A Game-Theoretic View of Voting

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Two game-theoretic arguments for the potential rationality of voting are presented. The first argument suggests that people make choices that allow the most favorable forecasts. People choose to vote inasmuch as they project their own choices between voting and abstaining more strongly onto members of their own political group than onto members of other political groups. Relevant evidence is reviewed and extended by new findings in a simulated public-goods dilemma. The second argument suggests that people preview how they will feel about each of the four possible scenarios generated by the conjunctions of their own choices (to vote or to abstain) and the election outcome (victory or defeat). They choose to vote inasmuch as they feel their own vote will not be wasted. The implications of both arguments for efforts to increase turnout are discussed.

The scientific analysis of voting behavior poses many puzzles. The most fundamental question is why people vote at all (Lanning, this issue) if no individual vote can affect the outcome of a large-scale election with any detectable probability (Aldrich, 1993). Some researchers assume that the insignificance of an individual vote is so obvious that citizens justify their voting by other means. Two prevalent justifications include expressive voting (i.e., voting feels good and it contributes to one's reputation as a responsible citizen) and civic-duty voting (i.e., to vote is to pay the price for living in a democracy; Gonzalez & Tyler, this issue; Harder & Krosnick, this issue). Both justifications are incomplete because they cannot explain several "stylized facts" in voting behavior, such as

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strategic voting or increased turnout in elections believed to be close (Geys, 2006).[1]

Another response is to assume that voters fail to appreciate their own insignificance. A game-theoretic framework suggests that people (a) think their own decision to vote predicts the decisions of millions of like-minded others (thus predicting victory) or (b) think that there is a nontrivial probability that their own votes matter (Acevedo & Krueger, 2004). The first argument rests on the theory of evidential decision making (Grafstein, 1991, 2002; Jeffrey, 1983), which suggests that an individual behavior (here: to vote vs. to abstain) is diagnostic of the behavior of others who are members of the same group. Compared with a Republican who abstains, for example, a Republican who votes can be more confident that other Republicans vote in large numbers. Inasmuch as the Republican's decision is less diagnostic about what Democrats will do, his or her decision to vote or to abstain is, respectively, predictive of victory and defeat. The implication is that someone can decide to vote because this decision permits the desired forecast.

The second argument casts the decision to vote as a cooperative choice in an iterated social dilemma (Kanazawa, 1998, 2000). Here, the idea is that people consider how they would react to each of the four possible scenarios resulting from the combinations of their own choice (vote or abstain) and the collective outcome (electoral victory or defeat). People are less likely to regard their own votes as being wasted when they vote and win or when they abstain and lose than when they vote and lose or when they abstain and win. Intentions to vote should be negatively correlated with perceptions of wastefulness. We now discuss both arguments more fully, consider their potential rationality, present relevant empirical evidence, and conclude with a review of strategies designed to increase voter turnout.

Voting as Evidential Decision Making

The theory of evidential decision making recognizes that no individual voter has a detectable causal effect on the outcome of a large-scale election. Yet each individual voter can estimate the probability that the election will be won given his or her own decision to vote, $p(w \mid v)$, and compare it with the probability that the election will be lost given his or her decision to vote, $p(l \mid v)$. The question is, why should $p(w \mid v) > p(l \mid v)$? The voter may realize that the behavior of individuals may be probabilistically inferred from the behavior of the collective. Victory of the favored party means that individual supporters of this party were more likely

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[1]It is easier to attribute intrinsic benefits to voters post hoc than it is to measure them independently and use them as predictors of voting. To say that people vote "because they want to," and to assume that different people experience different kinds of intrinsic satisfaction, runs the risk of being tautological.

to vote than supporters of the contending party. The voter can thus deduce that his or her own probability of having voted was higher after a victory than after defeat.

Bayes's theorem shows how a voter can probabilistically predict victory from own voting. Namely, $\frac{p(w \mid v)}{p(l \mid v)} = \frac{p(w)p(v \mid w)}{p(l)p(v \mid l)} \cdot \frac{p(v)}{p(v)}$. With p(v) canceling out, and the base rates of winning and abstaining assumed equal a priori, the voter infers victory from voting. Analogously, abstention suggests defeat because $\frac{p(l \mid a)}{p(w \mid a)} = \frac{p(l)p(a \mid l)}{p(w)p(a \mid w)} \cdot \frac{p(a)}{p(a)}$. Of course, the power of evidential decision making is reduced inasmuch as $p(w) \neq p(l)$ a priori.

Believing that $p(w \mid v) > p(l \mid v)$ does not mean that a person will necessarily vote. As social dilemmas, elections hold the promise of benefits in the case of victory, but they also burden the citizens with the cost of voting (Highton, 2004). For self-interested people, the most desirable outcome is to see their favored party or candidate win while not voting themselves. The second-best outcome is to win and vote, followed by losing and abstaining. The worst outcome is to vote and lose. The benefit B derived from winning is the difference between the outcomes of victory and defeat; the cost of voting, C, is the difference between the outcomes obtained with voting versus abstaining. Whether a rational person will vote now depends on whether the expected value of voting is greater than the expected value of abstaining. It can be shown that voting should be seen as worthwhile if $B(p(w \mid v) - p(w \mid a)) > C$. This inequality entails that $p(w \mid v) - p(w \mid a) > C/B$. In other words, if $C = 0$, any positive difference in the conditional probabilities will be sufficient to justify voting; if $C = B$, however, no difference between these probabilities is large enough.

Evidence

The empirical evidence for evidential decision making begins with Quattrone and Tversky's (1984) study on what they called the "voter's illusion." Participants were instructed to imagine a country "Delta," in which the war party and the peace party vie for control. Their task was to consider themselves members of the peace party and to assume that the outcome of the election depended on each party's ability to mobilize their constituencies. The critical hypothesis involved associations among three judgments. The first two judgments were estimates regarding other party members voting assuming that the participant had either decided to vote or to abstain. The difference between the two conditional estimates indicated to what extent participants thought their own choices were more diagnostic of the choices of fellow party members than of the choices of members of the other party. The critical statistic for evidential decision making was the correlation between the difference scores and the third variable, namely participants' unconditional judgments of voting.

Voting in a two-party or two-candidate election differs from the prisoner's dilemma because in the latter a player is only concerned with the predictive value of her own choice for the choices of others in the group. In contrast, a voter has to be concerned with the turnout of fellow party supporters relative to the turnout of supporters of the opposition. For a person who projects equally to the in-group and to the out-group, the expected value of voting is always smaller than the expected value of abstention. By projecting to the overall population, such a person can only predict overall turnout, but not which party or candidate will win. To be motivated to vote, it must be possible to project a difference in turnout among supporters of different parties. There is good evidence for in-group projection to be stronger than out-group projection. On average, the correlation between people's own choices and the choices they attribute to in-group members is about .5, whereas the correlation between their own choices and the choices they attribute to out-group members is about .1 (Robbins & Krueger, 2005). If in-group projection is stronger than out-group projection in a two-party election, the probability of victory is greater if it is conditioned on one's own voting than if it is conditioned on one's own abstention.

Two qualifications to this analysis should be noted. First, we have assumed that the in- group and the out-group are equal in size. In such a context, the election outcome depends on different rates of voter mobilization. If the two groups differ in size, mobilization in the smaller group must be stronger than mobilization in the larger group if the smaller group is to win. Let p denote in-group projection, q denote out-group projection, and z denote relative in-group size. A person would think that the election ends in a stalemate if $zp = (1 - z)q$. Solving for relative in-group size, a stalemate is expected if $z = q/(p + q)$. For example, if in-group projection $= 2/3$ and out-group projection $= 1/2$, victory is expected if $z > 3/7$. Solving for differential projection to the in-group and to the out-group, a stalemate is expected if $p/q = 1/z - 1$.

Second, groups (parties) may differ not only in size, but also in their homogeneity. The Republican party in the United States, for example, has recently been regarded as less diverse than the Democratic party. The strength of inductive inferences from single cases should increase with the perceived homogeneity of the group, a statistical requirement that people tend to honor intuitively (Krueger & Clement, 1996). In the Bayesian rationale for induction, the homogeneity of the group can be expressed by the width of the prior probability distribution. A highly homogeneous group would have a bimodal distribution. A person would assume that either a large majority or a small minority engage in the behavior in question. The prior $p(E)$ would still be .5, but the revised estimate, given own behavior, would be more extreme (i.e., $>2/3$ or $<1/3$) than it would be in the case of uniform priors. In sum, a smaller group or party size raises the bar for evidential decision making to induce voting, whereas greater perceived group homogeneity lowers it. Inasmuch as smaller groups

actually tend to be more homogeneous, these two effects can compensate for each other.

Returning to the assumptions of equal group size and equal homogeneity, Acevedo and Krueger (2004) replicated and extended Quattrone and Tversky's (1984) findings. The novel finding was that it did not matter whether participants were asked to imagine that they made their own choices before or after most others made theirs. This null finding was evidence against the idea that people confuse the diagnostic value of their own choice with a causal influence they might have on what others do. If the latter had been the case—and unless people subscribed to the notion of backward causation—the effect should have been stronger when people acted early rather than late.

Acevedo and Krueger (2005) presented experimental evidence showing that people, when making their own decisions, use the probability with which others respond as they themselves do. Willingness to cooperate in a prisoner's dilemma increased with the probability that the other player would reciprocate their choice (whatever that choice might be). To guard against the possibility that these results merely tapped participants' ability "to do the math," Krueger and Acevedo (2007) conducted a study in which individual differences in social projection were assessed independently of the prisoner's dilemma game. Participants varied in the degree to which they assumed that others were like them, but on average, correlations between self-judgments and other judgments over a set of personality traits were positive. The critical finding was that the individual differences in projection predicted choices in the game.

The theory of evidential decision making shows how players in a prisoner's dilemma and citizens facing an election can make predictions conditional on their own behavior. Favorable predictions regarding mutual cooperation or electoral victory are only legitimate, however, if the person actually commits the kind of behavior on which the prediction is based. There is no room for "last-minute intrigue" (Brams, 1975). It is not possible to "pretend" to choose the costly behavior in order to generate an optimistic prediction, and then to abruptly switch to the strategy of defection hoping to reap the Temptation payoff. Whatever the final behavior is, that is what must be assumed to be the behavior of the majority. "Statistical facts are still facts [and] the conditional probabilities statistically linking the individual's behavior to the behavior of others shadow the individual whether voting or abstaining" (Grafstein, 2002, p. 151).

Objections and Clarifications

After demonstrating evidential decision making, Quattrone and Tversky (1984) dismissed it as irrational. One cannot, they argued, choose a behavior that is associated with the most favorable forecast without tacitly claiming to cause the favorable outcome; and such a belief is magical. The problem, according to

Quattrone and Tversky, is that people do not know the difference between correlation and causation. A correlation is not sufficient to establish causation because correlations can be spurious. To illustrate, Quattrone and Tversky discussed the Calvinist doctrine of predestination. We explore this example further because it puts the contrast between evidential decision theory and causal decision theory in stark relief. For other objections against evidential decision theory see Elster (1985), Hurley (2005), or Skyrms (1996), for a defense; see Acevedo and Krueger (2005), Krueger (2007), or Krueger and Acevedo (2005).

The Calvinist is concerned about salvation (Calvin, 1536/1813). Salvation cannot be earned because God has already chosen the souls He will save before setting them on their earthly journey. The Calvinist also believes that the chosen are more likely to prosper than others. However, prosperity cannot be created by human deeds; instead, it depends only on the state of salvation. Why would a Calvinist lift a finger to work if he cannot cause his own prosperity and thereby earn salvation? As Calvinists have observed the correlation between effort and prosperity, they capitalize on it. With their theology barring them from taking credit for their prosperity (and thus salvation), they can regard prosperity only as a signal, a diagnostic sign, that they have been granted salvation.

The top panel of Figure 1 shows the three relevant variables and the paths among them. Path A indicates that prosperity perfectly depends on salvation. Path B refers to the observable correlation between effort and prosperity. Once prosperity is regressed on salvation, there is nothing left for effort to explain. The level of effort is not associated with the level of prosperity among the saved or among the damned. The two variables are conditionally independent. Why should there be a correlation between effort and prosperity, a correlation without causal power besides the power to confuse the faithful? The answer lies in path C, the correlation between salvation and effort. For example, if the paths A and B, respectively, are 1 and .8, path C is their product, namely $1 * .8 = .8$. Path B is spurious because it is the product of paths A and C (i.e., the numerator of the partial $r_{EP.S}$ is 0 and therefore the ratio is 0).

The Calvinist faces a problem only if he limits the doctrine of predestination to the outcomes of salvation and prosperity. If he regards his own efforts as a matter of his "free will," he is lost. To be free, the will (here: effort) must be independent of the state of salvation, and yet it must be "spuriously" associated with prosperity. But if salvation and prosperity are perfectly associated, the path between salvation and effort cannot be 0 unless the path between effort and prosperity is 0.[2] Whatever the Calvinist's belief is regarding the association between effort and prosperity must also be his belief about the degree to which his choice to make an effort is constrained be predestination. By embracing the doctrine of

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[2]As the correlation in path A departs from unity, paths B and C are increasingly to free to vary. Still, path B can only be assumed to be spurious if B = AC. Therefore, C must be greater than 0.
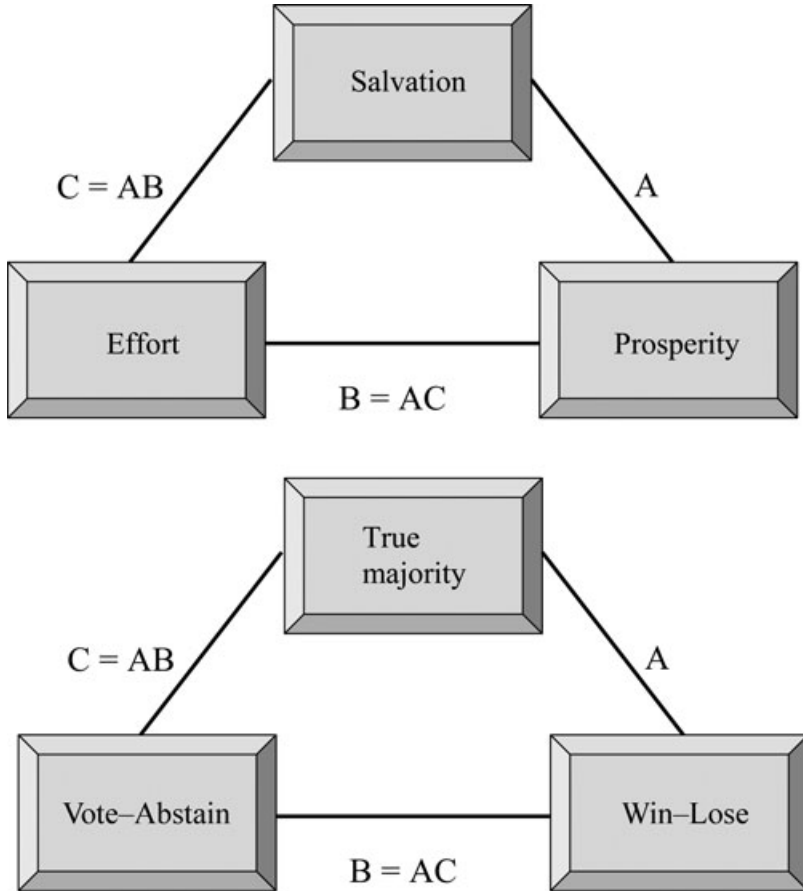
Fig. 1. A path diagram for evidential decision making among Calvinists (top) and voers (bottom).

predestination completely rather than partially, the problem is solved. The Calvinist can work hard toward success under the conviction that his efforts themselves are predetermined. Effort and prosperity thereby reveal the hidden third variable (here: God's plan), and the latter variable does so more faithfully than the former. That is why Calvinists think that prosperity is a better sign of their salvation than the effort they made.[3]

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[3]One might argue that evidential decision making is false in the Calvinist scenario because effort does cause success. However, effort's causal power over outcomes does not refute a deterministic framework operating outside of the laboratory. An experimental demonstration of effort's causal power would only show that if a person were moved by deterministic forces to exert herself, she

Following Quattrone and Tversky (1984), we accept the Calvinist's conundrum as an analogy for voting. The bottom panel of Figure 1 shows the three critical variables, now relabeled. The citizen's behavior is to vote or to abstain, the observable outcome is election victory or defeat, and the latent third variable is whether one's own political views are really those of the majority. In this context, it is even clearer than it is in the Calvinist analog that the two variables connected by path A are the same. Therefore, it is even clearer that path C is the same as path B. Much like the Calvinist is not free to choose to make the effort to pursue success, so is the citizen is not free to choose between voting and abstaining. If victory is preordained by the workings of a deterministic universe, then his or her small contribution is determined by it and correlated with it.

The error in rejecting evidential decision making is to assume that individual choices are free. Therefore, the objection that voting "in order to generate a favorable forecast" is a case of magical thinking is itself irrational. Trying to disabuse citizens of the idea that they can cause others to act as they themselves do, the objectors force them to ignore the correlation between their own behavior and that of others. But if correlation does not imply causation, it is a fallacy to assume that a belief in causation can only be undone by eliminating the belief in correlation. To ask people to act in defiance of that correlation is to ask them to "defy the facts science discovers about their behavior" (Grafstein, 2002, p. 153).

There is no need to assume that people's choices are free, and thus no reason to fault them for making the wrong ones. Most psychologists work with the tacit assumption of determinism because this assumption justifies the project of experimental research, which is to discover the causes of behavior (Bargh & Ferguson, 2000). That people think their choices are free is a different matter (Wegner, 2002). The experience of conscious will enables people to act strategically. They act as if they had free choice.

If evidential decision making is rejected for a more traditional game-theoretic concept of rationality, everyone must be advised to abstain from voting. This advice makes sense only in the case of an individual, but giving it to everyone leads to incoherence. The lone person who rejects the advice can get him- or herself elected as a write-in candidate (Tullock, 1975). But then again, everyone would be tempted to do that, and it would no longer be irrational to vote. Evidential decision making avoids this paradox by refraining from categorical demands on choice. The theory only asks that one use available knowledge and assumptions to compare the expected value of voting with the expected value of abstaining, and then to choose accordingly.

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would likely succeed. Conversely, one might argue against evidential decision making by noting that if a person were "made to vote" by experimental inducement, the insignificance of this choice should become obvious. This is true enough, but irrelevant. A forced decision is no decision at all and it has no diagnostic value for the choices of others.

An Illustrative Experiment

The goal of this study was to examine evidential decision making in an experimental context that avoids some of the ambiguities of the context of voting. We chose a simulated step-level public-goods game (Dawes, Orbell, Simmons, & van de Kragt, 1986), in which participants read about a state lottery set up to raise revenue while offering benefits to all residents if a certain threshold of participation is passed. The hypothesis of evidential decision making was that individual decisions to buy a ticket could be predicted from the degree to which participants felt their own behavior was diagnostic of collective behavior.

In the public-goods scenario, various sociopolitical motives that might facilitate the decision to vote are irrelevant (e.g., expression of own attitude, party allegiance, protest vote). In a voting scenario, these motives can have main effects on individuals' decisions or they can moderate the effects of evidential decision making. Evidential decision making is also simpler in the public-goods scenario than it is in the two-party election scenario in another sense. In the latter, people need to project more strongly to the in-group than to the out-group before they can conclude that their own cooperative behavior is diagnostic of the collective outcome. In the former, social categorization plays no role; the collective outcome depends only on the behavior of the majority. Finally, the public-goods scenario allows control over the expected payoffs. Whereas the voting scenario simply assumes that people anticipate benefits from victory and that they are mindful of the costs of voting, the lottery's benefits and costs can be explicitly stated, and their magnitude can be varied. By manipulating the payoffs, we examined whether participation rates would increase with the relative benefits of a successful outcome and decreases in the relative costs of participation.

Method

Female and male undergraduate students ($N = 86$) completed this study as an in-class activity. They read a description of a state lottery that would provide an opportunity for all taxpayers to receive a tax credit for the following year's income taxes. An excerpt from the scenario is shown here:

> Suppose there is a taxpayer movement in one of the states of the Union. For several months, the concerned taxpayers have lobbied the state to lower income taxes. As a response to this taxpayer movement, the state has set forth the following initiative:
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> Next Saturday, all 8 million adult state residents will be offered the opportunity to purchase a ticket for $10. The ticket sales will provide residents with an opportunity to receive a tax credit that may be applied towards next year's income taxes. Specifically, the outcome will depend on whether at least 50% of residents participate. If less than 50% participate, no one wins anything and the state government will keep all the proceeds collected from the tickets. If more than 50% of residents participate; however, everyone will receive a tax credit greater than the price of the ticket, regardless of whether or not they purchased a ticket.

For each of the potential lottery payoffs were stated as $20, $100, and $500. Because the cost of a ticket was constant at $10, the payoff for unilateral cooperation was always –$10, and the payoff for mutual defection was always $0. Conversely, the payoff for unilateral defection increased from $30 to $110 to $510, and the payoff for mutual cooperation increased from $10 to $90 to $490. Participants were asked to make four estimates. The first two estimates were conditionalized on their own behavior, namely (1) "If you buy a ticket, what percentage of others do you think will also buy a ticket?" and (2) "If you don't buy a ticket, what percentage of others do you think will buy a ticket?" The last two estimates were unconditional, namely (3) "What are the chances that you would buy a ticket?" and (4) "What are the chances that at least 50% of others will buy a ticket?" The order of the questions was counterbalanced.[4]

Results and Discussion

The means of the conditional estimates are displayed in the top panel of Figure 2. A repeated-measures analysis of variance (ANOVA) was conducted with the participants' behavior (buying a ticket vs. not buying a ticket) and the size of the payoff ($20, $100, $500) as independent variables. As predicted, participants were more confident that others would buy tickets if they assumed that they themselves did ($M = 47.59$) than if they assumed that they would abstain ($M = 44.36$), $F(1, 85) = 5.93$, $MSE = 226.37$, $p < .01$, $d = .26$. Also as predicted, the individual's prospective gain had a strong effect, $F(2, 170) = 129.50$, $MSE = 528.65$. However, the size of this gain did not moderate the effect of the person's own presumed behavior, $F(2, 170) = 3.01$, $MSE = 41.76$. In other words, the strength of a person's projection from his or her own decision to the decisions prevalent in the group was independent of incentives. This null finding is consistent with the idea that evidential decision making is neither amplified nor reduced by motivational states.

Projection was also tested using the two sets of unconditional percentage estimates of own and collective behavior. As expected, estimates of own and collective behavior were positively correlated at each payoff level ($20: $r(84) = .46$; $100: $r(84) = .40$; $500: $r(84) = .48$, all $p < .001$). Again, this finding suggested that the strength of social projection was not moderated by financial incentives. The bottom panel of Figure 2 shows the mean unconditional estimates, which were submitted to a repeated-measures ANOVA with the target (self vs. collective) and size of the payoff as its variables. Again, the size of the prospective gain had a strong main effect on willingness to contribute and on expectations

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[4]The timing of behavior was not manipulated in this experiment. A replication study ($N = 73$), which included this manipulation (considering to buy a ticket in the morning or in the evening), showed no timing effects for the gambler's illusion.
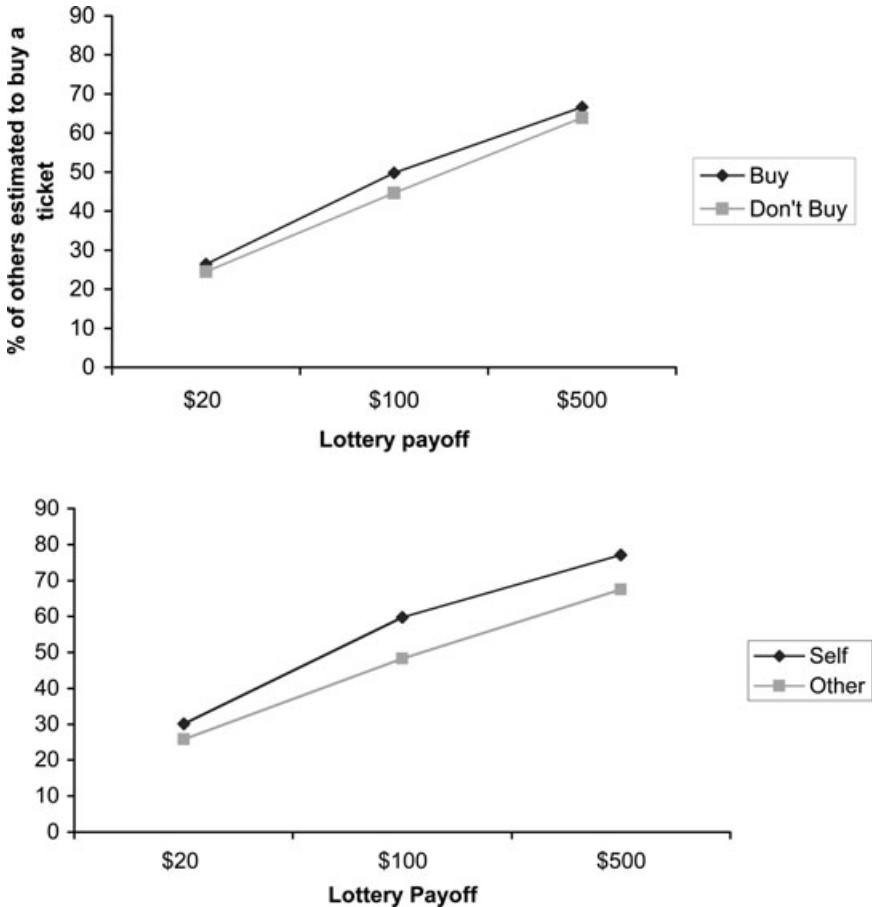
Fig. 2. Conditional (top) and unconditional (bottom) estimates of lottery participation.

that others would contribute, $F(2, 170) = 104.83$, $MSE = 813.62$. The effect of prospective gain was not moderated by the target, $F(2, 170) = 2.16$, $MSE = 265.34$. The target had a large overall effect, however. Regardless of the size of the payoff, participants thought that they themselves would be more likely to contribute to the lottery ($M = 55.65$) than most others ($M = 47.19$), $F(1, 85) = 9.63$, $MSE = 959.97$, $p < .01$, $d = 2.73$. This finding confirms reports that most people think that they are more cooperative than others (Krueger & Acevedo, 2007; Messick, Bloom, & Samuelson, 1985).

Recall that the critical test of evidential decision making involved both unconditional and conditional estimates. We computed for each participant the difference between the percentage estimate of others buying a ticket if the participant

him- or herself bought a ticket and the percentage estimate of others buying a ticket if the participant did not buy a ticket. This difference score (i.e., the measure of differential projection to the in-group and to the out-group) predicted participants' unconditional estimates of their own likelihood to enter the lottery at each of the three levels of payoff ($20: $r(84) = .04$; $100: $r(84) = .14$; $500: $r(84) = .19$). To partially disattentuate these correlations for unreliability, we averaged all ratings across conditions before computing the difference scores and voting intentions. The result was significant, and its size was comparable with earlier reports, $r(84) = .25, p < .01$.

The difference–score correlation masks the possibility that both variables that make up the difference score contribute to the prediction of the criterion (Krueger, 2008). The difference–score correlation should be positive inasmuch as the correlation between the first conditional rating ("others buy if I do") and the unconditional rating ("I buy") is positive, inasmuch as the correlation between the second conditional rating ("others buy if I do not buy") and the unconditional rating is low or negative, and inasmuch as the correlation between the two conditional ratings is positive (see Cohen & Cohen, 1983, p. 416). In the present data, the two conditional ratings were positively correlated ($r = .77$). As expected, estimates of others' contributions predicted unconditional decisions better when these estimates were conditioned on one's own contribution ($r = .56$) than on one's own abstention ($r = .44$), $t(83) = 2.21, p < .05$.[5] This inequality is not independent of the significant difference–score correlation. The statistical logic of that correlation entails it.

The present experiment yielded evidence for social projection on each test that was conducted. Most important, the experiment replicated the effect of evidential decision making, suggesting that people base their decision to contribute to a collective good if they think that their own decisions are diagnostic of the decisions of many others. The effect size obtained here ($r = .25$) fell between the one reported by Quattrone and Tversky (1984; $r = .33$) and the one reported by Acevedo and Krueger (2004; $r = .19$). Other motivations, which may be evoked in the voting scenario, neither enhanced nor reduced the effect of evidential decision making.

Voting as Self-Regulation

Evidential decision making provides a rationale for voting by casting citizens as utility maximizers who realize that their own choices between voting and

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[5]Difference scores are strong predictors of third variables if both components of the difference score predict equally well, but with opposite signs. Our finding that the second conditional rating was positively associated with participants' unconditional estimates regarding their own likelihood to enter the lottery is surprising. We take this finding as additional evidence for the power of projection. Even if participants assumed they would not buy, their judgments of others were associated with their self-judgments when the latter were allowed to vary.

abstaining have diagnostic significance for what others are likely to do. This rationale can induce voting without the presumption of causing others to vote; it sidesteps the "big brute fact" that individual votes do not matter in large elections (Meehl, 1977). The foregoing discussion leaves open the question of whether people nevertheless assume that their own votes are critical. In the remainder of this article we summarize studies showing that people, in fact, overestimate their individual effects on election outcomes or otherwise respond as they do.

In a variety of social judgment domains, people exhibit an illusion of control (Langer, 1975), thinking that they can control random events, or overestimating their own influence on outcomes that are controlled by others (Krueger, 2000; Krueger & Acevedo, 2007). In the domain of voting, people may confuse the effects of collective behavior with the effects of their own individual contribution. People who are highly identified with a group may bask in the reflected glory of the group's success (Cialdini et al., 1976) and claim the group's victory as their own (Caruso, Epley, & Bazerman, 2006). Consistent with this notion, people overestimate the probability that their own contribution makes the critical difference in reaching the provision threshold in small-scale public-goods dilemmas (Dawes et al., 1986).

The question is whether people overclaim their own effect even in a large-scale election. Riker and Ordeshook (1968) thought that they do, and Opp (2001) boldly claimed that "there is a widespread cognitive illusion among ordinary people that participation in an election makes a difference. In other words, citizens more or less assume that they can influence the outcome of an election" (p. 357). Using data from 3,206 participants in the German equivalent of the U.S. General Social Survey, Opp's analysis turned on the responses to the prompt "Please tell me to what extent *you personally* could exert influence in politics when you participate in elections" (p. 364). On a scale ranging from 1 (*not at all*) to 7 (*very strong*), the average response was 4.94 (Opp, 2001, Table 2, p. 368). Indeed, the frequency of the responses rose monotonically across the scale. Moreover, individual differences in the strength of this belief were positively correlated with the frequency of voting in past elections.

We were unaware of Opp's (2001) results when we designed a study to test the hypothesis of a belief in one's own influence more indirectly. We reasoned that when people contemplate their choice between voting and abstaining, they simulate their anticipated emotional responses to the four possible events given by the intersections of their own choice (to vote or to abstain) and the election outcome (victory or defeat). It seemed plausible that if people harbor a sense of their own significance, they will be most sensitive to the case in which they voted and won and to the case in which they abstained and lost. Counterfactually removing one's vote and adding one's vote respectively in the first and the second scenario might, at least in theory, alter the outcome. In the case in which people voted and lost and in the case in which they abstained as won, no amount of counterfactual thinking can make a difference.

Using the vignette approach introduced by Quattrone and Tversky (1984), we asked participants to imagine each of the four scenarios and rate their anticipated level of satisfaction, regret, wasting a vote, and confidence in future voting on 9-point scales (Acevedo & Krueger, 2004, Experiment 1). The critical variable of perceived "waste" yielded the expected interaction between own choice and election outcome. Ratings were lower for the vote–win and the abstain–lose scenarios than for the vote–lose and the abstain–win scenarios. The confidence variable showed the inverse pattern. Participants expressed the strongest intentions to vote in the future if they felt their current vote was not wasted (vote–win) or would not have been wasted if it had been cast (abstain–lose). Figure 3 (top) shows a stylized summary of the predictions and the results obtained for judgments of waste and judgments of confidence.

We further assumed that anticipatory responses would reflect a temporal trajectory. Whereas judgments of waste are made with reference to the past, judgments of confidence refer to the future. Therefore, the former should mediate the scenario effect on the latter, but not vice versa. Figure 3 (bottom) shows that the path (in brackets) from the predicted interactional pattern (coded as a set of weights to identify high and low ratings over conditions) to voting confidence was reduced when judgments of waste were controlled. In contrast, judgments of confidence did not mediate the path from the interactional pattern to judgments of waste. These findings were replicated, although with attenuated effect sizes, in a more realistic scenario using the presidential elections of 2000 as the decision frame (Acevedo & Krueger, 2004, Experiment 2).

From a game-theoretic perspective, the belief in personal influence resembles the strategy of PAVLOV. Though named after the namesake of classical conditioning, this strategy has more in common with Thorndike's (1898) "law of effect." PAVLOV repeats a choice after success and it switches after failure. After electoral victory, a PAVLOVian voter resolves to vote again and an abstainer to abstain again. After defeat, a voter resolves to abstain, and an abstainer to vote. The strategy capitalizes on the past correlation between choices and outcomes, which can be found in electoral databases (Kanazawa, 1998, 2000) and recovered in computer simulations (Bendor, Diermeier, & Ting, 2003). Indeed, winning parties or candidates account for more votes than losing parties or candidates. Yet a person who thinks that this correlation reveals his or her personal power to control the outcome is being superstitious.

The self-regulatory strategy examined in our work does not require a correlation over past choices and outcomes. After a preview of the four possible choice–outcome combinations even a first-time voter can recognize the personal benefits of voting. However, neither PAVLOV nor its future-oriented derivative can be used to manage interpersonal transactions in large-scale social dilemmas, such as national elections. Citizens cannot send others a message by switching to voting after experiencing a loss while abstaining. PAVLOV does connect, however,
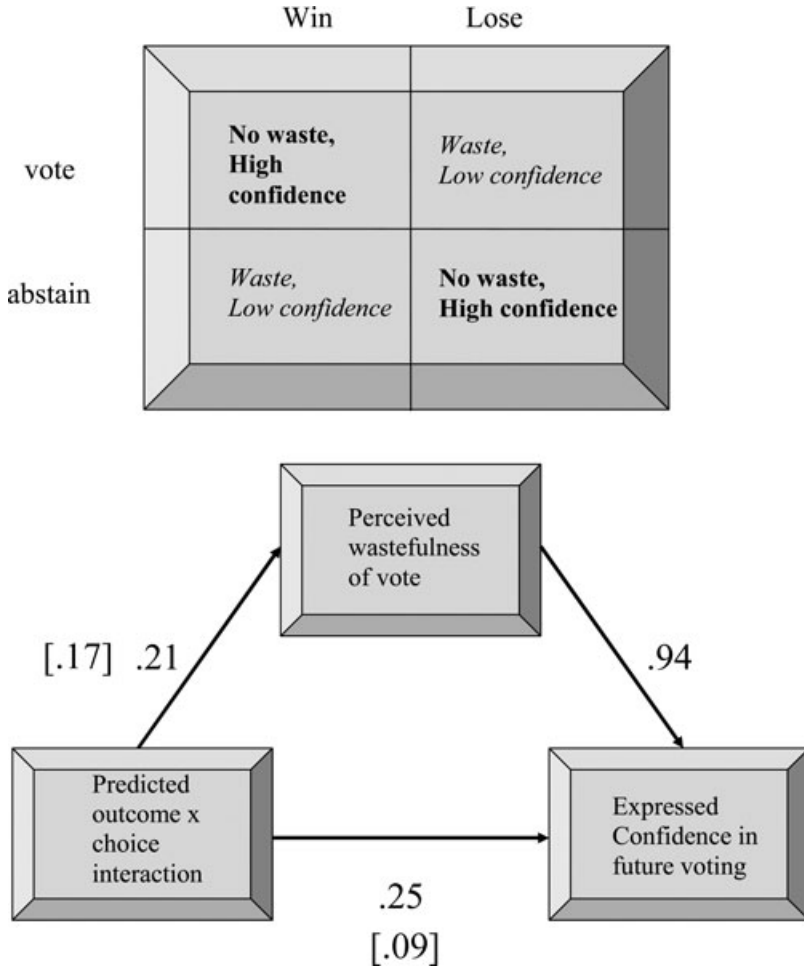
Fig. 3. Anticipated wastefulness of voting and confidence in future voting as a function of one's own choice and election outcome (top). The path from the intersections of choice and outcome to confidence in voting as mediated by perceptions of wasting a vote (bottom). Partial paths are shown in brackets.

with evidential decision making. After a victory, voters may be hesitant to switch to abstention for fear that their own abstention would signal widespread abstention among other party supporters. Conversely, abstainers may switch to voting after a defeat in hopes that their own switch signals similar intentions among party supporters. Yet evidential decision making was independent of the PAVLOV-like pattern of self-regulatory voting in our sample (Acevedo & Krueger, 2004).

The view that voting is a social dilemma suggests that judgments of satisfaction (and inversely, judgments of regret) should reflect a preference ranking characteristic of social dilemma. Instead, participants were more satisfied with the victory-and-vote scenario ($M = 7.47$) than with the victory-and-abstain scenario ($M = 2.42$). Similarly, they anticipated less regret for the former scenario ($M = 1.40$) than for the latter ($M = 2.87$). Conversely, participants were more satisfied with the defeat-and-vote scenario ($M = 5.04$) than with the defeat-and-abstain scenario ($M = 2.00$); and they anticipated less regret for the former ($M = 3.30$) than for the latter ($M = 6.48$).

One interpretation of this pattern is that voting is intrinsically pleasurable. Alternatively, people attribute instrumental value to their own voting behavior and do not see the election outcome as independent of what they do. They are more satisfied with the victory-and-vote scenario than with the victory-and-abstain scenario because they view their vote as critical. Similarly, they are less satisfied with the defeat-and-abstain scenario than with the defeat-and-vote scenario because they failed to exert their influence in the latter. This pattern is consistent with a strategy of regret minimization (Blais, Young, Fleury, & Lapp, 1995; Ferejohn & Fiorina, 1974). If voting were only intrinsically valuable, confidence judgments should have been equally high in all four scenarios. Recall, however, the critical differences among the scenarios. Confidence judgments were particularly high in the victory-and-vote scenario and in the defeat-and-abstain scenario. In other words, high satisfaction and low regret appear to motivate continued voting, whereas low satisfaction and high regret motivate the abandonment of abstention.

We agree with Opp (2001) that the belief in the instrumental value of one's own vote is irrational in the sense that it is false. Nevertheless, this belief is consistent with a broader interpretation of the rational choice model according to which it is subjective rather than objective probabilities that determine whether actors are being rational (Fischer, 1999). In this sense, our data suggest people are being rational when using their instrumental beliefs—no matter how mistaken they may be—as a guide for their future behavior. The self-regulating voter is internally consistent, though factually wrong. In a broader evolutionary sense, instrumental beliefs are rational in that they are adaptive. The strategy of PAVLOV does, after all, yield desirable outcomes for those who use it (Nowak & Sigmund, 1993).[6]

Conclusion

The game-theoretic approach has three theoretical and practical implications. First, the reasoning strategies explored here strike a middle ground between

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[6]PAVLOV is beaten by its main competitor, tit-for-tat, when pitted against a strategy of ruthless defection (Wu & Axelrod, 1995). Although there is a risk of facing such a strategy in a two-person game, it is unlikely that a voter will be chronically among constituents who refuse to vote.

orthodox rational choice theory (Downs, 1957) and theories of expressive or duty-bound voting (Feddersen, 2004). The former is too restrictive in its assumptions about what ordinary voters are able and willing to contemplate; the latter are not restrictive enough in their assumptions about just what the intrinsic benefits of voting are and how they are to be measured. Evidential decision making and PAVLOVian strategies of self-regulation are statistically coherent, evolutionarily adaptive, and tractable in research.

Second, the view that voting is egocentric and boundedly rational satisfies the dual requirements of internal validity (i.e., to generate testable hypotheses) and external validity (i.e., to account for trends in the natural ecology of voting). We discussed the fit between the egocentric-reasoning model and large social trends in voting behavior in an earlier article (Acevedo & Krueger, 2004). We can now add the common finding that voting becomes more likely with higher education (Plutzer, 2002). This finding is significant because, by and large, education and intelligence are associated with rational decision making (Stanovich, Sá, & West, 2004). If voting were irrational, the negative correlation between education and rationality would be unique to this domain, and its explication would require additional theoretical efforts.

Third, the present account suggests new ways of getting people to vote. The standard approach is to tell people that their own individual votes matter (Federal Election Commission, 1999). This claim is false. Opp (2001) may have found strong beliefs in personal influence in part because people believe the propaganda. When people are told the truth about orthodox rational choice theory, they become less likely to vote (Blais & Young, 1999). An alternative approach to increase turnout would be to prime people's projective reasoning or their ability to simulate their own future emotions. The former can be achieved by emphasizing group identity. The more typical a person perceives her- or himself to be as a member of a party or supporter of a cause, the more readily she or he will project her or his preferences and choices onto the group. By the logic of evidential decision making, heightened in-group projection will increase the person's likelihood to vote. The latter can be achieved by inviting people on a tour of guided visualization. When they realize what each of the four possible outcomes (from vote–win to abstain–lose) will mean to them, they will be more likely to vote. If it is possible to achieve the social good without deceiving the citizens, what is the excuse for not doing it?

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