An Experiment on Coordination
in Multi-Candidate Elections:
The Importance of Polls and Election Histories[*]

by

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ABSTRACT

Do polls simply measure intended voter behavior or can they affect it and, thus, change election outcomes? Do candidate ballot positions or the results of previous elections affect voter behavior? We conduct several series of experimental, three-candidate elections and use the data to provide answers to these questions. In these elections, we pay subjects conditionally on election outcomes to create electorates with publicly known preferences. A majority (but less than two-thirds) of the voters are split in their preferences between two similar candidates, while a minority (but plurality) favor a third, dissimilar candidate. If all voters vote sincerely, the third candidate--a Condorcet loser-- would win the elections. We find that pre-election polls significantly reduce the frequency with which the Condorcet loser wins. Further, the winning candidate is usually the majority candidate who is listed first on the poll and election ballots. The evidence also shows that a shared history enables majority voters to coordinate on one of their favored candidates in sequences of identical elections. With polls, majority-preferred candidates often alternated as election winners.

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I. Introduction

Before voters cast their ballots in an election, they typically have access to several pieces of public information which serve to differentiate the candidates. Such information includes the results of previous elections (and, in particular, whether one candidate is incumbent), the candidates' standings in pre-election polls and the positions of the candidates on the ballot. Public information can serve to facilitate tacit coordination between groups of voters who might otherwise split their votes among several similar candidates, allowing the election of another, who is much less preferred.

In this paper we report the results from experiments designed to test the effects of election histories, polls, and ballot position on election outcomes. We look at these effects in three-candidate elections conducted under plurality voting. In each election there is a Condorcet loser (i.e., a candidate who would lose a two-way race against either of the other candidates). However, the Condorcet loser will win if voters vote sincerely (i.e., if each votes for his or her most-preferred candidate). To defeat the Condorcet loser, voters who prefer the other two candidates must coordinate their votes on one of these candidates. We examine the circumstances under which this coordination arises and the extent to which polls and election histories facilitate coordination.

To examine these questions we conduct a series of complete-information elections in which subjects know their own preferences and the aggregate preferences of the electorate over the candidates. These elections are similar to those studied by Felsenthal, Rapoport and Maoz [4], Forsythe, Myerson, Rietz and Weber [5] (hereinafter referred to as FMRW) and Rapoport, Felsenthal and Maoz [13]. In these previous studies, each subject participated in a series of identical elections as a member of one voting group with complete information about the group's preferences over election outcomes. While the information structure is similar, our work focuses on a different class of models than Felsenthal, et al. and Rapoport, et al. They effectively restrict voters of identical preference to vote as a single bloc, representing each bloc of voters by a single experimental subject with an appropriately scaled vote vector. We allow voters with identical preferences to cast independent votes. Thus, here, we choose to have classes of several voters with identically induced preferences in a setting with commonly known demographic data.

Though differing in design, all of these previous studies reported a high degree of strategic voting. Voters often voted for their second-most-preferred candidate when they believed that their most-preferred candidate was unlikely to win. All three studies supported the proposition that Condorcet losers rarely win in a sequence of repeated elections. Felsenthal, et al. and Rapoport, et al. also examined the likelihood of Condorcet winners winning elections. While there were no pure Condorcet winners in the FMRW elections, we examined the likelihood of winning for a candidate who

would win over or tie with every other candidate in two way races. Such candidates and pure Condorcet winners usually won these elections.

Here, in addition to studying the effects of election histories on outcomes, we examine the effects of polls on outcomes. There is ongoing debate about whether published poll results influence voter behavior. Previous studies have examined the extent to which poll results can lead to "bandwagon" and "underdog" effects. (For examples, see Simon [16], Baumol [2] and Brown and Zech [3].) In our study, we would expect to see such effects if poll announcements lead sets of voters to coordinate their actions. Coordination could be achieved if voters are either more likely to vote for a candidate who is ahead in a poll (a bandwagon effect) or more likely to vote for a candidate who is behind in a poll (an underdog effect).

Finally, we look at the effect of ballot position, which is popularly believed to give first-listed candidates an edge.[1] In our setting, we ask whether supporters of two similar candidates tend to poll or vote more often for the first-listed of their preferred candidates and, if so, whether their actions suffice to increase substantially the likelihood the first-listed candidate is elected.

While there has been a substantial amount of experimental research studying elections,[2] very little of it has studied the influence of polls on election outcomes. McKelvey and Ordeshook [6] and [7] studied elections in which some voters were not completely informed about the candidates' positions on issues. Hence, those voters did not know with certainty the value they placed on the election of a candidate. By conducting sequences of polls, McKelvey and Ordeshook demonstrated that poll results could disseminate information about candidates' positions from informed to uninformed voters. Plott [11] also examined (two types of) polls in experimental elections. In these elections, candidates were not completely informed about voters' preferences. The candidates used polls to collect information about voter preferences and help them choose positions. In the same experiment, polls of voters' voting intentions were also conducted. Plott found that polls helped voters coordinate in the sense that, in an effort not to "waste" their votes, some voters avoided voting for their most-preferred candidate when that candidate was doing poorly in the polls. Thus, there was a bandwagon effect which led voters to sometimes vote for less-preferred candidates with higher poll standings.

In this paper, we discuss how shared election histories and non-binding, pre-election polls affect election outcomes. To examine the effect of polls alone, we conducted two experimental sessions in which voters participated in a sequence of repeated "one-shot" elections. To do this, we randomly assigned voters to new voting groups and varied their payoffs after each election. In one

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[1]See Bain and Hecock [1] for early references to ballot position effects. As they point out in their introduction: "It is generally believed that when people are asked to choose one or more items from a series presented to them...they tend to favor the items appearing in certain positions, notably first position....But there is surprisingly little to be found on this phenomenon...in the literature of public opinion, educational testing or political science, and only a few of the references to the subject are supported by systematic research."

[2]See McKelvey and Ordeshook [8] for a recent survey of this literature.

of the sessions, no polls were conducted while, in the other, a single poll was conducted before each election. To examine the effect of election histories and the combination of election histories and polls, we re-analyze two experimental sessions from FMRW. In these sessions, each voting group participated in eight repeated elections, developing shared election histories. As in the one-shot experiment, a single poll was conducted before every election in one of these sessions while no polls were conducted in the other. In all sessions, we kept track of ballot positions in order to study ballot position effects.

When examining election outcomes, we ask whether they correspond to "voting equilibria."[3] In our three-candidate elections, there are three such equilibria: one in which all voters vote sincerely and the Condorcet loser wins and two in which voters who prefer the other two candidates successfully coordinate their votes to elect one of those candidates. We examine the extent to which election histories, polls and ballot position affect the equilibrium selection process. We find that the concept of voting equilibria is quite useful in organizing the data. Ballot position has some effect on voting when polls are not present, but has a more pronounced effect on election outcomes when polls are present. Election histories and polls each have significant effects in determining which equilibria appear to arise, on how individuals vote and on which candidates win elections.

We also test Duverger's Law,[4] which (roughly) states that, under plurality voting, only two candidates will be viable in a multi-candidate field. The intuition behind this belief is that voters will (somehow) identify two front-runners and ignore all other candidates (since a vote for a non-front-runner would be a wasted vote). Duverger's Law begs the question of how voters identify the front-runners. We find that either polls or election histories facilitate such identification. In sessions with polls, a shared history or both, we obtain strong support for Duverger's Law. However, in the session with one-shot elections and no polls, Duverger's Law fails to hold. Supporters of the two candidates who could potentially defeat the Condorcet loser do not coordinate their votes effectively and all three candidates garner significant vote totals.

Finally, we analyze individual voting behavior. We classify voter behavior as sincere, strategic (but insincere) or dominated. Sincere voting occurs whenever a voter casts a vote for his or her most-preferred candidate. To vote sincerely, a voter need not consider, or even have information about, the preference orderings or likely behavior of other voters. Alternatively, voters may use their perceptions about candidate viability when casting their votes. Such strategic behavior may result in voters voting for their most-preferred candidate, but can also lead to insincere voting which is, nevertheless, at times, optimal. Dominated behavior occurs when a voter casts a vote that could never change the election outcome in a manner that the voter finds favorable. In our experiments, a vote for one's least-preferred candidate is always dominated. As in FMRW, as well as Felsenthal, et al. [4], Plott [11] and

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[3]We use Myerson and Weber's [9] definition of proper voting equilibria.

[4]See Riker [14] and [15] and Palfrey [10] for a description of Duverger's Law.

Rapoport, et al. [13], we find that voters seldom cast dominated votes in elections (although such behavior is somewhat more common in pre-election polls). However, they often vote strategically.

In the next section, we present our experimental design and list the voting equilibria for the parameters we consider. In Section III we state our hypotheses and present our results. In the final section, we provide a summary and a discussion of these results.

II. The Experiment and Equilibria

A. Description

In this paper, we report evidence from two sessions presented in FMRW (sessions PWOPS1 and PWPS1). Procedures for those sessions are described completely in FMRW. The sessions were conducted "by hand," while the new sessions described below were run on a computer network. The procedures in the FMRW sessions were similar to those described here except where noted.

The experiment conducted for this paper consisted of two sessions, with 28 different voters in each cohort. The sessions are labeled CPSS and CPSSP (for Computerized, Plurality, Single-shot, Symmetric-payoff elections without and with Polls). We conducted the sessions at the University of Iowa, drawing subjects from a subject pool consisting of approximately 450 subjects who were recruited from the population of students attending M.B.A. and undergraduate classes in the Colleges of Business Administration and Liberal Arts.

Upon arrival, subjects were seated at computer terminals in a large classroom and given copies of the instructions for the session. (The appendix contains these instructions.) Dividers concealed each subject's screen from the view of other subjects. The instructions were read aloud and questions were answered in public in order to make all instructional information common knowledge.

Each subject was given a voter identification number and assigned to an initial voting group consisting of 14 of the 28 subjects. At all times, there were two distinct voting groups in the room. Each voting group was divided into voters of three "types," distinguished by their payoffs conditional on the winning candidate. Each group participated in one election using plurality voting. After each election, voters were randomly reassigned to new groups and new types. Voters then used new payoff schedules with randomly rearranged and relabeled rows and columns. This allowed us to observe a number of different groups in each cohort while minimizing any repeated-game effects that might carry over from one group to the next.

In each of the sessions, we conducted forty-eight elections. Each subject was therefore a member of 24 different voting groups, and participated in 24 elections. Across the two sessions, this yielded 96 elections and a total of 1344 voter responses in elections. In the second session, each group participated in a poll before each election. Thus, there were 48 polls and 672 voter responses to polls.

Each group used a payoff schedule equivalent to the "symmetric" payoff schedule given in Figure 1.[5] For each voting group, rows and columns of this payoff schedule were randomly shuffled and relabeled as discussed above.[6] Within a group, each individual payoff schedule was identical except that each voter's type was highlighted on his or her own computer screen. In this way, each voter knew his or her own payoffs, the payoffs to the other voter types in the group and the number of voters of each type. However, voters did not know the specific assignment of types to others in the room. Furthermore, the voters did not know the specific identities of others in their groups.

Insert Figure 1 about here.

The actual voter types and responses have been transformed so they match this schedule for reporting purposes. We will call the candidates corresponding to Orange and Green the "majority" candidates, and the candidate corresponding to Blue the "minority" candidate. Of the two candidates corresponding to Orange and Green in the payoff matrix, the first to appear (from left to right) in the payoff schedule and on the poll and election ballots appears as Orange for reporting purposes.[7]

Notice that, under this payoff schedule, the Blue candidate is a Condorcet loser (i.e., Blue would lose two-way races with either Orange or Green). However, if all voters vote sincerely, Blue will win plurality-voting elections. While the majority of the electorate prefers either Orange or Green to Blue, members of the majority are evenly split and must coordinate their votes in order for one of their favored candidates to win.[8]

In each election, a voter could either abstain or cast one vote for one candidate. The candidate with the most votes was declared the winner. If a tie occurred between two or more candidates, we selected the winner randomly. To do this, we placed colored balls corresponding to the names of the

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[5]Voter types are designated by their most preferred candidate here. They were designated only by number in the actual payoff tables. Payoffs were slightly higher for sessions PWPS1 and PWOPS1 because these sessions were expected to take longer.

[6]Given the structure of payoffs, subjects presumably could identify which candidate was the same as the Blue candidate in this payoff schedule and which voter type was the same as Voter Type 3 (B). However, they could not systematically track the other two candidates or voter types from one group to the next. Throughout this paper, we will refer to candidate labels from this rearrangement of the actual payoff schedules.

[7]The candidate names in PWOPS1 and PWPS1, groups D and F have been changed so that Orange corresponds to the first listed majority candidate. Because of this re-labeling, the statistics for these sessions reported in this paper differ from those reported in FMRW.

[8]We modeled this payoff structure loosely on the 1970 race for the U.S. Senate seat from New York in which an apparent Condorcet loser won. While over 60% of the votes were cast for liberal candidates, Richard L. Ottinger (Orange here) and Charles E. Goodell (Green here) split the liberal vote, allowing the conservative, James R. Buckley (Blue here), to win the election with 38.6% of the vote. Neither of the liberal candidates appeared to be a significantly stronger challenger than the other. While Ottinger was the Democratic party nominee, Goodell was the incumbent and was nominated by both the Republican and Liberal parties. Neither could muster enough support to overtake Buckley (the Conservative nominee) in pre-election straw votes and polls. We assume that our subjects were unaware of the historical-name/color correspondence, and by using color-coded candidates we avoided connotations such as those attached to "liberal" and "conservative" labels.

tied candidates in a bucket and asked one of the subjects to draw a ball from the bucket without looking. The candidate whose name was the same as the color of the selected ball was declared the winner. After each election, subjects were informed (on their screens) of the vote totals received by each candidate, the winner and their payoff from the election.

In the session with polls, the instructions informed voters that polls were non-binding. Voters were told that they could vote in the election even if they abstained from the poll, and further, that their vote need not match their poll response. Before each period's election, we asked each voter to submit a ballot for the poll. Voters could abstain by casting zero votes for all candidates or they could participate by casting one vote for one candidate. Before the election, subjects were each notified of the total number of poll-votes received by each candidate. Since no payoffs were based on poll results, no tie-breaking procedure was needed to select poll "winners."

Sessions PWPS1 and PWOPS1 differed from these sessions in that groups participated in eight elections before reassignment. The sessions were each broken into three rounds, with reassignment of subjects to voting groups and preference types between rounds. Thus, each of these sessions yielded six groups (labeled "A" through "F"), each participating in a series of eight elections.

B. Voting Equilibria

In our discussion of the experimental results, we will refer to voting equilibria which may occur in each single-period election (i.e., on the stage-game equilibria). Here, without going into detailed computations, we will discuss each equilibrium and how voters expectations and responses serve to support that equilibrium.

A voter can affect the election outcome only if two or more candidates receive vote totals which are nearly equal and exceed the vote totals of all other candidates. How the voter perceives the relative likelihood of various "close races" should play a role in ballot choice. Following Myerson and Weber [9], we assume the following: First, near-ties for the lead between two candidates are perceived to be much more likely than between three or more candidates. Second, the probability that a particular ballot moves one candidate past another is perceived to be proportional to the difference in votes cast on the ballot for the two candidates. And third, voters seek to maximize their expected utility gain from the outcome of the election. Then, if $K = \{1,2,...,k\}$ is the set of candidates, a voter who assigns utility u_i to the election of candidate i and who perceives the likelihood of a near-tie for the lead between candidates i and j to be p_{ij}, will cast the vote vector $(v_1,...,v_k)$ which maximizes:

$$\sum_{i \in K} \sum_{j \neq i} p_{ij}(u_i - u_j)(v_i - v_j) = \sum_{i \in K} v_i \sum_{j \neq i} p_{ij}(u_i - u_j). \tag{1}$$

A *voting equilibrium* is an election outcome for which there exist perceptions which simultaneously (a) justify the voter behavior leading to that outcome, (b) assign positive (although perhaps very small) near-tie probabilities to all candidate pairs and (c) are rationalized by the outcome

(in the sense that candidates receiving high vote totals are perceived to be much more likely to be involved in near-ties for victory than are candidates with low vote totals).

Plurality voting allows a maximum of one non-zero vote in each admissible vote vector. We define a vote vector as "sincere" if the vote is cast for the voter's favorite candidate. We define it as an "other strategic" vote vector if the vote is cast for the voter's second-favored, but not least-favored, candidate (i.e., a vote for Green by a type-"O" voter or a vote for Orange by a type-"G" voter). These may be optimal vote vectors if the voter perceives that his or her favorite candidate is less likely to be in contention for victory than the other majority candidate. "Dominated" vote vectors as those that cannot be justified by any set of perceptions (i.e., abstention or a vote cast for one of a voter's least-favored candidates).

Table I describes the voting equilibria that may arise from our payoffs under plurality voting. We write " $\approx$ " to represent a "close" race and " $\gg$ " to represent a "strict ranking." In the equilibrium $O \gg B \gg G$, voters perceive a near-tie between Orange and Blue to be much more likely than between any other pair of candidates (and all supporters of the majority candidates vote for Orange). Similarly, in the equilibrium $G \gg B \gg O$, voters perceive a near-tie between Green and Blue to be by far the most likely (and all majority supporters vote for Green). Finally, in the equilibrium $B \gg O \approx G$, near-ties for the lead between Orange and Blue, and between Green and Blue, are perceived to be of comparable likelihood and much more likely than a near-tie for the lead between Orange and Green (and all voters vote sincerely, with Blue emerging as the victor). Only this last equilibrium stands in violation of Duverger's Law.

Insert Table I about here.

Since there are multiple equilibria, we ask which best organizes the data, both in terms of election outcomes and individual responses. If the symmetry of the payoff schedule leads subjects to expect that neither majority candidate has a better change of beating Blue, we would expect the $B \gg O \approx G$ equilibrium to arise. Alternatively, if the position on the ballot leads subjects to expect the first-listed majority candidate to be more likely to be in contention for victory, we would expect more responses consistent with the $O \gg B \gg G$ equilibrium. That is, if first-listing plays a roll in forming subject expectations, Orange should typically receive higher vote totals than Green and should win more elections than Green. Finally, the relative poll position may focus attention on the leading majority candidate. If so, when one majority candidate leads the other in the poll, we would expect majority voters to vote for that candidate in the following election. Thus, the leading majority candidate should receive more votes and win more of the following elections than the other majority candidate.

III. Results

A. Election Summaries

In this section, we present summaries of the poll and election results and individual voter responses. In the following two sections, we analyze the impact of polls and ballot position.

Table II summarizes the polls and elections from each of the four sessions. Displayed first are the frequencies with which each candidate won polls or elections. The Orange win-frequencies indicate how often the first-listed of the majority candidates won and the Blue win-frequencies indicate how often the Condorcet loser won. The final columns measure the closeness of the races.

Insert Table II about here.

Duverger's Law, when applicable, would predict relatively small values for the average low vote total. Of the six rows of the table corresponding to election outcomes, only two (initial elections in PWOPS1 and all elections in CPSS) summarize elections preceded by neither polls nor shared election histories (i.e., elections with "no prior event"). In only these two of the six cases did third-place candidates draw an average of more than three votes (in the other four cases, the third-place candidates averaged less than two votes). Further, in only these two cases did the third-place vote totals exceed the winning margin on average.

Blue, the Condorcet loser, won at least two-thirds of the elections in the two no-prior-event cases, but no more than half of the elections in the other four cases. Each majority candidate won exactly the same number of elections in the no-prior-event cases. However, when elections were preceded *only* by polls (initial elections in PWPS1 and all elections in CPSSP), the majority candidate listed first on the ballot was roughly twice as likely to win. (In the remaining two cases, elections were preceded by shared election histories. Repeated-game effects seem to have been present in these cases. This will be discussed below in the context of Table V.)

Table III summarizes how voters of each type voted in the elections. It also shows the proportions of votes which were sincere, other strategic, or dominated, according to the definitions in Section II.B. Dominated voting behavior was quite rare. Across all 192 elections, majority voters voted for majority candidates 97.52% of the time (of 1536 responses), while minority voters voted for the minority candidate 93.23% of the time (of 1152 responses). In contrast, strategic voting was common. Majority voters cast votes for their second-favorite candidate 36.45% of the time overall. In polls (both in the PWPS1 and CPSSP cases), minority voters frequently abstained or voted for one of the majority candidates. Though such actions are labeled as "dominated," they can be interpreted as strategic attempts either to weaken the polls as coordination devices for the majority voters or to

make the minority candidate appear sufficiently non-threatening that the majority voters would not perceive the need to coordinate.

Insert Table III about here.

B. Poll and History Effects

In the sessions with one election per group (CPSS and CPSSP), the presence of polls significantly increased the likelihood of majority voters coordinating their support behind a single majority candidate. Without polls, the Condorcet loser won 87.50% of the elections while the majority candidates each won 6.25% of the elections. With polls, the Condorcet loser won only 33.33% of the elections. Differentiation between the majority candidates in a poll ranking dramatically affected the probability that the Condorcet loser would win the subsequent election. The Condorcet loser won only 16.22% (3 outright wins and 6 two-way ties) of the 37 elections that followed polls in which one majority candidate led the other, while winning 90.91% (10 outright wins) of the 11 elections that followed a tie between the majority candidates in the poll. After leading Green in the poll, Orange won 87.50% of the elections. Green won none. After leading Orange in the poll, Green won 76.92% of the elections. Orange won none.

Table IV presents χ^2 statistics testing the effect of polls on win frequencies. Majority candidates won significantly more often in the session with polls. Moreover, the relative ranking of the majority candidates in a poll significantly affected which candidate would win the election. However, at conventional levels, there were not significant differences in candidate win-frequencies between elections without polls and elections following polls in which the majority candidates were tied. In order for majority voters to successfully coordinate their actions in an election, one of the majority candidates must have been distinguished from the other by leading in the preceding poll.

Insert Table IV about here.

In both sessions with repeated elections (PWOPS1 and PWPS1), Condorcet losers won a relatively small fraction of the elections. Further, one of the majority candidates was typically a distant third, as predicted by Duverger's Law. While the majority voters usually managed to coordinate their support behind one of the majority candidates, polls significantly affected the manner in which they coordinated. Evidence for this is given in Table V.

Insert Table V about here.

In PWOPS1, majority voters tended to coordinate their support behind the majority candidate who led in the preceding election. Thus, a majority candidate who was ahead of the other in early elections tended to win the later elections, while the other majority candidate was driven out of subsequent races. Indeed, there were no groups in which both majority candidates won elections.

In elections which alternated with polls (PWPS1), majority voters tended to coordinate their support behind the leading majority candidate in the preceding poll. These results are (on a poll/election round-by-round basis) consistent with Duverger's Law. However, in the post-first-round polls, majority voters tended to cast their poll ballots for the majority candidate who was *behind* in the previous election. The polls provided an inexpensive way for supporters of the losing majority candidate in one election to "request" consideration in the next election and for the supporters of the previous winner to signal their willingness to grant such consideration. Both majority candidates won at least one election in every group but one.

In both sessions with polls (PWPS1 and CPSSP), majority voters were significantly more likely to vote for the leading majority candidate from the preceding poll. Table V gives χ^2 statistics showing how significant polls were in determining majority voter responses. Without polls, majority voters usually voted for the leading majority candidate in the previous election. With polls, majority voters usually voted for the leading majority candidate in the previous poll. When the candidates tied in the previous poll or election, the votes were relatively evenly split, with neither candidate receiving significantly more of the majority vote in any session.[9] Thus, again, the mere availability of poll results or election histories is not sufficient for coordination among the majority voters to occur. One of the majority candidates must be distinguished from the other by leading in the previous poll or election.

We construct a formal statistical test for Duverger's law effects as follows. Suppose voters randomly choose for whom to vote (i.e., vote vectors (1,0,0), (0,1,0) and (0,0,1) are equally likely for all voters). Given the number of voters, one can easily construct the cumulative density function for votes received by a single candidate in such an election. Then, in one sided tests, we ask whether voters are voting in a manner that makes the vote total for one candidate significantly smaller than we would otherwise expect. In 14 voter, 3 candidate, "random voting" elections, the probability of a single candidate receiving 0 or 1 votes is 0.027. The probability of a single candidate receiving 2 or fewer votes is 0.105. Using this density, we will reject random voting in favor of a Duverger's law type effect if a candidate receives 0 or 1 votes.

Table VI shows the periods in which we reject the null hypothesis that voters voted randomly, in favor of the alternative hypothesis that they voted in a manner that made either the Orange or Green

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[9]This is according to binomial tests of the null hypothesis that the probabilities that a majority voter will vote for Orange and Green are equal. This is valid since there were always equal numbers of "O" and "G" voters. The standardized ($\sim N(0,1)$) statistics are -0.1278 for PWOPS1 conditional on a tie in the previous election, 0.7124 for PWPS1 conditional on a tie in the previous poll, 0.2588 for PWPS1 conditional on a tie in the previous election and 1.0065 for CPSSP conditional on a tie in the previous poll. None are significant at conventional levels.

vote total small (i.e., that they voted in a manner consistent with Duverger's Law). In repeated elections without polls, we never reject random voting in favor of a Duverger's Law effect in the initial elections, but we do reject in 78.57% of the ensuing elections in a group. Each of the rejections occurred for the majority candidate who was behind in the preceding election. In repeated elections with intervening polls, we reject random voting in favor of low Orange or Green vote totals in 66.67% of the initial elections and 80.95% of the ensuing elections. Each of these rejections occurred for the majority candidate who was behind in the preceding poll.

Insert Table VI about here.

We did not observe results consistent with Duverger's Law in the single-election sessions without polls (CPSS). Neither majority candidate ever received significantly fewer votes that predicted by random voting. However, we often observed the effect in single-election sessions with polls (CPSSP). We reject random voting in favor of low Orange or Green vote totals in 60.42% of the elections overall and in 68.42% of the elections after period 5. Except when the two majority candidates were tied in the preceding poll, every rejection occurred for the majority candidate who was behind in the poll. For Duverger's Law to hold, it appears to be necessary that voters have information concerning the voting intentions of their peers. In our experiments, the information took the form of pre-election polls or a prior history of election outcomes.

C. Ballot Position Effects

Majority voters seemed able to use poll outcomes and election histories as coordinating signals. Here we ask whether, in the absence of a previous election, a candidate's position on the poll and election ballots affected the likelihood of voters voting for that candidate and the likelihood with which that candidate would win the poll or election. We will focus on the initial polls and elections in PWOPS1 and PWPS1 and on all polls and elections in CPSS and CPSSP. Recall that the majority candidate listed first in the subjects' payoff matrices (from left to right) is labeled Orange here.

Table II shows the frequencies with which each candidate won elections. The majority candidates won 2 of the initial 6 elections in PWOPS1, 1.5 of the initial polls and 3 of the initial elections in PWPS1 and 6 out of 48 elections in CPSS. (Recall, two-way ties count as 1/2 and three-way ties count as 1/3.) In these sessions there are too few observations to draw conclusions about the relative likelihood of Orange and Green winning. However, majority candidates won nearly half of the polls and two-thirds of the elections in CPSSP. The standardized binomial test statistic for the hypothesis that Orange was more likely to win the poll conditional on a majority candidate winning is 1.8640. The analogous statistic for the elections is 6.4727. Thus, the first-listed majority candidate appears slightly more likely to have won polls when the electorate shared no history. Voter reactions

amplified this effect in the following election, making the first-listed majority candidate significantly more likely to have won the elections.

Table VII gives the percentage of all majority voters who voted for Orange and Green in the polls or elections with no prior election history. It also gives binomial test statistics for the hypothesis that, conditional on voting for a majority candidate, majority voters were equally likely to vote for Orange and Green overall.[10] There were no significant differences in the initial elections in sessions PWOPS1 and PWPS1. There was also not a significant difference using all the data from CPSS. However, majority voters were more likely to vote for the first-listed majority candidate during the last 14 periods of CPSS (the last half of the session).[11] They were also slightly more likely to vote for the first-listed majority candidate in the polls in CPSSP. Again, reactions to poll outcomes amplified this effect in the following election.[12]

Insert Table VII about here.

Thus, ballot position in elections alone was not focal enough to affect the outcomes of elections. Sufficiently experienced subjects tended to vote for the first-listed majority candidate in elections not preceded by polls. However, without polls, this tendency was too weak to increase that candidate's chances of winning the election. Ballot position also gave the first-listed majority candidate only a slight edge in polls. However, majority voters then used the polls as coordinating signals. This resulted in the first-listed majority candidate leading the other majority candidate in the polls and then winning ensuing elections more than twice as often as the other majority candidate in CPSSP.

IV. Conclusions

We have reported the results of several series of three-candidate elections under plurality voting. We found that, in elections without polls or a shared history, Condorcet losers usually won elections and Duverger's Law did not apply. We found that shared election histories, polls or both helped voting groups arrive at election outcomes in which the Condorcet loser did lose. In all cases, we found a significant amount of strategic voting by (the majority of) voters who wished to see the Condorcet loser defeated. In addition, with polls or election histories that distinguished the majority candidate, voter reactions generally resulted in Duverger's Law holding.

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[10]This test is valid because there were always equal numbers of "O" and "G" voters in the electorate.

[11]While the conditional binomial statistic for CPSS was not significant when using all the data, there appeared to be an upward trend in the number of votes for the first listed majority candidate. Using the data from period 14 on and from period 15 on, the statistics are 1.8194 and 2.0684, respectively.

[12]As in CPSS, the tendency to poll and vote for the first listed majority candidate tends to increase over time.

Ballot position had some effect on voter responses, though other factors usually overwhelmed any advantage that a candidate had in an election because of ballot position. Both polls and election histories seemed to provide majority voters with clear signals, which enabled them to coordinate their actions when one of their favored candidates led the other in a preceding poll or election. With polls, but no relevant electoral history, this coordination was typically achieved by majority voters polling for the first-listed of their preferred candidates and then voting for the majority candidate which led in the poll. These results were foreshadowed by V.O. Key in his forward to Bain and Hecock [1], stating "The advantage or disadvantage from ballot position differs with the character of the circumstances in which the election occurs." Here the circumstances were the shared election histories or pre-election poll results, either of which generally served to focus majority voters' attention on one of the majority candidates more than ballot position.

The evidence that voters use polls as a coordination device is further strengthened by examining the election outcomes when the candidates preferred by the majority of voters tied in the polls. After such a tie, their constituencies were unable to successfully coordinate their actions and the Condorcet loser was frequently elected.

The impact of polls upon election outcomes is an ongoing subject of controversy. Here, we have shown that a poll can be a useful coordination device.[13] Norman Wise, former head of Gallup International, commented on this potential role of polls when responding to suggestions that polls be restricted during election campaigns in Great Britain. He stated:

> If the view of the writer is taken that information about the state of people's minds about politics is part of the information that people are entitled to have in a free society, then the advocates of restrictions of polls have a much harder task to perform in justifying this intervention. They have to show not only that the polls have an effect, but that this effect is in some way undemocratic. If, for instance, in a three-cornered fight some voters whose first choice would be Party A discover that Candidate A has no chance, but that by voting for Party B they have an opportunity of defeating Candidate C to whom they are implacably hostile, then tactical voting will have occurred. Should Candidate C lose as a consequence of this he will undoubtedly be furious. If the knowledge of this tactical voting opportunity arises as a consequence of previous election results he will have no axe to grind. But if it arises as a consequence of an opinion poll the substance of any complaint he might make must be in some sense it is more democratic for the electorate to vote in ignorance of such a tactical possibility.[14]

Indeed, the information provided by polls and election histories can influence the outcome of elections and this influence can be beneficial. One criterion by which to judge an electoral system is that a Condorcet loser (a candidate who would lose *every* two-way race) should not win. Though

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[13]In practice, some polls ask voters about their preferences over candidates, while others ask about their voting intentions. In our elections, voters knew the electorate's preferences perfectly. However, this alone was not enough information for coordination. Our polls asked specifically for voting intentions and served as very effective coordinating devices. Thus, while voters are always free to respond strategically to polls, we believe that polls asking for voting intentions provide clearer coordinating signals.

[14]From a roundtable discussion published in [12].

debatable, this criterion is compelling enough that some writers have recommended abandoning plurality voting in favor of other voting rules (such as approval voting and Borda rule) to avoid the possibility of Condorcet losers emerging victorious.[15] However, in our experiments, we have seen that means exist for achieving such a goal without abandoning plurality voting. The provision of pre-election polls or election histories provides coordination signals which help voters to defeat Condorcet losers.

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[15]References are too numerous to list here. See Riker [14] for a summary of various voting rules and why they were proposed.

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[15] Riker WH (1982) The Two Party System and Duverger's Law. American Political Science Review 76:753-756.

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Appendix: Instruction Sets

In this appendix, we give the instructions sets we used for sessions CPSS and CPSSP and sample demonstration screens and record sheets.[16] Each subject had a copy of the instructions. They were read aloud and all questions were answered before the sessions began.

INSTRUCTIONS

GENERAL

This experiment is part of a study of voting procedures. The instructions are simple and if you follow them carefully and make good decisions, you can make a considerable amount of money which will be paid to you in cash at the end of the experiment.

The experiment will consist of a series of separate decision making periods. In each period you will have the opportunity to [**Sessions with polls:** participate in a poll and then] vote in an election with three candidates. The candidates are named Orange ("O"), Green ("G") and Blue ("B"). You must vote according to the rules discussed below. The votes cast will determine the winning candidate in each election. In the next period, the process will be repeated, with the exception that the identities of some of the members in your voting group will change. Your payoff in each period will depend upon your payoff schedule for the election and on which candidate wins the election. (We will describe payoff schedules and the procedure for determining payoffs in more detail later.)

VOTING GROUPS

Initially, each participant will be assigned randomly to one of two groups of voters labeled group "A" and group "B." (When you have been assigned to a voting group, your participant identification number followed by your voting group's letter will appear at the top center of your computer screen.) In each period, two separate and totally independent elections will take place, each involving one of the two groups of voters. Your payoff will depend only on your decisions and those of the others in your group. The decisions made by the other group of voters will have no effect on your payoffs.

After each period, we will change the voting groups. When this happens, all participants will again be randomly assigned to one of two new groups. After each re-assignment, the members of the group you are in and the individual payoff schedules will generally not be the same as they were previously.

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[16]See FMRW for the instruction sets used in PWPS1 and PWOPS1.

PAYOFF RULES

In each period, the payoff you receive will be determined by which candidate wins your voting group's election. For each group you are in, a payoff schedule will automatically appear in the upper left corner of your computer screen.

There are three types of voters in each group. Voter types differ by their payoffs. The payoff schedule shows your voter type, how payoffs will be determined for your voter type, how payoffs are determined for other voter types and the number of voters of each type. As an example, suppose that you are initially assigned to a group with the payoff schedule displayed below: [Spoken, but not in individual written instruction sets: To display this sample payoff schedule on your screen, press the F1 key now.[17]]

payoff from winner			# of
O	G	B	voters
$0.15	$0.35	$0.10	6
$0.35	**$0.05**	**$0.20**	**6**
$0.10	$0.00	$0.50	4

Your payoffs are determined by those listed in the highlighted row. Thus, your payoffs will be determined by the second row of the payoff schedule. You can also see that there are 5 other voters besides yourself with the same payoffs as you. There are 6 voters with payoffs corresponding to the first row of the payoff schedule and 4 voters with payoffs corresponding to the third row of the payoff schedule.

Your payoffs each period are determined by your row in the "payoff from winner" section. You will receive the payoff listed in your row under the winning candidate. Thus, if you had this payoff schedule, you would receive the following payoffs: $0.35 if the orange candidate (O) wins; $0.05 if the green candidate (G) wins and $0.20 if the blue candidate (B) wins. Thus, you receive the "payoff from winner" listed under the winning candidate.

Remember that this is only an example and does not correspond to the actual payoff schedules used in this experiment.

VOTING RULES

Each period, when the election is held, you must decide whether to abstain (not vote for any candidate) or cast a vote in your group's election. If you do decide to vote, you must do so according to the following rule (which applies to all voters in your group):

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[17]Upon pressing the F1 key, the sample payoff table given below appeared on each subject's computer screen.

VOTING RULE: You must cast 1 vote for one candidate, and 0 votes for the others. You may abstain by casting 0 votes for all three candidates.

(This rule will also be given in the "VOTING RULE BOX" which will automatically appear on your screen.) [Spoken, but not in individual written instruction sets: To see a sample voting rule box, press the F2 key now.[18]]

Each period, before the election is held, a "BALLOT BOX" will automatically appear on your computer screen announcing the election. [Spoken, but not in individual written instruction sets: To see a sample ballot box, press the F3 key now.[19]] In the BALLOT BOX, the three candidates are listed separately. There is also a number below each candidate. At any given time, these numbers show the votes you would be casting for each candidate should you submit your ballot at that time. After all participants have been notified of the upcoming election, it will be held and you will be allowed to enter votes in the BALLOT BOX and submit your ballot.

When the election is held, a cursor will appear in your BALLOT BOX and you will be allowed to change the number of votes for each candidate on you ballot. To change the number of votes for a candidate, use the ← and → arrow keys to highlight the number below the candidate. Then use the ↑ and ↓ arrow keys to increase or decrease the number of votes you are giving to that candidate. As you change the number of votes for each candidate, the message on the right side of your BALLOT BOX will change. This message tells you whether your ballot is currently (1) valid according to the above rule, (2) not valid according to the above rule, or (3) an abstention.

Prior to submitting your ballot, make sure it is valid. If you submit an invalid ballot, you will receive a message in your BALLOT BOX stating that your ballot is invalid. You will have to change your ballot before re-submitting it. To submit your ballot, press the "Enter" key. If your ballot is valid, you will be asked to confirm your submission. If your ballot is satisfactory, press "y". If not, press "n" and you will be allowed to change the votes on your ballot.

Even if you choose to abstain, you must submit a ballot. To abstain, enter zeros (0's) under each candidate and press "Enter". Then confirm this ballot by pressing the "y" key.

[Spoken, but not in individual written instruction sets: To see how to cast votes in the ballot box, hold down the shift key and press the F10 key now. You will be allowed to increase or decrease the votes for each candidate using the arrow keys. As you do so, the message appearing on the right side of the ballot box should change telling you whether the votes in the ballot box are valid, invalid or an abstention. You can also submit and confirm valid ballots or abstentions. Invalid ballots will be rejected.[20]]

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[18]Upon pressing the F2 key, the sample voting box given below appeared on each subject's computer screen.

[19]Upon pressing the F3 key, the sample ballot box given below appeared on each subject's computer screen.

[20]Upon pressing the <shift>-F10 key, subjects were allowed to enter votes in their ballot box and submit the ballot.

After all voters have submitted ballots, the computer will total the votes for each candidate. The votes cast by one voting group will have no effect on the other group's election. For each group, the candidate with the highest number of votes in an election will be declared the winner of that election. If two or more of the candidates tie with equal (highest) vote totals, we will randomly determine a winner. Specifically, we have a tie-breaking bucket and we have three colored balls: an orange one, a green one and a blue one. Balls corresponding to the tied candidates will be put in the bucket and one of you will be asked to randomly draw a ball from the bucket. The candidate whose name is the same as the color of the selected ball will be declared the winner. After the winner of the election has been announced, the computer will determine your payoffs and notify you of the results.

[Sessions with polls:
POLLING RULES

Prior to each election, we will be conducting non-binding polls (separately for each of the two voting groups). In each poll, we will ask all participants how they would vote if the election were held at the time of the poll. Polls will be conducted according to the same voting rules as the elections.

Each period, before the poll is conducted, a BALLOT BOX will automatically appear on your computer screen announcing the poll. When the poll is conducted, you will be able to enter votes in the ballot box in the same manner as in elections. At this time, you must decide whether to participate in the poll. (You can always choose not to participate in the poll by entering 0's for all candidates.) If you do decide to participate, you should vote according to the above voting rule. In this way, the poll is a "straw" vote.

After all participants have submitted ballots in the poll, the computer will total them and you will be notified of the number of "straw" votes each candidate received in the poll for your voting group. After the polls, we will give you time to consider the results. Thus, you will know how the voters in your group responded in the poll before you are asked to vote. The poll responses of one group will have no effect on the results of the other group's poll.

When all participants are ready, we will conduct the actual election for each group. You may participate in your group's election even if you did not participate in the poll. Furthermore, in the election, you may vote in a manner that differs from what you stated in the poll.]

NOTIFICATION AND RECORDING RULES

[Sessions without polls: After each election, you will be notified of the outcome in the following manner. After the election for your voting group, a "HISTORY BOX" will appear on the right side of your screen. It gives the votes you cast and the total votes cast by your group for each candidate. You may check your recorded vote in the election by comparing it to your previous ballot (which will remain in your BALLOT BOX). The HISTORY BOX also highlights the number of votes for the winning candidate in yellow and gives your payoff for that election. After voting groups are re-

assigned, you will begin with a new HISTORY BOX. Thus, your HISTORY BOX only contains information from your current group.

You have also been given several Record Sheets that are similar to HISTORY BOXes. To have a permanent record of the information that will appear in your HISTORY BOXes, you should fill out a line in a Record Sheet for each election. First, record your ID number and group from the top center of your computer screen. Then you should record the event (election), how you voted and the outcome of the election in the spaces provided. You should also circle the vote total of the winning candidate and record your payoff for each election.]

[**Sessions with polls:** After each poll or election, you will be notified of the outcome in the following manner. After the poll for your voting group, a "HISTORY BOX" will appear on the right side of your screen. It gives the votes you cast and the total votes cast by your group for each candidate in the poll. You may check your recorded vote in the poll by comparing it to your previous ballot (which will remain in your BALLOT BOX). After the election for your voting group, the HISTORY BOX will also give the votes you cast and the total votes cast by your group for each candidate in the election. The HISTORY BOX will also highlight the number of votes for the winning candidate in yellow and give your payoff for that election. After voting groups are re-assigned, you will begin with a new HISTORY BOX. Thus, your HISTORY BOX only contains information from your current group.

You have also been given several Record Sheets that are similar to HISTORY BOXes. To have a permanent record of the information that will appear in your HISTORY BOXes, you should fill out a line in a Record Sheet for each poll or election. First, record your ID number and group from the top center of your computer screen. Then you should record the event (poll or election) how you voted and the outcome of the poll or election in the spaces provided. You should also circle the vote total of the winning candidate and record your payoff for each election.]

When the experiment is completed, the computer will sum your earnings from each election and place the total on your screen. You can confirm this number by summing your earnings recorded on your record sheets. Please place this amount on your receipt. The experimenter will pay you this amount in cash.

If you have any questions during the experiment, ask the experimenter and he or she will answer them for you. Other than these questions, you must keep silent until the experiment is completed. If you break silence while the experiment is in progress, you will be given one warning. If you break silence again, you will be asked to leave the experiment and you will forfeit your earnings.

Are there any questions?

Insert Figure 2 about here.

Insert Figure 3 about here.

Figure 1: "Symmetric" Payoff Schedule

Payoff Schedule Group: ___

Voter Type	Election Winner			Total Number of Each Type
	Orange	Green	Blue	
1 (O)	$1.20	$0.90	$0.20	4
2 (G)	$0.90	$1.20	$0.20	4
3 (B)	$0.40	$0.40	$1.40	6

Figure 2: Subject Demonstration Screen

ID: 1.Q

payoff from winner		# of
O	G	B	voters
0.15	0.35	0.10	6
0.35	0.05	0.20	6
0.10	0.00	0.50	4

→ Pressing the F1 key displayed the payoff schedule.

next event: ELECTION

```
       O    G    B
       O    O    O
```

→ Pressing the F3 key displayed the "Ballot Box".
Pressing Shift-F10 allowed subjects to enter votes in the "Ballot Box".

VOTING RULE: You must cast 1 vote for one candidate, and 0 votes for the others.

You may abstain by casting 0 votes for all three candidates.

→ Pressing the F2 key displayed the "Voting Rule Box".

Figure 3: Sample Record Sheet

Record Sheet Number 1

row	ID #/ group	event	your vote				total						your payoff
			O		G	B	O		G		B		
1													
2													
.	.	.	.	.	.	.	.	.	.	.	.	.	.
29													
30													

Table I: Three Equilibria and Consistent Individual Vote Vectors
(Vote Vectors are in the Order: Orange, Green and Blue)

Voting Rule	Voter Type	Vote Vectors Consistent with the Equilibrium:		
		O≫B≫G	G≫B≫O	B≫O≈G
Plurality Voting	O	(1,0,0)*	(0,1,0)†	(1,0,0)*
	G	(1,0,0)†	(0,1,0)*	(0,1,0)*
	B	(0,0,1)*	(0,0,1)*	(0,0,1)*

*The vote vector is sincere in that it weakly ranks the candidates the same as the voter's preferences.
†The vote vector is not sincere, but it is strategic since it is the voter's best response given the related perceptions.

Table II: Summary of Poll and Election Results

Session (Elections per Voting Group)	Events Summarized (Obs.)	Fractions of Election Won By Each Candidate*			Number of Ties for First Place		Average Winning Margin† (Std Dev)	Average Total Spread‡ (Std Dev)	Average Low Vote Total (Std Dev)
		Orange	Green	Blue	2-way	3-way			
PWOPS1 (8)	Initial Elections (6)	0.1667	0.1667	0.6667	0	0	2.3333 (0.8165)	3.1667 (0.9832)	3.3333 (0.5164)
	All Elections (48)	0.2604	0.4791	0.2604	10	0	2.0208 (1.6947)	5.8333 (2.3550)	1.4375 (1.4426)
PWPS1 (8)	Initial Polls (6)	0.0833	0.1667	0.7500	1	0	1.8333 (1.7224)	2.8333 (1.3292)	3.1667 (0.7528)
	Initial Elections (6)	0.3333	0.1667	0.5000	0	0	2.3333 (1.7512)	5.6667 (1.6330)	1.6667 (1.2111)
	All Polls (48)	0.3646	0.4583	0.1771	4	0	1.8125 (1.2489)	3.3333 (1.7300)	2.7708 (0.9280)
	All Elections (48)	0.3854	0.4167	0.1979	7	0	1.6250 (1.2138)	5.6875 (2.0017)	1.4167 (1.1639)
CPSS (1)	All Elections (48)	0.0625	0.0625	0.8750	8	0	1.3125 (0.8031)	2.9167 (1.0686)	3.1042 (0.7217)
CPSSP (1)	All Polls (48)	0.3368	0.1597	0.5035	6	2	1.4167 (0.9857)	2.6042 (1.2332)	2.8542 (0.7143)
	All Elections (48)	0.4583	0.2083	0.3333	6	0	2.1042 (1.8246)	5.9792 (2.4100)	1.3333 (1.3422)

*Total wins over number of elections. Wins are scored as follows: Outright Wins = 1, Two-Way Ties = 1/2 and Three-Way Ties = 1/3.

†The winning margin is the number of votes separating the 1st and 2nd place candidates.

‡The total spread is the number of votes separating the 1st and 3rd place candidates.

Table III: Summary of Individual Voter Responses

Session	Events Summarized	Voter Type	Obs.	Percentage of Votes Cast by Each Voter Type for Each Candidate:				Percentage of Votes Cast That Were:		
				Orange	Green	Blue	Abst.	Sincere[*]	Strategic[*]	Dominated[*]
PWOPS1	Initial Elections	O	24	62.50	25.00	12.50	0.00	62.50	25.00	12.50
		G	24	29.17	70.83	0.00	0.00	70.83	29.17	0.00
		B	36	5.56	8.33	86.11	0.00	86.11	0.00	13.89
	All Elections	O	192	43.23	50.00	6.25	0.52	43.23	50.00	6.77
		G	192	22.92	77.08	0.00	0.00	77.08	22.92	0.00
		B	288	8.33	3.82	87.50	0.35	87.50	0.00	12.50
	Initial Polls	O	24	70.83	20.83	8.33	0.00	70.83	20.83	8.33
		G	24	20.83	66.67	0.00	12.50	66.67	20.83	12.50
		B	36	2.78	2.78	91.67	2.78	91.67	0.00	8.33
PWPS1	Initial Elections	O	24	62.50	29.17	8.33	0.00	62.50	29.17	8.33
		G	24	37.50	54.17	8.33	0.00	54.17	37.50	8.33
		B	36	0.00	0.00	100.0	0.00	100.0	0.00	0.00
	All Polls	O	192	63.02	31.77	3.65	1.56	63.02	31.77	5.21
		G	192	17.19	70.31	4.17	8.33	70.31	17.19	12.50
		B	288	14.58	10.07	68.06	7.29	68.06	0.00	31.94
	All Elections	O	192	59.90	39.06	1.04	0.00	59.90	39.06	1.04
		G	192	34.38	64.58	1.04	0.00	64.58	34.38	1.04
		B	288	2.78	2.43	94.79	0.00	94.79	0.00	5.21
CPSS	All Elections	O	192	56.25	41.15	1.56	1.04	56.25	41.15	2.60
		G	192	42.71	53.65	1.56	2.08	53.65	42.71	3.64
		B	288	1.39	0.69	97.22	0.69	97.22	0.00	2.78
	All Polls	O	192	75.52	10.94	3.13	10.42	75.52	10.94	13.55
		G	192	17.71	64.58	4.69	13.02	64.58	17.71	17.71
		B	288	8.33	9.72	70.14	11.81	70.14	0.00	29.86
CPSSP	All Elections	O	192	74.48	22.92	1.56	1.04	74.48	22.92	1.60
		G	192	48.44	48.44	2.60	0.52	48.44	48.44	3.12
		B	288	4.17	1.04	93.40	1.39	93.40	0.00	6.60

[*] "Sincere" votes or poll responses.
[*] "Other Strategic" votes and corresponding poll responses.
[*] "Strategically Dominated" votes and corresponding poll responses.

Table IV: χ^2 Tests for The Effects of Polls on Election Outcomes

Test For:	Control Variables	Number of Obs.	Fractions of Elections Won By Each Candidate			χ^2-Statistic (d.o.f.) Pr($\chi^2 > \bullet$)
			Orange	Green	Blue	
Effect of Polls Overall	CPSS (No Polls)	48	6.25	6.25	87.50	29.8644 (2) 0.000
	CPSSP (Polls)	48	45.83	20.83	33.33	0.000
Effect of Orange/Green Poll Ranking (CPSSP)	Orange Leads Green	24	87.50	0.00	12.50	59.6870 (4) 0.000
	Tie	11	9.09	0.00	90.91	
	Green Leads Orange	13	0.00	76.92	23.08	0.000
No-Poll Elections versus Elections with Orange/Green Poll Ties	CPSS (No Polls)	48	6.25	6.25	87.50	0.8058 (2) 0.668
	CPSSP w/ Poll Ties	11	9.09	0.00	90.91	0.668

Table V: Votes Cast by Majority Voters Conditional on Previous Majority Candidate Rankings

Session	Previous Event	Ranking	Obs.	Percentage of Votes Cast for Each Candidate by Majority Voters				χ^2-Statistic (d.o.f.) Prob$[\chi^2 > \bullet]$
				Orange	Green	Blue	Abst	
PWOPS1	Election	Orange leads Green	88	86.36	13.64	0.00	0.00	180.3206
		Tie	64	46.88	48.44	4.69	0.00	(6)
		Green leads Orange	232	9.05	86.64	3.88	0.43	0.000
PWPS1	Poll	Orange leads Green	154	76.62	23.38	0.00	0.00	109.1454
		Tie	34	52.94	41.18	5.88	0.00	(4)
		Green leads Orange	196	22.96	76.02	1.02	0.00	0.000
PWPS1	Election	Orange leads Green	136	36.76	63.24	0.00	0.00	30.4503
		Tie	64	48.44	45.31	6.25	0.00	(4)
		Green leads Orange	184	54.35	45.65	0.00	0.00	0.000
CPSSP	Poll	Orange leads Green	192	90.63	8.33	1.04	0.00	181.2926
		Tie	88	51.14	40.91	6.82	1.14	(6)
		Green leads Orange	104	16.35	81.73	0.00	1.92	0.000

Table VI: Elections in Which We Reject the Hypothesis that Voters Voted Randomly in Favor of the Hypothesis that Voters Tend to Vote in a Manner that Made either the Orange or Green Candidate's Vote Total Small (Non-Viable)

Voting Group	Non-Viable Candidate	Periods in Which the Hypothesis is Rejected			
		PWOPS1	PWPS1	CPSS	CPSSP
A	Orange	2-8	2,6,7	None	1,7,15,17,23
	Green	None	3,4	None	2,6,8,9,10,13,16,20,22,24,
B	Orange	2	1	None	12,21,22
	Green	5-8	2,4,7,8	None	3,7,8,10,11,14,16,17,18,20,24
C	Orange	2-8	1,3,5,7	-	-
	Green	None	2,4,6,8		
D	Orange	2-8	5,6,8	-	-
	Green	None	1,3,7		
E	Orange	3,4,7,8	1,3,4,6-8	-	-
	Green	None	5		
F	Orange	None	3,5,7	-	-
	Green	3-5	2,4,6,8		

Table VII: Votes Cast by Majority Voters

Session	Events Summarized	Obs.	Percentage of Votes Cast for Each Candidate by Majority Voters				Conditional Binomial Test Stat* (# of Obs.)
			Orange	Green	Blue	Abst	
PWOPS1	Initial Elections	48	45.83	47.92	6.25	0.00	-0.1496 (45)
	Initial Polls	48	45.83	43.75	4.17	6.25	0.1523 (43)
PWPS1	Initial Elections	48	50.00	41.67	8.33	0.00	0.6053 (44)
CPSS	Elections	384	49.48	47.40	1.56	1.56	0.4142 (372)
CPSSP	Polls	384	46.61	37.76	3.91	11.72	1.8985# (324)
	Elections	384	61.46	35.68	2.08	0.78	5.3163† (373)

*Tests the hypothesis that the probability of voting for Orange conditional on voting for a majority candidate is 0.5.
#Significant at the 10% and 5% levels in two and one sided tests, respectively.
†Significant at the 5% and 2.5% levels in two and one sided tests, respectively.