing voter's curse with sequential voting in the jury voting game suggests that the winner's curse might be less severe in a common value auction in which bidders can observe other bidders drop out as the clock auction price is raised sequentially. The implication is that clock auctions should be seriously considered for selling assets, such as wind energy leases, in novel locations where the common value aspect is pervasive.

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Appendix A

Instructions with Sequential Voting (with Majority Rule for Periods 1–10 and Unanimity for Periods 11–20).

Your Letter:___________

Instructions

This is an experiment in the economics of decision making. Various agencies have provided funds for the experiment. Your earnings will depend partly on your decisions and partly on chance. If you are careful and make good decisions, you may earn a considerable amount of money, which will be paid to you, in cash, at the end of the experiment today. The experiment will consist of three parts. We will throw a 6-sided die at the end of the session. If the result of the die throw is 1, 2 or 3, you will be paid $\frac{1}{2}$ of your cumulative earnings for Part I and all of your earnings for Part IIIa of the experiment. If the result of the die throw is 4, 5 or 6, you will be paid $\frac{1}{2}$ of your cumulative earnings for Part II and all of your earnings for Part IIIb of the experiment.

We will begin by reading these instructions out loud. Please follow along. If you have any questions as we are reading, raise your hand and your question will be answered for everyone.

Before beginning, we will choose one of you to assist us in the experiment today. This person, who will be called the monitor, will help us by throwing dice and drawing colored balls from a container. The monitor will also observe procedures to insure that the instructions are followed. The monitor will be paid the average of what all participants earn. We will now assign each of you a number from 1 to 13 and we will throw a 20-sided die to select the monitor.

In this experiment, you will be asked to predict from which randomly chosen cup a ball was drawn. We will begin by having the monitor roll a six-sided die behind a screen at the front of the room. If the roll of the die yields a 1, 2, or 3, we will draw from the Blue Cup, which contains three blue balls and one red ball. If the roll of the die yields a 4, 5, or 6, we will draw from the Red Cup, which contains three red balls and one blue ball. Therefore, it is equally likely that either cup will be selected. Since the monitor will roll the six-sided die behind a screen, *you will not see the result of the die throw or know which cup is being used for the draws*.

Blue Cup {tc \13 "Red Cup}	{ tc \13 "Blue Cup }	**Red Cup**
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Private Draws:

Once a cup is determined by the roll of the die, we will empty the contents of that cup into an unmarked container. (The container is always the same, regardless of which cup is being used.) Then, we will approach each of you in turn and draw a ball from the container. The result of this draw will be your private information and should not be shared with other participants. *After each draw, we will return the ball to the container before making the next* *private draw so the contents of the container are always the same when we make a private draw.* Each person will have one private draw, with the ball being replaced after each draw.

The Voting Sequence:

After each person has seen a private draw, we will begin the voting sequence. We will approach each of you in turn to ask for your vote: vote B if you think the Blue Cup was emptied into the unmarked container or R if you think the Red Cup was emptied into the unmarked container. After the first person approached has voted, we will announce their vote, **but not their private draw**. After the first person's vote has been announced, we will approach the second person, ask for their vote, and announce their vote but not their private draw. We will continue in this manner until the period ends. At the end of each period, the monitor will announce the color of the cup that was actually emptied into the unmarked container. Private draws will never be revealed.

When Does a Period End?

In every period, all members of the group will be able to see a private draw, but it is possible that the period will end before every participant has cast a vote. This is because the voting sequence will stop and the period will end as soon as a "group decision" is reached. An explanation of what constitutes a group decision follows in the next paragraph.

Your Payoff:

Your money payoff for the period depends on the cup that was actually used and the "group decision." The group decision is Red if at least 10 of the 12 people vote "R." Otherwise, if three or more people vote "B," the group decision is Blue. Therefore, these periods will end as soon as a third person votes "B" or all members have voted, whichever comes first.

Your dollar payoffs are summarized in the table below. Any correct decision earns each member of the group a USD 4 payoff. A correct group decision is one that matches the cup actually used. If the group decision is Blue and the Red Cup was actually used, each member of the group earns a USD 2 payoff. Finally, there are no money payoffs if the group decision is Red and the cup used for the draws was actually Blue.

	Cup Used Is Blue	**Cup Used Is Red**
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet:

This part of the experiment will consist of 10 periods. The results for each period will be recorded on a separate row on the decision sheet that follows. The period numbers are listed on the left side of each row. Next to the period number is a blank that should be used to record the draw (blue or red) that you see when we come to your desk. Write b (for blue) or r (for red) in column (0) at the time the draw is made. The columns labeled 1st through 12th should be used to record the votes (B or R) as they are announced. When you are asked to record your vote, you will be able to see the votes, if any, which have been made previously by other participants. Recall that private draws are never revealed to the group. Write your vote in the column (1st through 12th) that corresponds to the order in which you are approached, *and circle your vote to distinguish it from others' votes*. After you have recorded your vote, (B or R), we will announce it out loud. At the end of each period, the monitor will announce the group decision and the color of the cup that was actually used. Record the group decision (Blue or Red) in column (2) and the color of the cup actually used for the draws in column (3). Recall that if at least ten of the twelve people voted "R," and the Red Cup was actually used, then each of you earns USD 4. However, if at least ten of the twelve people voted "R" and the Blue Cup was actually used, then each of you earns nothing. If fewer than ten people vote "R," the group decision is Blue, and you each earn USD 4 if the Blue Cup was actually used or USD 2 if the Red Cup was actually used. Notice that the payoff for an incorrect group decision of Blue is higher than the payoff for an incorrect group decision of Red. You should record your earnings for the period in column (4) and keep track of your cumulative earnings for all periods in column (5).

At this time, we will draw a scrabble tile for each participant; the letter on the tile will serve as your identification during the experiment. Please write this letter in the blank indicated at the top of your decision sheet. In each period, the order in which votes are cast will be randomly determined by drawing these same scrabble tiles in sequence.

Before we begin the periods that determine your earnings, we will go through one practice period. In this practice period, the monitor will throw the die that determines which cup will be used, and you will each see a draw from that cup. However, unlike in the periods that determine your earnings, you will observe the throw of the die, your draw will not be private, and you will not be asked to vote in this practice period.

At this time the monitor will throw the die that determines which cup is to be used. Remember that the Blue Cup is used if the throw is 1, 2, or 3, and the Red Cup is used if the throw is 4, 5, or 6. Now we will come to the desk of each person and show them a private draw from the unmarked container. If this were not a practice period, this person would record the color of the ball, (b or r) in column (0). Then, we would return the ball to the unmarked container. Recall that each person will have one private draw with the ball being replaced after each draw. After each person has seen a private draw, we will draw a scrabble tile to determine who casts the first vote. The letter is ______. If this were not a practice round, the first person would then record a vote (B or R), enter it in column labeled 1st, and circle it. We would then announce the vote, and then everyone would record this vote in column (1), but would not circle it since it is not their own. We would continue to request votes and announce them until a group decision had been reached, and then the period would be over. Please do not record a vote until we draw your letter and come to your desk.

Are there any questions before we begin the periods that determine your earnings? Please do not talk with anyone during the experiment. We will insist that everyone remain silent until the end of the last period. If we observe you communicating with anyone else during the experiment we will pay you $\frac{1}{2}$ of your cumulative earnings at that point and ask you to leave without completing the experiment.

At this time, the monitor will throw the die that determines which cup is to be used. Remember that the Blue Cup is used if the throw is 1, 2, or 3, and the Red Cup is used if the throw is 4, 5, or 6. Now we will bring the container to each person's desk and draw a ball from the unmarked container. After you see a private draw, record the color of the ball (b or r) in column (0), and then we will return the ball to the unmarked container before approaching the next person.

Now we will draw a scrabble tile to determine who casts the first vote. The letter is ____. The first vote is _____. Now we will draw a scrabble tile to determine who casts the second vote. The letter is _____. The vote is _____.

Blue Cup **{tc \13 "Red Cup}**	**{ tc \13 "Blue Cup }**	**Red Cup**
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Group Decision is Red if at least 10 of the 12 people vote R. Otherwise Group Decision is Blue.

	Cup Used Is Blue	**Cup Used Is Red**
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet																	
(0)		(1)												(2)	(3)	(4)	(5)
Period	Your Draw (b or r)	Votes (B for Blue or R for Red)												Group Decision	Cup Used	Earnings	Cumulative Earnings
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th				USD
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Part II

The group decision will be determined differently for the remaining periods of the experiment. The group decision is Red if all of the 12 people vote "R." Otherwise, if one or more people vote "B," the group decision is Blue. Notice that we require a unanimous vote to make Red the group decision, but if any one person votes "B," then the group decision is Blue. Therefore, the voting will stop and the period will end as soon as any member of the group votes "B," because that vote by itself makes the group decision Blue. The contents of the cups and the payoffs will remain the same as summarized on your new Decision Sheet.

Blue Cup {tc \13 "Red Cup}	**{ tc \13 "Blue Cup }**	**Red Cup**
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Group Decision is Red if all 12 people vote R. Otherwise Group Decision is Blue.

	Cup Used Is Blue	Cup Used Is Red
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet																	
	(0)	**(1)**												**(2)**	**(3)**	**(4)**	**(5)**
Period	**Your Draw (b or r)**	**Votes (B for Blue or R for Red)**												**Group Decision**	**Cup Used**	**Earnings**	**Cumulative Earnings**
		1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**				**USD**
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Appendix B

Instructions with Simultaneous Voting (with Majority Rule for Periods 1–10 and Unanimity for Periods 11-2).

Your Letter:___________

Instructions

This is an experiment in the economics of decision-making. Various agencies have provided funds for the experiment. Your earnings will depend partly on your decisions and partly on chance. If you are careful and make good decisions, you may earn a considerable amount of money, which will be paid to you, in cash, at the end of the experiment today. The experiment will consist of three parts. We will throw a 6-sided die at the end of the session. If the result of the die throw is 1, 2 or 3, you will be paid $\frac{1}{2}$ of your cumulative earnings for Part I and all of your earnings for Part IIIa of the experiment. If the result of the die throw is 4, 5 or 6, you will be paid $\frac{1}{2}$ of your cumulative earnings for Part II and all of your earnings for Part IIIb of the experiment. In addition, you will be paid USD 6 for showing up today.

We will begin by reading these instructions out loud. Please follow along. If you have any questions as we are reading, raise your hand and your question will be answered for everyone.

Before beginning, we will choose one of you to assist us in the experiment today. This person, who will be called the monitor, will help us by throwing dice and drawing colored balls from a container. The monitor will also observe procedures to ensure that the instructions are followed. The monitor will be paid the average of what all participants earn. We will now assign each of you a number from 1 to 13 and we will throw a 20-sided die to select the monitor.

In this experiment, you will be asked to predict from which randomly chosen cup a ball was drawn. We will begin by having the monitor roll a six-sided die behind a screen at the front of the room. If the roll of the die yields a 1, 2, or 3, we will draw from the Blue Cup, which contains three blue balls and one red ball. If the roll of the die yields a 4, 5, or 6, we will draw from the Red Cup, which contains three red balls and one blue ball. Therefore, it is equally likely that either cup will be selected. Since the monitor will roll the six-sided die behind a screen, *you will not see the result of the die throw or know which cup is being used for the draws*.

Blue Cup {tc \13 "Red Cup}	{ tc \13 "Blue Cup }	Red Cup
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Private Draws:

Once a cup is determined by the roll of the die, we will empty the contents of that cup into an unmarked container. (The container is always the same, regardless of which cup is being used.) Then, we will approach each of you and draw a ball from the container. The result of this draw will be your private information and should not be shared with other participants. *After each draw, we will return the ball to the container before making the next private draw so the contents of the container are always the same when we make a private draw.* Each person will have one private draw, with the ball being replaced after each draw.

The Voting Process:

After each person has seen a private draw, we will begin the voting process. We will approach each of you to ask for your vote: vote "B" if you think the Blue Cup was emptied into the unmarked container or "R" if you think the Red Cup was emptied into the unmarked container. After everyone has voted, we will announce the total number of "R" and "B" votes and the monitor will announce the color of the cup that was actually emptied into the unmarked container.

Your Payoff:

Your money payoff for the period depends on the cup that was actually used and the "group decision." The group decision is Red if at least 10 of the 12 people vote "R." Otherwise, if three or more people vote "B," the group decision is Blue.

Your dollar payoffs are summarized in the table below. Any correct decision earns each member of the group a USD 4 payoff. A correct group decision is one that matches the cup actually used. If the group decision is Blue and the Red Cup was actually used, each member of the group earns a USD 2 payoff. Finally, there are no money payoffs if the group decision is Red and the cup used for the draws was actually Blue.

	Cup Used Is Blue	Cup Used Is Red
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet:

This part of the experiment will consist of 10 periods. The results for each period will be recorded on a separate row on the decision sheet that follows. The period numbers are listed on the left side of each row. Next to the period number is a blank that should be used to record the draw (blue or red) that you see when we come to your desk. Write b (for blue) or r (for red) in column (0) at the time the draw is made. Column 1 contains spaces to record your vote and the total number of blue and red votes, which will be announced at the end of each period. Once you see your draw, your should write your vote (B or R) in the column labeled "Your Vote." At the end of each period, the monitor will announce the group decision and the color of the cup that was actually used. Record the group decision (Blue or Red) in column (2) and the color of the cup actually used for the draws in column (3). Recall that if at least ten of the twelve people voted "R," and the Red Cup was actually used, then each of you earns USD 4. However, if at least ten of the twelve people voted "R" and the Blue Cup was actually used, then each of you earns nothing. If fewer than ten people vote "R," the group decision is Blue, and you each earn USD 4 if the Blue Cup was actually used or USD 2 if the Red Cup was actually used. Notice that the payoff for an incorrect group decision of Blue is higher than the payoff for an incorrect group decision of Red. You should record your earnings for the period in column (4) and keep track of your cumulative earnings for all periods in column (5).

Before we begin the periods that determine your earnings, we will go through one practice period. In this practice period, the monitor will throw the die that determines which cup will be used, and you will each see a draw from that cup. However, unlike in the periods that determine your earnings, you will observe the throw of the die, your draw will not be private, and you will not be asked to vote in this practice period.

At this time the monitor will throw the die that determines which cup is to be used. Remember that the Blue Cup is used if the throw is 1, 2, or 3, and the Red Cup is used if the throw is 4, 5, or 6. Now we will come to the desk of each person and show them a private draw from the unmarked container. If this were not a practice period, this person would record the color of the ball, (b or r) in column (0). Recall that each person will have one private draw with the ball being replaced after each draw. After each person has seen a private draw, each person should record a vote, B or R, in the column labeled "Your Vote." Then, we will come to each desk and tally the total number of B and R votes.

Are there any questions before we begin the periods that determine your earnings? Please do not talk with anyone during the experiment. We will insist that everyone remain silent until the end of the last period. If we observe you communicating with anyone else during the experiment we will pay you your cumulative earnings at that point and ask you to leave without completing the experiment.

At this time, the monitor will throw the die that determines which cup is to be used. Remember that the Blue Cup is used if the throw is 1, 2, or 3, and the Red Cup is used if the throw is 4, 5, or 6. Now we will bring the container to each person's desk and draw a ball from the unmarked container. After you see a private draw, record the color of the ball (b or r) in column (0), and then we will return the ball to the unmarked container before approaching the next person.

Blue Cup **{tc \13 "Red Cup}**	**{ tc \13 "Blue Cup }**	**Red Cup**
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Group Decision is Red if at least 10 of the 12 people vote R. Otherwise Group Decision is Blue.

	Cup Used Is Blue	**Cup Used Is Red**
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet								
Period	(0)		(1)		(2)	(3)	(4)	(5)
	Your Draw (b or r)	Your Vote (B or R)	Total Number of "B" Votes	Total Number of "R" Votes	Group Decision	Cup Used	Earnings	Cumulative Earnings
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Part II

The group decision will be determined differently for the remaining periods of the experiment. The group decision is Red if all of the 12 people vote "R." Otherwise, if one or more people vote "B," the group decision is Blue. Notice that we require a unanimous vote to make Red the group decision, but if any one person votes "B," then the group decision is Blue. The contents of the cups and the payoffs will remain the same as summarized on your new Decision Sheet.

Blue Cup {tc \13 "Red Cup}	{ tc \13 "Blue Cup }	Red Cup
Used if die roll is 1, 2 or 3		Used if die roll is 4, 5 or 6
Contents: 3 blue balls and 1 red ball		Contents: 3 red balls and 1 blue ball

Group Decision is Red if all 12 people vote R. Otherwise Group Decision is Blue.

	Cup Used Is Blue	Cup Used Is Red
Group Decision is Blue	Your Payoff is USD 4.	Your Payoff is USD 2.
Group Decision is Red	Your Payoff is USD 0.	Your Payoff is USD 4.

Decision Sheet								
Period	(0)		(1)		(2)	(3)	(4)	(5)
	Your Draw (b or r)	Your Vote (B or R)	Total Number of "B" Votes	Total Number of "R" Votes	Group Decision	Cup Used	Earnings	Cumulative Earnings
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Appendix C

Derivations of Nash Equilibria and Model Predictions

Our parameters:

Probability the signal matches the true state: $p = 0.75$

Threshold of reasonable doubt: $q = 0.667$

Number of jurors: $n = 12$

Number of guilty votes required to convict under majority rule: $\hat{k} = 10$

Note that while here our threshold of reasonable doubt is 0.667, and we added USD 4 to all of the payouts in the experiments, these computations remain valid.

A. Nash equilibrium probability a juror will vote guilty after observing an innocent signal under Unanimity voting.

From Feddersen and Pesendorfer [4]

$$\sigma(i) = \frac{\left(\frac{(1-q)(1-p)}{qp}\right)^{\frac{1}{n-1}} p - (1-p)}{p - \left(\frac{(1-q)(1-p)}{qp}\right)^{\frac{1}{n-1}} (1-p)}$$

$$\sigma(i) = \frac{\left(\frac{(1-2/3)(1-3/4)}{2/3*3/4}\right)^{\frac{1}{12-1}} (3/4) - (1-3/4)}{3/4 - \left(\frac{(1-2/3)(1-3/4)}{2/3*3/4}\right)^{\frac{1}{12-1}} (1-3/4)}$$

$$\sigma(i) = 0.7204$$

B. Nash equilibrium probability a juror will vote guilty after observing an innocent signal under Majority rule voting.

From Feddersen and Pesendorfer [4] Appendix B:

$$\sigma\left(i, \hat{k}\right) = \frac{p(1+f) - 1}{p - f(1-p)}$$

$$\sigma\left(i, \hat{k}\right) = \frac{0.75(1 + 0.641859) - 1}{0.75 - 0.641859(0.25)}$$

$$\sigma(i) = 0.3925$$

where f is determined by

$$f = \left(\frac{1-q}{q} \left(\frac{1-p}{p} \right)^{n-\hat{k}+1} \right)^{\frac{1}{\hat{k}-1}}$$

$$f = \left(\frac{1-0.667}{0.667} \left(\frac{1-0.75}{0.75} \right)^{12-10+1} \right)^{\frac{1}{10-1}}$$

$$f = 0.6419$$

C. Probability an innocent defendant will be convicted under Unanimity voting. From Feddersen and Pesendorfer (1998, page 26):

$$l_I(p,\ q,\ n) = \left(\frac{(2p-1)\left(\frac{(1-q)(1-p)}{qp}\right)^{\frac{1}{n-1}}}{p-(1-p)\left(\left(\frac{(1-q)(1-p)}{qp}\right)^{\frac{1}{n-1}}\right)} \right)^n$$

$$l_I(0.75,\ 0.667,\ 12) = \left(\frac{(2(0.75)-1)\left(\frac{(1-0.667)(1-0.75)}{(0.667)(0.75)}\right)^{\frac{1}{12-1}}}{0.75-(1-0.75)\left(\left(\frac{(1-0.667)(1-0.75)}{(0.667)(0.75)}\right)^{\frac{1}{12-1}}\right)} \right)^{12}$$

$$l_I(0.75,\ 0.667,\ 12) = 0.0594$$

D. Probability a guilty defendant will be acquitted under Unanimity voting. From Feddersen and Pesendorfer [4]:

$$l_G(p,\ q,\ n) = 1 - \left(\frac{(2p-1)}{p-(1-p)\left(\left(\frac{(1-q)(1-p)}{qp}\right)^{\frac{1}{n-1}}\right)} \right)^n$$

$$l_G(0.75, 0.667,\ 12) = 1 - \left(\frac{(2(0.75)-1)}{0.75-(1-0.75)\left(\left(\frac{(1-0.667)(1-0.75)}{(0.667)(0.75)}\right)^{\frac{1}{12-1}}\right)} \right)^{12}$$

$$l_G(0.75, 0.667,\ 12) = 0.5808$$

E. Probability an innocent defendant will be convicted under Majority rule voting. From Feddersen and Pesendorfer (1998, page 30):

$$l_I\left(\hat{k}\right) = \sum_{j=\hat{k}}^{n} \binom{n}{j} \left(\gamma_I\left(\hat{k}\right)\right)^j \left(1-\gamma_I\left(\hat{k}\right)\right)^{n-j}$$

where

$$\gamma_I\left(\hat{k}\right) = (1-p)\sigma\left(g,\hat{k}\right) + p\sigma\left(i,\hat{k}\right)$$

Our parameters and above give

$$\gamma_I\left(\hat{k}\right) = (1-0.75)(1) + (0.75)(0.392502)$$

$$\gamma_I\left(\hat{k}\right) = 0.5444$$

Since for us

$$\hat{k} = 10$$

$$n = 12$$

we need only find the sum

$$\sum_{j=10}^{12} \binom{n}{j} \left(\gamma_I\left(\hat{k}\right)\right)^j \left(1 - \gamma_I\left(\hat{k}\right)\right)^{n-j}$$

Thus,

$$\begin{aligned} l_I(10) = \quad & \binom{12}{10}(0.5443765)^{10}(1-0.5443765)^2 \\ & +\binom{12}{11}(0.5443765)^{11}(1-0.5443765)^1 \\ & +\binom{12}{12}(0.5443765)^{12}(1-0.5443765)^0 \end{aligned}$$

$$l_I(10) = 0.0388$$

F. Probability a guilty defendant will be acquitted under Majority rule voting. From Feddersen and Pesendorfer [4]:

$$l_G\left(\hat{k}\right) = 1 - \sum_{j=\hat{k}}^{n} \binom{n}{j} \left(\gamma_G\left(\hat{k}\right)\right)^j \left(1 - \gamma_G\left(\hat{k}\right)\right)^{n-j}$$

where

$$\gamma_G\left(\hat{k}\right) = p\sigma\left(g, \hat{k}\right) + (1-p)\sigma\left(i, \hat{k}\right)$$

Our parameters and above give

$$\gamma_G\left(\hat{k}\right) = (0.75)(1) + (1-0.75)(0.392502)$$

$$\gamma_G\left(\hat{k}\right) = 0.8481$$

Thus, we have

$$\begin{aligned} l_G(10) = \quad & 1 - \binom{12}{10}(0.8481255)^{10}(1-0.8481255)^2 \\ & -\binom{12}{11}(0.8481255)^{11}(1-0.8481255)^1 \\ & -\binom{12}{12}(0.8481255)^{12}(1-0.8481255)^0 \end{aligned}$$

$$l_G(10) = 0.7294$$

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