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Information, Individual Errors, and Collective Performance: Empirical Evidence on the Condorcet Jury Theorem

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Abstract.

The Condorcet Jury Theorem implies that the collective performance of a group, in arriving at a "correct" judgment on the basis of majority or plurality rule, will be superior to the average performance of individual members of the group, if certain apparently plausible conditions hold. Variants of the Jury Theorem are reviewed, particularly including the politically relevant variant that allows for conflicting interests within the group. We then examine two kinds of empirical data. First, we compare individual and collective performance in a large number of multiple-choice tests, and we find that collective performance invariably and substantially exceeds average individual performance. Second, we analyze American National Election Study data to create dichotomous-choice tests concerning positions of candidates on a variety of political issues; Condorcet-like effects are again evident. Finally, continuing to use NES data, we construct, on each political issue, a simulated referendum (direct voting on the issue) and election (indirect voting on the issue by voting for candidates on the basis of their perceived positions on the issue), and we compare the two results. Despite high rates of individual error, electoral error is quite small, and collective performance is fairly high, providing evidence of Condorcet-like effects in situations of conflicting preferences.

Key Words: information, individual errors, collective performance, majority rule, Condorcet Jury Theorem

1. Information and the political process

One of the most persistent descriptive themes in voting studies over the last four decades or so has been that individual voters are poorly informed and generally fail abysmally to meet, or even to approach, the requirements of citizenship postulated by the "classical doctrine" of democracy (in the sense of Schumpeter 1942). At the same time, sophisticated observers of politics might be hard put to name a single recent national election in which the vote division plausibly would have been substantially different, even if all voters had in fact made more complete use of the information potentially available to them. To quote V.O. Key, Jr. (1966, p. 7):

> To be sure, many individual voters act in odd ways indeed; yet in the large the electorate behaves about as rationally and responsibly as we should expect, given the clarity of the alternatives presented to it and the character of the information available to it.

This discrepancy between inferior performance by individual voters and apparently superior performance by the electorate collectively has been asserted by others as well (e.g., Berelson et al. 1954, p. 312; Page and Shapiro 1992). However, if the contrast between individual and collective political performance has been fairly frequently noted, the precise mechanisms that produce it were at one time less well understood.

In recent decades, however, social scientists have developed a clearer understanding of both why individual voters are typically poorly informed and why electorates may nevertheless collectively perform rather well.

While voter ignorance is often condemned or, in any case, attributed to individual irrationality, typically low levels of voter information can actually be attributed to voter rationality, not irrationality, according to the argument originally set out by Anthony Downs (1957).

First, information is in some measure *costly* to obtain (beyond some minimal amount that may be freely available in any individual's environment) and to process. In addition, information is typically subject to *diminishing marginal returns* (and perhaps increasing marginal costs as well). It therefore almost never pays even an *individual* decision maker to become fully informed, because marginal information costs exceed marginal information returns at some point well short of complete information.

Second, for a participant in a *collective* decision making process, such as a voter in an election, the incentive to acquire information is far more attenuated. Making the correct decision now becomes a public good, while information is still purchased individually, so information gathering presents a collective action problem of the familiar sort and one that is more severe the larger the group. Whatever the individual's incentive to acquire information before, it must now be discounted by the probability that his vote will be pivotal, and this probability becomes exceedingly small as group size increases. Thus, everyone in the decision-making group rationally chooses to remain largely uninformed. This phenomenon, which has been dubbed *rational ignorance*, must be taken as a fundamental characteristic of mass elections and of mass politics generally.

There are, however, at least two positive twists to the story of rational ignorance:

1. *A little information can go a long way—quite poorly informed individuals often make correct choices.* This is most evident in the kind of dichotomous choice presented in typical two-candidate or two-party elections or in yes/no referenda. An individual who has acquired just a few bits of information is very far from completely informed and could improve his probability of choosing correctly by acquiring additional information, *but he is already quite likely to choose correctly.* (This observation is just the converse of the observation that information is subject to diminishing marginal returns—the first few bits are worth a great deal.) Theoretical and experimental research by McKelvey and Ordeshook (1985, 1986, 1990) particularly supports this argument.
2. *A group choice (based on majority or plurality rule) can be correct, even if many individuals in the group make errors.* While individual members of a collective decision-making group have very little incentive to acquire information, if members do acquire some information and cast their votes independently, then—even though many individuals will vote "incorrectly"—it is very likely that the voting outcome will be "correct." This second positive twist is a consequence of the Jury Theorem of Condorcet (see Black 1958, pp. 159–180; Grofman 1975, 1978; Grofman, Owen, and Feld 1981; Grofman and Feld 1988), and it is the focus of the present essay.

2. Condorcet Jury Theorem variants

There are a number of variants of the Condorcet Jury Theorem, which we informally review here:

1. The *"all gray" model.* Suppose that each individual in a decision-making group has a given level of "competence," i.e., a given probability p of making a correct choice in a dichotomous choice situation. We may think of this level of competence as determined in part by his level of information. In the "all gray" model, p is the same for all members of the group (and is less than 1). It follows that the *proportion* of the group that can be expected to choose correctly is p. The basic Condorcet Jury Theorem says this: assuming only that individuals are at least minimally competent, i.e., that p exceeds ½ (e.g., that each has an information sample of at least one bit) and that they choose independently of one another (e.g., their 1-bit samples are independently selected): (1) the *probability P* that the *group*, deciding on the basis of majority rule, makes the correct decision (i.e., the group's collective *competence*) is greater than p, the level of individual competence; and (2) P increases as the *size* of the group increases and quite rapidly approaches perfection.

2. The *"shades of gray" model.* In an embellished and more interesting version of the theorem, each individual i has a distinct level of competence p_i (perhaps reflecting a distinct level of information), where each p_i exceeds ½. It follows that the proportion of the group that can be expected to choose correctly is $\bar{p}$, (the mean of the individual p_i's). The embellished Jury Theorem states that: (1) the group, deciding on the basis of majority rule, is more competent than the average member and, quite possibly, more competent than the most competent individual; and (2) collective competence P again increases with the size of the group (so that adding members to the group may increase group competence even as it reduces average individual competence) and quite rapidly approaches perfection.[1]

3. The *"black and white" model.* In this variant, a certain fraction F of the group is sufficiently informed to always choose correctly ($p = 1$), while the remaining fraction $1 - F$ of the group is completely uninformed ($p = ½$). The proportion of the population expected to choose correctly is therefore $F + ½(1 - F) = ½(1 + F)$, which exceeds ½ for any $F > 0$. It turns out that the collective competence P of a "black and white" group of a given size is no lower than that of an "all gray" group of similar size with $p = ½(1 + F)$; in fact, the collective competence of the "black and white" group is at least slightly higher.[2]

4. The *multichotomous model.* Condorcet Jury Theorem variants have most commonly been applied to dichotomous choice situations (like true/false tests). But the basic setup—most obviously the "black and white" variant—can pretty readily be extended to multichotomous choice situations (like multiple-choice tests). In a dichotomous choice situation, the $(1 - F)$ fraction of voters can be expected to split their choices equally between the two choices, one "correct" and the other "incorrect." In a multichotomous choice

situation, the $(1 - F)$ fraction of voters can be expected to distribute their choices uniformly over all m options, one "correct" and $m - 1$ "incorrect." Each incorrect option gets about $(1 - F)/m$ choices, while the correct option gets about $F + (1 - F)/m$ choices. In the probabilistic version, an individual has a probability $p > 1/m$ of choosing the correct option and is equally likely to choose any incorrect option. In either event, if Condorcet-like assumptions hold, we would expect to see a more or less uniform distribution over the multiple options with an additional frequency mass (whose magnitude depends on p, $\bar{p}$, or F) plumped on the correct answer. Regular or substantial deviations from this pattern of choices would indicate that Condorcet-like conditions do not hold.

5. *Statistical interdependence.* Standard Condorcet Jury Theorem variants assume that individual choices are statistically independent. In effect, it is assumed that group members do not deliberate together or otherwise influence one another. In many contexts (indeed, in the jury context), this is not reasonable. Deliberation and mutual influence can be thought of as having two effects: first, they increase average individual competence $\bar{p}$; second, they reduce the "effective number" of group members. The first effect increases collective competence, while the second reduces it, so the net effect is difficult to predict. While the problem presents difficult modeling problems, significant progress has been made (see Shapley and Grofman 1983; Owen et al. 1989; Ladha 1992, 1993; Berg 1993, 1994). In the empirical circumstances considered in the present article, however, group deliberation is prohibited or infeasible.

6. *Subminimal individual competence.* All the optimistic implications of Condorcet Jury Theorem variants are critically dependent on the assumption that each p_i exceeds ½ (in a dichotomous choice situation) or $1/m$ (in a multichotomous situation), which is considered minimal competence. If typical individual competence falls below this level, the Condorcet Jury Theorem gets stood on its head: collective competence falls below average individual competence and diminishes as group size increases. The assumption of at least minimal competence in effect requires that there are no systematically misleading cues in the environment that will make individuals consistently more likely to choose incorrectly than correctly and, in a multichotomous choice situation, more likely to choose one incorrect option than another.

7. *The political or conflicting interests model.* It may be objected (see Black 1958, p. 163) that all Condorcet Jury Theorem variants are irrelevant to the case of voting in a *political* context, because political choice involves the aggregation or reconciliation of conflicting preferences, values, judgments, or interests, with the result that neither individual choices nor collective outcomes can be characterized as "correct" or "incorrect."

I previously proposed a generalization of the Jury Theorem that can be applied to political choices in which individual interests conflict (Miller 1986a). In essence, we need only to admit that a choice that is "correct" for one individual may be "incorrect" for another. In any dichotomous political choice situation, such as a referendum or two-party or two-candidate election, voters can be divided into two groups: those whose "true" interests lie in one direction and those whose "true" interests lie in the other direction. Let $M > ½$

be the fraction of voters in the larger of the two sets; we call the candidate, party, platform, etc., that serves their "true" interests the *majority position*.

In this context, a voter's "true" interest (or "correct judgment") is to be thought of as the preference that he would have *in the event that he were completely informed*. And the competence of an individual voter is now the probability that he votes for the position, party, or candidate that best serves his true interest (and for which he would certainly vote in the event that he were completely informed). Because of the arguments concerning rational ignorance (and for all the reasons identified in the empirical literature on public opinion and voting behavior), this probability likely falls far below certainty. Finally, we may say that the electoral outcome is "correct" when the interests of the majority prevail—put otherwise, when the victorious position, party, or candidate is the one that would win in the event that all voters were completely informed, i.e., the majority position.

The Jury Theorem can be generalized (Miller 1986a) to say that, if all voters are equally competent, whatever that level of competence (greater than ½), or, more generally, if the two groups of voters (divided in terms of their true interests) have the same average competence, then majority interests will probably prevail, and—once the electorate achieves some minimum size (varying inversely with M)—this probability is greater than the average competence of individual voters, increases further as the size of the electorate further increases, and then (at a rate that increases with M) approaches perfection. Moreover, the same conclusion may be reached if the two groups are of unequal average competence, provided that the size of the majority group exceeds the size of the minority group by a ratio greater than the ratio of average minority competence less ½ to average majority competence less ½.

We may observe that the original Jury Theorem is a special case of the theorem generalized in this fashion. In the general case, $\frac{1}{2} < M \leq 1$ (so there may be two groups with conflicting interests); in the special case, $M = 1$ (so all individuals must have identical interests). As M falls below 1, two things happen.

First, the more closely M approaches ½, the more closely individual errors tend to balance out (as some members of the majority group mistakenly support the minority position and vice versa), so *expected electoral error*—i.e., the difference that may be expected between true support (in the absence of individual errors) for the majority position (i.e., M) and realized support (given a uniform $p < 1$) for that position (i.e., $p \times M + (1 - p)(1 - M)$)—diminishes. Expected electoral error is $1 - p$ if $M = 1$, and it approaches zero as M approaches ½. However, so long as M exceeds ½ (and p is uniform), the balancing out of individual errors is less than total, and expected electoral error never disappears entirely. Specifically, there is an *attenuation effect*, in that expected support for the majority position, while greater than ½, is always less than its "deserved" margin of M.

Second, as M approaches ½, the probability that the majority position will prevail also diminishes. Even though expected electoral error is small, when the majority position's true support barely exceeds ½, even a small electoral error can reverse the electoral outcome. While the attenuation effect by itself can never reverse electoral outcomes, such a reversal can result from either of two factors. First, the p_i's may not be uniform, and, in particular, members of the minority may be on average better informed and therefore more competent than members of the majority. If the magnitude of this *information bias* is sufficiently large, the minority position can be expected to win. Second, even if the p_i's are such that the majority position can be expected to win, random fluctuation in individual votes can reverse the outcome, especially if the majority position's expected support barely exceeds ½. Of course, it is just such random fluctuations that produce the probabilistic results of the Condorcet Jury Theorem and that become relatively less important as group size increases.

Thus, what the argument going back to Downs concerning the acquisition of political information has generally overlooked is that the apparent bad consequences for democracy and the electoral process resulting from rational ignorance are at least mitigated and perhaps reversed by the "statistical" mechanism identified by the Condorcet Jury Theorem and its extensions. Moreover, the same factor—the large size of electorates that discourages voters from investing in political information—also reduces the need for individual voters to be well informed. Of course, this optimistic conclusion cannot be sustained if there are substantial inequalities (of a particular sort) in the distribution of political information. But it is worth reemphasizing that it is fundamentally the factor of *inequalities or biases in the distribution of information*, and *not generally low levels of information*, that may undermine the collective performance of an electorate.

These relatively optimistic theoretical conclusions rest, of course, on a number of assumptions, and it is not clear to what extent these assumptions are at least approximately realized under what actual circumstances. In the remaining sections of this essay, we look for empirical evidence of Condorcet-like effects.

3. Plurality rule in multiple-choice tests

I first examine data that I had very readily at hand. Over the past 20 years or so, I have administered 127 multiple-choice tests in undergraduate classes. Each student on each test received a score equal to the number of questions answered correctly, divided by the total number of questions, and for each test there is a mean individual score. Over all tests, such *mean individual performance* was generally in the range of about .59–.65; the mean of such means was .617 (SD = .059). For each test, there was also a best individual score; over all tests, the mean best individual performance was .921 (SD = .058).

I reviewed each test and, in effect, did the following. I generated one additional multiple-choice answer sheet for a fictitious test-taker *C*, representing the collective group of students taking each test. *C*'s answer to each question was determined by the *modal* or *plurality* answer given by all students who took the test. *C*'s answer sheet was then checked against the answer key and received a score representing *collective performance* in the same manner as was done for each individual student, except that, when two answers, one of which was correct, were tied in the modal position, *C* got half credit.

It is clear that Condorcet-like conditions did not always underlie student choice behavior. There was no consistent tendency for responses to be even approximately uniformly distributed over wrong options. Clearly, some questions were "tricky" and included an appealing but incorrect option, which attracted a very disproportionate share of responses. Moreover, questions were often repeated in identical or only slightly modified form from semester to semester, and the same distinctive clustering of responses appeared each time. Thus, the assumption of better than minimal individual competence certainly did not hold for every question.

Nevertheless overall Condorcet-like effects are very evident and of considerable magnitude. *In every one of the 127 tests, collective performance substantially exceeded mean individual performance*. The mean collective score was .866, giving an average improvement of collective performance over mean individual performance of .249. On the other hand, mean collective performance fell somewhat short of the mean best individual performance of .921. Typically, the Condorcet effect jumped *C* from the middle of the class to the top ranks of the class but usually not to the very top. *C* ranked uniquely in first place 15% of the time, tied for first place an additional 13% of the time, and at least tied for second place 47% of the time. *C*'s median ranking was third place, and *C* ranked seventh or lower less than 10% of the time. The mean of all *standardized collective scores* was +1.64; since individual scores tend to be normally distributed, we can say that typically *C* stood at about the 95th percentile overall.

4. Political information in the electorate

We now turn to examine political and electoral data more directly relevant to the motivating concerns of this article. In the two remaining sections, we examine American National Election Study (NES) survey data from 1984 and 1988.[3] In this section, I create what are in effect dichotomous-choice tests for representative populations in the electorate concerning the positions of presidential candidates on a variety of political issues, and I examine these data somewhat as I examined the student test data in the previous section.[4]

I focus on questions of perceptual judgment that can, with reasonable objectivity, be scored as "correct" or "incorrect." These questions deal in particular with the (relative) positions of candidates on issues or on the ideological spectrum. For example, in 1984, NES respondents were asked:

> We hear a lot of talk these days about liberals and conservatives. Here is a seven-point scale on which the political views that people might hold are arranged from extremely liberal to extermely conservative.
>
> Where would you place yourself on this scale, or haven't you thought much about this?
>
> [*Asked only of people who are willing to place themselves on the scale, at least in response to a follow-up probe*] Where would you place Ronald Reagan on this scale? Walter Mondale? The Democratic Party? The Republican Party?

Here is the distribution of responses to the latter set of questions:

	Reagan	Mondale	Democrats	Republicans
Liberal	10.2%	27.5%	29.6%	8.2%
Slightly liberal	7.6%	18.0%	18.4%	7.8%
Moderate	8.8%	17.9%	14.8%	10.6%
Slightly conservative	12.2%	8.9%	8.3%	17.2%
Conservative	44.9%	9.9%	10.0%	37.5%
DK/NA	16.3%	17.9%	18.8%	18.6%
	100.0%	100.0%	100.0%	100.0%

While these distributions suggest a fair amount of ideological confusion at the individual level, respondents appear to be preponderantly correct in their judgments. We need to refine this assessment, however. For example, a respondent who was himself a *really extreme* conservative might put Reagan in the center or even on the liberal side of the scale, and would thus appear in the frequency distribution above to be making an inaccurate judgment. However, such a respondent would at the same time presumably view Mondale as being even further on the liberal side, so that his *relative* judgment would be quite accurate. Thus, what we will do is combine each respondent's judgments on the placement of the pairs of candidates into a single measure indicating which candidate is judged to be more liberal (in this case), or which candidate is judged to be closer to a given issue position (in other cases). For the liberal/conservative candidate question in 1984, we get the following results:

More Liberal Candidate?		*n*	%	*n*	%	Adj %	*n*	%
Correct	Mondale	1107	55.7%	1107	55.7%	77.8%	1390	69.9%
In error	Reagan	316	15.9%	316	15.9%	22.2%	599	30.1%
	No difference	182	9.2%	1423		100.0%		
	DK/NA	384	19.3%	566	28.5%			
		1989	100.0%	1989	100.0%		1989	100.0%

The first pair of columns shows the overall distribution of respondents. Of all 1989 respondents, 1107 (55.7%) are scored, by their response to the two separate questions on each candidate, as "correct" by giving responses that imply that Mondale is more liberal; the remaining respondents are in one way or other in error. Of the latter 316 (15.9%) are flatly "incorrect," giving responses that imply that Reagan is more liberal; 182 (9.2%) are less flatly wrong, giving responses that imply that Reagan and Mondale occupy the same ideological position; and 384 (19.3%) are simply unable or unwilling to answer one or both questions or, more likely, the preceding question on their own ideological position (e.g., they "haven't thought much about this").

We can rearrange this distribution in various ways to highlight different interpretations that can be linked with our earlier theoretical discussion. The second pair of columns combines erroneous respondents in the No Difference (ND) and DK/NA categories. For some purposes, it is useful to put these respondents to one side and look only at the others, who express definite "correct" or "incorrect" judgments. We can use the difference in frequency between "correct" and "incorrect" responses as a measure of how well informed a group is. In terms of the "black and white" model, this difference provides an estimate of the fraction F of the group that is informed. That is, in this case, we might suppose that 28.5% of the respondents were uninformed *and either admitted as much* (DK/NA) *or gave an evasive answer* (ND); 15.9% were likewise uninformed *but chose to guess and happened to guess wrong*. But, since uninformed people who choose to guess in a dichotomous-choice situation are presumably about equally likely to guess one way as the other, we would estimate that another 15.9% or so of the respondents were also uninformed *but chose to guess and happened to guess right*. Thus, applying the "black and white" model, it appears that $1 - F = 28.5\% + 15.9\% + 15.9\% = 60.3\%$ and $F = 55.7\% - 15.9\% = 39.8\%$.

In sum, 28.5% + 15.9% = 44.4% of the individual respondents are in error on this judgment, and 60.2% (including the lucky guessers) may be uninformed. At the same time, the electorate collectively reaches the correct judgment based on majority rule. In the dichotomous choice situation, we know how 1423 will choose. We can make either of two assumptions concerning the remaining 566 respondents. We can suppose that they will abstain from choosing, so that nonabstaining respondents choose Mondale over Reagan as more liberal by a margin of 77.8% to 22.2% (third set of percentages displayed); or we can suppose that the 566, faced with a demand that they make a choice, will guess randomly (as we infer about 15.9% + 15.9% = 28.8% of the respondents already have), and thus divide their choices about equally between the "correct" and "incorrect" answers, so choosing Mondale over Reagan as more liberal by about 69.9% to 30.1% (final set of percentages displayed).

I repeated this kind of analysis for the "More Liberal Party" judgment, as well as judgments concerning candidate positions on the following political issues, in both the 1984 and 1988 election studies ("correct" answers are parenthetically shown):

Minority aid: scale running from "the government in Washington should make every effort to improve the social and economic positions of blacks and other minorities" (*Mondale/Dukakis*) to "the government should not make any special effort to help minorities because they should help themselves (*Reagan/Bush*).

Government services: scale running from "having the government provide fewer services to reduce spending" (*Reagan/Bush*) to "having the government provide more services even if it means increased spending" (*Mondale/Dukakis*).

Job guarantee: scale running from "having the government see that every person has a job and a good standard of living" (*Mondale/Dukakis*) to "letting each person get ahead on his own" (*Reagan/Bush*).

Defense spending: scale running from "we should spend much less money on defense" (*Mondale/Dukakis*) to "defense spending should be greatly increased" (*Reagan/Bush*).

Central American involvement (1984 only): scale running from "the U.S. should be much more involved in the internal affairs of Central American countries" (*Reagan*) to "the U.S. should be much less involved in this area" (*Mondale*).

Health insurance (1988 only): scale running from "government insurance plan that would cover all medical and hospital costs for everyone" (*Dukakis*) to "medical expenses should be paid by individual through private insurance plans like Blue Cross and other company paid plans" (*Bush*).

Cooperation with USSR: scale running from "we should try to cooperate more with Russia" (*Mondale/Dukakis*) to "we should be much tougher in our dealings with Russia" (*Reagan/Bush*).[5]

We do not repeat the tabular display and detailed analysis for each of the other 15 items, but summary data are provided below. For each year and issue, an *information profile* is shown, corresponding to the middle column (55.7%/15.9%/28.5%) in the "More Liberal Candidate" table above. The summary F measure is calculated for each item, and averages are shown for each year.

1984	L/C Candidate	L/C Party	Minority Aid	Government Service	Job Guarantee	Defense Spend	Central American Involvement	Cooperation with USSR	Average
Correct	55.7%	55.5%	51.5%	59.1%	52.3%	63.5%	44.0%	51.5%	54.1%
Incorrect	15.9%	15.8%	8.6%	9.3%	6.9%	5.8%	9.3%	8.6%	10.0%
ND/DK/NA	28.5%	28.7%	39.8%	31.6%	40.8%	30.6%	46.7%	39.8%	35.8%
F	39.8%	39.7%	42.9%	49.8%	45.4%	57.7%	34.7%	42.9%	44.1%

1988	L/C Candidate	L/C Party	Minority Aid	Government Service	Job Guarantee	Defense Spend	Government Health	Cooperation with USSR	Average
Correct	55.4%	54.0%	43.5%	46.9%	49.7%	57.7%	43.9%	29.7%	47.6%
Incorrect	11.8%	13.6%	6.8%	10.6%	9.2%	5.9%	6.9%	13.7%	9.8%
ND/DK/NA	32.8%	32.4%	49.6%	42.4%	41.2%	36.3%	49.2%	56.7%	42.6%
F	43.6%	40.4%	36.7%	36.3%	40.5%	51.8%	37.0%	16.0%	37.8%

Combining all 16 items for the two election years, the average of information profile is 50.9%/9.9%/39.2%, for an overall F measure of 41.0%.[6] Thus, typically about half of the electorate was making individual errors, and barely 40% appeared to have the relevant information. *Yet the electorate invariably rendered the correct collective judgment.*

How many individuals performed as well as the collectivity? Of course, the population of respondents is different in the two years, so we have, in effect, two eight-item tests, one for each population. Here is the distribution of individual scores (number of questions answered correctly) for each year.

Score	1984			1988		
8	309	15.5%	⇐ Col. Score	205	11.5%	⇐ Col. Score
7	252	12.7%		196	11.0%	
6	215	10.8%		172	9.7%	
5	230	11.6%		176	9.9%	
4	191	9.6%	⇐ mean ind. (4.3)	185	10.4%	⇐ mean ind. (3.8)
3	195	9.8%		178	10.0%	
2	183	9.2%		194	10.9%	
1	160	8.0%		179	10.1%	
0	254	12.8%		290	16.3%	
	1989	100.0%		1775	100.0%	

5. Issue referenda and electoral error

In the preceding section, we examined information levels in the electorate in a manner parallel to the earlier analysis of errors in student multiple-choice tests. Accordingly, our analysis entailed no "politics"—no preferences, no conflicts, no votes, no outcomes. In this final section, we extend the analysis to bring in a kind of (simulated) politics, so that the analytical setup parallels the "conflicting interests" extension of the Condorcet Jury Theorem model discussed in section 2 and presented in detail in Miller (1986a).

In section 4, we examined NES respondents' judgments concerning various issue positions of presidential candidates. Before being asked such questions, each respondent was asked to indicate his or her own position on the issue in question (as the portion of the 1984 interview schedule on liberal versus conservatives quoted near the beginning of section 4 illustrates). Consider, for example, the 1984 question on defense spending:

> Some people believe that we should spend much less money for defense. Others believe that defense spending should be greatly increased. Where would you place yourself on this scale, or haven't you thought much about it?

Greatly decrease	1	340	17.1%	569	48.5%
	2	229	11.5%		
	3	560	28.2%		
	4	318	16.0%	605	51.5%
Greatly increase	5	287	14.4%		
Haven't thought/DK/NA		255	12.8%		
		1989	100.0%	1174	100.0%

Let us simulate a referendum on the question of whether defense spending should be increased or decreased. We partition the electorate into three blocs: those who favor a decrease, those who favor an increase, and those who apparently are indifferent (occupying the middle position on the scale) or who have no opinion on the issue. Let us suppose that only those with clear preferences, i.e., those in the first two blocs, participate in the referendum. Then we see that the *increase* position wins, though only narrowly, by a 51.5% to 48.5% margin. We take this *referendum outcome* as the baseline for our analysis, in effect, assuming that it represents the distribution of "true preferences" (in the sense dicsussed in section 2) among the electorate. Accordingly, we take *increase* to be the *majority position* on the defense spending issue, and we take 51.5% to be its "deserved" level of support. Of course, the referendum does not really reveal "true" preferences, because these voters are (very) incompletely informed and, if they had more complete information, some would hold and express different opinions on the issue and would vote differently in the referendum. But a survey such as NES does not allow us to assess empirically this aspect of incomplete information.

What it does allow us to do, however, is to look at incomplete information further down the political road and to see how it changes individual choices and the collective outcome against the baseline of this referendum outcome.

Suppose now that the 1174 voters who would participate in this referendum instead had only the opportunity to express their preferences *indirectly* by voting for candidates in a simulated election, where the candidates have distinct positions on the issue in question, so voters can vote for candidates on the basis of their positions on the issue. Of course, voters characteristically are incompletely informed about candidate positions on any issue, so moving from the referendum to the election will introduce a fair amount of individual error. Our task is to assess the extent of this error and its impact on the division of the vote and on the *electoral outcome*, i.e., which position wins.[7]

Though many individual voters make errors of judgment, the Condorcet Jury Theorem style of argument suggest that the vote divisions in the referendum and election are likely to be quite similar and, in particular, that the two processes will typically yield the same majority-rule outcome (though we may have doubts in this particular issue, because the referendum is so close). We also have the further theoretical expectation that the election will reflect the *attenuation effect* discussed in section 2, the relative magnitude of which will depend on the frequency of individual errors, but the direction of which is consistently to drive the election closer to a 50%-50% split.

As can be checked in section 4, voters were actually exceptionally well informed on the defense spending in 1984: 63.5% reported the correct judgment, 5.8% the incorrect judgment, and the remaining 30.6% reported no judgment, giving an F of 57.7%—the highest on any issue in either year. Moreover, this information profile belongs to the entire sample of 1989 respondents, and our present concern is only with the probably better informed subsample of 1174 respondents with clear preferences on the defense spending issue. If we restrict the information profile to the 1174 voters with clear preferences on the issue, 75.1% report the correct judgment, 6.6% the incorrect judgment, and the remaining 18.3% no judgment, giving an F of 68.5%.

Next we must decide what respondents in the ND/DK/NA category with respect to candidate judgments will do in the election. There are two possibilities: such voters may abstain, reducing turnout but increasing F; or such voters may vote randomly and so can be expected to split their votes equally between the two candidates. The resulting error rates for the defense spending issue in 1984 are summarized below:

	All Voters Participating in Referendum		All Voters Participating in Election: With Absention		All Voters Participating in Election: Without Abstention	
Correct	882	75.1%	882	92.0%	989.5	84.3%
ND/DK/NA	215	18.3%				
Incorrect	77	6.6%	77	8.0%	184.5	15.7%
	1174	100.0%	959	100.0%	1174	100.0%

Let us consider how the referendum vote division is affected by individual errors as this division is transformed into the electoral vote division. Three factors produce actual *electoral* *error*—i.e., the discrepancy between the actual referendum and electoral vote divisions. The first (given an election with abstention) is the *abstention effect*, which results from the fact that, in general, abstainers will not be distributed between supporters of the majority and minority positions in the same ratio as all referendum participants. The second is the *attenuation effect* that has been previously discussed. Calculation of the attentuation effect uses the appropriate overall error rate such as shown above for defense spending; it therefore presumes that individual error rates are the same for supporters of the majority and minority positions. The third factor is the *information bias* that results from unequal individual error rates that arise when one group of supporters is better informed than the other.

Let us now trace out these effects with respect to defense spending in 1984. This can be done by means of a simple cross tabulation, as shown in Table 1. The column variable is "true" voter preference on the issue, as indicated by the voter's referendum choice; the column totals give the referendum outcome (51.5% for the majority position on this issue). The row variable is voter judgment concerning candidate positions on the issue, scored not by which candidate is judged closer to a given position, but by which candidate is judged closer to the voter's preferred position. Thus, the column percentages in this cross tabulation show the information profiles among supporters of the majority (74.5%/18.7%/6.8%) and minority positions (75.7%/17.9%/6.3%), but the positions of the "correct" and "incorrect" groups are interchanged in the two columns. The column totals, with the middle row subtracted out, give the number of "true" supporters of the majority and minority positions in an election with abstention (51.3% for the majority position). The totals of the top and bottom rows show the outcome of the election with abstention (50.8% for the majority position) and, when the center row total is equally allocated between them, the outcome of the election without abstention (50.6% for the majority position).

Table 1. 1984 defense spending.

Election		Referendum: Increase	Referendum: Decrease		
Candidate thought closer to *R*'s position	Reagan (Increase)	451 (74.5%)	36 (6.3%)	487 (50.8%)	594.5 (50.6%)
	ND/DK/NA	113 (18.7%)	102 (17.9%)	215	
	Mondale (Decrease)	41 (6.8%)	431 (75.7%)	472 (49.2%)	579.5 (49.4%)
		605 (51.5%)	569 (48.5%)	959	1174
	Nonabstaining	492 (51.3%)	467 (48.7%)		

	Referendum Outcome	+	Abstention Effect	+	Attenuation Effect	+	Information Bias	=	Electoral Outcome
With abstention	51.5%		−0.2%		−0.2%		−0.3%		50.8%
Without abstention	51.5%		—		−0.4%		−0.5%		50.6%

In the case of defense spending in 1984, total electoral error is therefore 50.8% − 51.5% = −0.7% with abstention, and 50.6% − 51.5% = −0.9% without abstention. To see how this error is apportioned between attenuation and information bias, we can calculate the *expected electoral error* (as discussed in section 2) that would result from equal individual error rates among both groups of supporters. For defense spending in 1984, with abstention there are 492 supporters of the majority position and 467 supporters of the minority position. Applying the overall error rate with abstention, the expected number of votes for the majority position in the election is 492 × .920 + 467 × .080 = 490 out of 959 nonabstaining voters or 51.1%—an attenuation of 0.2% relative to the number of "true" supporters of the majority position in the nonabstaining electorate. (The attenuation effect is very small, because the error rate is quite low and because M barely exceeds 50% in the first place.) Thus, the information bias is 50.8% − 51.1% = −0.3%, reflecting the fact that supporters of the minority position are slightly better informed than supporters of the majority position. Without abstention there are 605 supporters of the majority position and 569 of the minority position. Applying the overall error rate without abstention, the expected number of votes for the majority position in the election is 605 × .843 + 569 × .157 = 599.35 of 1174 referendum votes of 51.1%—an attentuation of 0.4% relative to the number of "true" supporters of the majority position in the referendum electorate. These effects are summarized below in the cross tabulation in Table 1.

In this case, although (1) the referendum is very close, (2) the majority position suffers a normal attenuation effect, and (3) the minority has a very slight information advantage, the majority position still ekes out an extremely narrow electoral victory.[8]

Table 2 displays similar summaries for all 16 issues. Note that every table entry pertains to support for the majority position. (Thus, the first entry on each line, i.e., the referendum outcome, is always greater than 50%.) We can see that the abstention effect typically hurts the majority position a bit—that is, supporters of the majority position on these issues typically are more likely to fall in the ND/DK/NA category than are supporters of the minority position. The direction of the attenuation effect is necessarily toward a 50%-50% split, and thus always hurts the majority position unless electoral support for the majority position has already fallen below 50% due to abstention, as in the case of government services in 1984. The direction of information bias tends also to favor the minority position—not as consistently as the abstention effect but with somewhat greater magnitude on average.

The sample of 16 issues produces a total of four *collective errors*, in which the election reverses the referendum outcome, for a collective performance of .75.[9] The reversals occur because of information biases in favor of the minority position of sufficient magnitude.[10]

Can we reach any general conclusions about collective performance in the face of conflicting interests in an electoral setting?

First, it is worth reiterating that, on average, individual voters were frequently poorly informed and made many errors of judgment in all these simulated elections. On average, barely 60% of individual voters made correct judgments on a given issue (and, as we saw at the end of the last section, many fewer made consistently correct judgments). The average F score of about 45% indicates, in terms of the "black and white" model, that less than one half of the voters on average actually had the requisite information reliably to vote correctly in an election.

Collective performance was noticeably, but not dramatically, better than individual performance. This modest Condorcet effect essentially reflects the theoretical fact that collective

Table 2. Referendum summaries.

Issue	Referendum Outcome	+	Abstention Effect	+	Attenuation Effect	+	Information Bias	=	Electoral Outcome
1984									
Defense spending	51.5%		−0.2%		−0.2%		−0.3%		50.8%
	51.5%		—		−0.4%		−0.5%		50.6%
Job guarantee	57.9%		+3.4%		−2.4%		+3.4%		62.3%
	57.9%		—		−3.5%		+4.2%		58.6%
Minority aid	54.3%		−2.5%		−0.7%		−3.4%		47.7%**
	54.3%		—		−2.5%		−3.4%		48.4%**
Government services	50.8%		−2.0%		+0.3%		−1.5%		47.6%**
	50.8%		—		−0.3%		−2.4%		48.1%**
Cooperation with USSR	54.0%		−0.3%		−1.1%		−3.6%		49.0%**
	54.0%		—		−2.0%		−2.7%		49.3%**
Central American involvement	68.4%		−2.8%		−5.4%		−1.2%		59.0%
	68.4%		—		−10.0%		−2.1%		56.3%
Liberal/conservative candidate	61.8%		+0.9%		−4.2%		+1.4%		59.9%
	61.8%		—		−4.7%		+1.8%		58.9%
Liberal/Conservative Party	61.8%		−0.4%		−4.0%		+1.3%		58.7%
	61.8%		—		−4.8%		+0.8%		57.8%
1988									
Defense spending	50.4%		−0.3%		0.0%		+2.9%		53.0%
	50.4%		—		0.0%		+1.8%		52.2%
Job guarantee	65.6%		−1.1%		−4.2%		0.0%		60.3%
	65.5%		—		−8.4%		−0.5%		56.7%
Minority aid	64.8%		−4.5%		−3.0%		−5.8%		51.5%
	64.8%		—		−8.6%		−5.3%		50.9%
Government services	53.9%		−1.2%		−1.0%		−2.2%		49.5%**
	53.9%		—		−2.0%		−2.3%		49.6%**
Cooperation with USSR	58.2%		−4.7%		−2.2%		−0.9%		50.4%
	58.2%		—		−6.6%		−1.4%		50.2%
Health insurance	52.5%		−1.7%		−0.2%		+1.7%		52.3%
	52.5%		—		−1.4%		+0.2%		51.3%
Liberal/conservative candidate	66.7%		−0.7%		−4.4%		−2.4%		59.2%
	66.7%		—		−8.0%		−1.7%		57.0%
Liberal/conservative party	66.7%		−0.9%		−6.0%		−2.0%		57.8%
	66.7%		—		−9.7%		−0.9%		56.1%

**Collective error (electoral decision reverses referendum decision).

Note: For each issue and year, the first line pertains to the election with abstention and the second to the election without abstention. All entries pertain to support for the majority position on the issue.

competence is lower, other things being equal, in the face of conflicting interests than in the face of common interests. The reason for this, and the obvious reason for the four collective errors here, is that the margin of support for the majority position may barely exceed 50%. If so, "true" preferences (such as are taken to be expressed in the referenda) are rather likely to be reversed, even if electoral error is quite small (as it usually is). We should note that *every collective error involved an issue in which the majority position received less than 55% support in the referendum.* (There are seven such issues, and four of them produced collective errors.) On the other hand, none of the nine issues in which the majority position received more than 55% support in the referendum produced a collective error.

While the collective error was 25%, average electoral error was only 5.5%. (This is the average *absolute error*, ignoring the direction of the error.) It is worth noting that average electoral error on the issues that produced collective errors was actually less (4.6%) than on the issues that did not produce collective errors (5.8%). This seeming anomaly comes about because the issues that do not produce collective errors include all issues in which the majority position is strongly supported, and these issues necessarily have large attenuation effects, which in turn tend to produce large electoral errors. Restricting our attention to the seven issues in which the majority position received less than 55% support, electoral error averaged 4.6% among the four that produced collective errors, but only 1.2% among the three that did not. The empirical conclusion is that relatively weak support for the majority position is necessary to produce collective error, which then will actually occur if there is significant electoral error produced by an information advantage in favor of the minority.

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Notes

1. If the p_i's are (sufficiently) symmetrically distributed, it suffices that $\bar{p}$ exceeds ½, even if some individual p_i's fall below ½.
2. This point is most obvious when $F > ½$, in which case the collective competence of the "black and white" group is perfect whatever its size, whereas an "all gray" group with $p = .75$ is certainly less than perfectly

competent, especially if the group is of small size. (Actually, this "black and white" model can readily be generalized to a "gray and white" model, with the result still holding. However, the "black and white" model is especially useful for interpreting survey data below.)

3. For reasons of practical convenience, I have used the data sets distributed by the ICPSR to accompany the American Political Science Association's SETUPS teaching modules, which are based on the 1984 and 1988 National Election Studies. Only respondents who were successfully interviewed both before and after the election are included, and certain variables have been combined or categories collapsed. In particular, the variables we use here were seven-point scales in the original data, but, in the present data, the two extreme pairs of points were collapsed, so five-point scales result.
4. Notice that, in this section and the next, I am analyzing the NES samples as *populations* whose information (and, in the next section, preferences) have been measured and in terms of which we can look for evidence of Condorcet-like effects. I am not estimating parameters pertaining to the entire American voting-age population.
5. Given the notable rapprochement between Reagan and Gorbachev that occurred between 1985 and 1988, one might question the "scoring" of this item in 1988, and indeed it is the outlier among the 16.
6. In an attempt to verify that, in terms of information, the interpretation was reasonable, I ran all respondents through a "political involvement filter," measuring their inclination and ability to acquire political information; I separately analyzed those in the top and bottom categories. *F* figures for those in the bottom category typically approached 0%, while those in the top category averaged around 70–75%.
7. It may be worth explicitly noting that the outcome of the simulated election depends solely on voters' preferences on the issue in question, in conjunction with their judgments concerning candidate positions on the same issue. Voting choices in the election are quite independent of voters' preferences on other issues, perceptions of candidate stands on other issues, evaluations of the candidates' personal qualities, party identification, voting habits, etc. In particular, this analysis makes no use of voters' actual (reported) votes in the presidential election.
8. And what is true about the electoral outcome with abstention is also true without abstention, as must always be the case, since the electoral outcome without abstention always lies between that of the election with abstention and a 50%–50% split.
9. Allen (1974), in his generally similar analysis of ten issues in 1964, found three collective errors, for a collective performance of .70.
10. The minority aid issue in both years illustrates the point that the information advantage is not always held by higher status, better educated, higher income, etc., groups, since, on balance, the well-informed minority on this issue scored lower than the less well-informed majority on such demographic variables (income in particular). This issue in 1984 illustrates that, even if turnout is uniform, an intense and accordingly well-informed minority can win out over a more apathetic and accordingly less well-informed majority by making fewer individual errors—a theoretical point noted in Miller (1986a).

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