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ATTITUDE-DEPENDENT ALTRUISM, TURNOUT AND VOTING

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ABSTRACT

This paper presents a goal-oriented model of political participation based on two psychological assumptions. The first is that people are more altruistic towards individuals that agree with them and the second is that people's well-being rises when other people share their personal opinions. The act of voting is then a source of vicarious utility because it raises the well-being of individuals that agree with the voter. Substantial equilibrium turnout emerges with nontrivial voting costs and modest altruism. The model can explain higher turnout in close elections as well as votes for third-party candidates with no prospect of victory. For certain parameters, these third party candidates lose votes to more popular candidates, a phenomenon often called strategic voting. For other parameters, the model predicts "vote-stealing" where the addition of a third candidate robs a viable major candidate of electoral support.

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1 Introduction

This paper presents a simple model of turnout and voting based on two features of human psychology. The first is people's tendency to be more altruistic towards those who agree with them. The second is the gain in self-esteem and well-being that people tend to experience when they find out that others share their opinions. This second feature implies that each vote for a candidate (or a proposition) raises the welfare of people who think highly of this candidate (or proposition), since this vote validates their opinion. Voting for a candidate thus gives people an opportunity to enhance the welfare of those they agree with.

The effect of voting that is stressed here is that it changes people's perception of how many individuals have a particular view. Every vote contains some information about this because people are uncertain regarding the views of abstainers. If I expect an abstainer to agree with me with probability $\tilde{p}$, one less abstention coupled with one more vote for the candidate I favor raises my estimate of the expected number of people that agree with me by $(1-\tilde{p})$. This cannot be expected to have a very substantial effect on any one person's utility. The importance of this phenomenon lies in the fact that the number of people changing their perception is as large as the electorate. Thus, even if a single vote has only a very slight effect on the utility of any one other person, and even if each person's altruism for individuals that agree with them is small, the capacity to give a tiny bit of pleasure to a large population can be sufficient to induce people to incur realistic costs of voting.

This sets the model apart from pivotal voter models based on Downs (1957) and Riker and Ordeshook (1968). As has been extensively discussed, these models cannot explain why so many people vote. Once votes are numerous, the probability that one vote will tip the election is negligible. It is even less appealing to imagine that people vote for third-party candidates to ensure their victory since there is often complete consensus that they have no chance of winning.

This lack of electoral viability does not stop such candidates from obtaining votes, even in close contests. An extreme set of examples of this phenomenon was observed in the 2000

U.S. Presidential election in Florida. In this election, each of 8 candidates representing the Green, Reform, Libertarian, Workers World, Constitution, Socialist and Socialist Workers Parties obtained more votes than the 537 votes that separated the victor George Bush from his runner-up Al Gore. While the least popular of these obtained 562 votes, the Green Party candidate Ralph Nader obtained over 97,000 votes and was accused by Democrats of having cost Al Gore the U.S. presidency.[1]

People who vote for third party candidates can be divided in two: those that would have abstained if no minor candidate were running and those that would have voted for a major party candidate instead. Lacy and Burden (1999) call the latter a "vote stealing" effect of third party candidates while they call the former a "turnout" effect of their presence. They find that Ross Perot's 1992 Presidential candidacy had both effects. The turnout effect may be less problematic for conventional theories of voting because the resulting votes for third party candidates do not affect the election's outcome. The vote stealing effect, by contrast, can lead a viable major party candidate to lose the election as a result of the entry of an unviable one.

Thus effect seems particularly challenging for pivotal voter theories. If the people who sympathize with a major candidate vote for a minor one, they are essentially helping the major candidate they like the least. The only existing academic explanation for these small-party votes appears to be the Brennan and Buchanan (1984) idea that people derive utility from expressing an attitude by voting. The model presented here is related to this "expressive voting" idea in the sense that, unlike what is true in pivotal voter models, the purpose of voting is not primarily to affect the election's outcome.

An observation regarding third party candidates that is more consistent with conventional theories of voting is that people who prefer minor candidates sometimes vote for major party candidates that have a chance of electoral success (Cain 1978, Abramson *et al* 1992). This phenomenon has been dubbed "strategic voting" (see Cox 1997) and has been taken to be

[1]Added to Gore's victory in other states, a Gore victory in Florida would have led him to become U.S. president. For evidence that many Democrats were angry at Nader, see "A Fading 'Nader Factor' ", Washington Post, October 22, 2004.

supportive of the idea that people vote to affect the election's outcome. This paper provides a rather different interpretation. This is that voting for major party candidates has the benefit that more people derive utility from learning that people agree with them. One advantage of this interpretation is that "strategic voting" and "vote stealing," which seem contradictory in conventional accounts, can be fit into the same framework. Which outcome prevails then depends only on the taste parameters characterizing the people who like third party candidates.

A different observation that has played a central role in the literature is that turnout is larger in closer elections (Blais 2000). This has been taken to be supportive of pivotal voter models on the ground that some leading alternatives do not share this prediction. In particular, theories of expressive voting where people derive direct utility from expressing a point of view through their vote do not predict any association between turnout and the margin of victory.[2] The same is true if people vote only out of a sense of duty. Similarly, several observers have noted that Ferejohn and Fiorina's (1974) theory of voting, according to which people vote to avoid the regret of failing to vote for a candidate that loses, does not predict the observed relation between turnout and victory margin across elections.

The current model does imply that turnout should fall when elections are more lopsided although, consistent with the evidence, this effect is predicted to be quite modest. The reason why election closeness matters is that the altruistic benefits of voting are reduced in more lopsided elections. If a candidate can expect the support of the vast majority of the population, his supporters do not derive as much utility from an additional vote because they already expect abstainers to agree with them. At the other extreme, the vicarious benefits of voting for a candidate are lessened as the number of his supporters fall.

One reason third-party candidates continue to get votes is that this latter effect is offset by the fact that each vote for a third party candidate is more valuable to its supporters for

[2]Schuessler (2000) assumes that people vote to attach themselves to a group and further supposes that the benefits people obtain from this attachment depend on the group's size. This model of expressive voting should thus imply a connection between turnout and voting outcomes. These implications are likely to depend heavily on the properties one assumes about the benefits of attachment, however.

being more unexpected. In addition, supporters of minor candidates may find it particularly valuable to hear that others agree with them. This fits with the reason given by the Libertarian presidential candidate in 2000, Harry Browne, for his interest in obtaining votes. "Like other Libertarians, I was disappointed with the vote total we received. I had hoped we would achieve two electoral breakthroughs: 1. Surpass a million votes for the first time. 2. Outpoll Pat Buchanan and the Reform Party. Neither achievement would have created a turning point in American politics. But either one would have been a boost to Libertarian morale..."[3]

This paper is not the first to use non-selfish preferences as a rationale for voting. Jankowski (2002) and Fowler (2006) consider altruistic individuals who vote because they internalize other people's benefit from the election of a particular candidate. The current model shares these models' prediction that altruists with strong political opinions are more likely to vote (for which Fowler (2006) provides empirical support). My model differs in that I suppose that people also derive utility from discovering that others agree with them. This is what makes the probability of being pivotal less important in my model.

Other related papers suggest that people might be willing to vote to help the interest group that they belong to. In Uhlaner (1989) group members vote for the candidates chosen by their leaders, with leaders obtaining promises from candidates in exchange for their group's support. Whether these promises involve resources or changes in the candidate's electoral platform, their value hinges on the candidate winning the election. Her model is thus able to explain why major candidates can count with the votes of different groups.

However, Uhlaner (1989) cannot explain why candidates with no prospect of winning an election stand for office rather than taking advantage of their support to win concessions from more viable candidates. Situations where the entry of third-party candidates rob a leading candidates of votes and cost the candidate the election seem particularly inconsistent with her model. In the current model, this outcome is possible because group leaders are unable to redirect votes and negotiate with leading candidates. The Feddersen and Sandroni (2006)

[3]This report can be found in http://www.harrybrowne.org/2000/toc.htm.

model shares with Uhlaner (1989) that it can be interpreted as one where leaders can induce turnout to win elections, though it also has an interpretation where groups of voters vote if they feel that doing so is directly beneficial to their group. However, the only benefits in this model are the benefits that accrue with electoral victory, so this model cannot explain votes for third-party candidates either.

The current paper rationalizes voting on the basis of two psychological assumptions for which there is some evidence in the literature. Evidence for the idea that people are more helpful and have warmer feelings towards those that agree with them has been presented in two kinds of studies. The first involves field and experimental data that people report more "liking" for people that they agree with. Byrne (1961) obtains this result by manipulating experimentally the extent to which a confederate agrees with a subject, and numerous variants of this study have been carried out since.[4] Similarly, Brady and Sniderman (1985, p. 1067) show that people who describe themselves as liberals report warmer and more favorable feelings towards liberals than towards conservatives, while self-described conservatives do the reverse.

Expressions of liking are easier to elicit in an experiment than altruism or helping behavior. The two are likely to be linked, however. The subjects in Kanekar and Merchant (2001) expect more helping from people who like each other more. More directly, Karylowski (1978) obtained more help in the laboratory from people who were led to believe that their experimental partners were more similar to them.[5]

A second demonstration that people are more helpful to those they agree with is based on the lost letter technique pioneered by Milgram *et al* (1965). For purposes of this paper, Tucker *et al.* (1977) is particularly revealing. They left parcels with either a 2$ money order or 2$ in cash on the sidewalk to be picked up by strangers. Attached to these funds were contribution forms and a stamped and addressed envelope that made it clear that the funds

[4]See Montoya and Horton (2004) for a recent example.

[5]Similarity of interests, rather than similarity of attitudes, was used in this study. Still, the empirical connection between liking and similarity found in the literature seems robust to varying the dimension of similarity.

were intended for a medical charity. In some of the experimental treatments, there was also a form where the purported contributor had filled out an opinion questionnaire that was addressed to a polling organization. These packages were left in a predominantly Jewish neighborhood and the stated opinions were either favorable to American aid to Israel or opposed such aid. The paper reports that the cash and the money order were more likely to be forwarded if the questionnaire contained pro-Israeli views, which is consistent with the idea that people are more inclined to help strangers if they agree with them. Notice in particular that people's desire to help the medical charity is not sufficient to explain this finding, since this would not explain a differential rate of forwarding the funds.[6]

In a related study, Sole *et al.* (1975) used money orders for medical foundations that were attached to questionnaires relating to other political issues (including discrimination and the desirability of war). When the opinions expressed in these questionnaires matched more closely the opinions that were obtained from people chosen randomly in the same neighborhood, a larger fraction of the money orders was forwarded. This effect was stronger when the opinions related to important issues such as discrimination than when they referred to less important issues (such as whether groceries should be delivered for free).

The second psychological assumption of this paper is that people's well-being rises when they find that others agree with them. This may be seen as intrinsically difficult to establish because well-being is unobservable. There is, however, some experimental evidence showing that self-reported feelings are correlated with information that subjects are given about the attitudes of other people. Kenworthy and Miller (2001) asked subjects whether they were for or against the death penalty and then told them the responses to this question in a (bogus) poll. After they were given this information, subjects were asked to report their feelings. Respondents who were told their position was losing support reported feeling substantially worse than those that were told that support for their position was growing. In a related study, Pool *et al.* (1998) elicited attitudes towards an issue from students and then told

[6]By contrast, the fact that the questionnaire was also forwarded more frequently when it contained pro-Israeli views could be attributable to pro-Israeli bias.

subjects that a group that the students identified with held opposite views. This led to a measurable drop in reported self-esteem.

The paper proceeds as follows. The next section presents the model's general structure and derives its equilibrium conditions. Section 3 then turns its attention to electoral competitions with two types of people, each of which supports a different candidate for office. Its main result is that turnout is larger in closer elections. Section 4 considers electoral competition in which small groups of people prefer minor candidates to major ones. It shows that, under plausible assumptions, third-party candidates with no prospect of winning can receive votes that can cost a major candidate the election. It also shows that, for certain parameters, the model is consistent with the observation that some people stop voting for viable major candidates when third-party candidates stand for office. For other parameters, people continue to vote for major candidates even though they prefer the position of third-party candidates. Section 5 offers some concluding remarks.

2 Basic Setting

People's preferences depend on their type. As in spatial voting models, let the vector r_i denote the ideal position of individuals of type i and let d_{ij} be a measure of the subjective distance between r_i and r_j with $d_{ii} = 0$. Candidates also belong to these types, although there can be more types than candidates. Because I assume that there is at most one candidate of each type, the candidate who prefers r_k can be referred to as candidate k.

Let y_{ix} be the "material payoffs" of individual x of type i. This material payoff is assumed to depend on three variables. First, as in Downs (1957), any individual of type i suffers the loss d_{ie} when the elected candidate is of type e.[7] Second, the individual incurs the cost c if he votes, where this cost is a random variable drawn independently for each person from the

[7] In the Downs (1957) framework, this leads people to vote for the candidate k with the lowest value of d_{ik}. There is an extensive empirical literature that has sought to measure these distances by comparing attitudes of people, candidates and parties. This literature has studied whether people do indeed favor parties and candidates whose distance is the lowest. See Markus and Converse (1979) for a classic treatment and Blais *el at.* (2001) for a more recent effort.

common probability density function $F(c)$ with range $[\underline{c}, \bar{c}]$. Third, and this is one of the key assumptions discussed in the introduction, the payoff y_{ix} falls when individual x expects to be more distant from the rest of the population.

Let N be the size of this population, p_j be the *ex ante* probability that an individual is of type j and N_j be the actual number of individuals of this type. If individuals' type were observable, the N_j could be thought of as the number of draws of type j in a sample of type N where each observation is drawn from a multinomial distribution with parameters $\{p_1, \ldots, p_I\}$ where I is the number of types. This way of thinking about the uncertainty concerning N_j is useful below when people form expectations of the N_j on the basis of what they actually observe, which are the vote totals for each candidate.

Individual x of type i's material payoffs depend on his expectation of the total distance D_i, which equals

$$D_i \equiv \sum_{j \neq i} N_j d_{ij}. \tag{1}$$

This distance measure is thus based on the same d_{ij}'s that affect candidate preferences and that have been estimated in the empirical literature on the spatial voting model. The expectation of D_i differs before and after the election. Let $E^0_{ix} D_i$ denote the expectation held before the election by person x of type i while $E^1_{ix} D_i$ denotes this expectation after the election. People's instantaneous utility presumably depends on their current perception of D_i. Even right before an election, however, individuals know that their lifetime utility is much more affected by their perception of D after the election since more time will elapse afterwards than before.

For simplicity, suppose that individuals of type i are concerned only with $E^1_{ix} D_i$ so that their utility from others' opinions is $S_i(E^1_{ix} D_i)$ with $S'_i < 0$ where S'_i is the derivative of S_i with respect to its argument. To simplify further, let the S_i function be linear so that $S_i = S_{i0} - S'_i E^1_{ix} D_i$ where S_{i0} and S'_i are constants. The material payoff y_{ix} is then

$$y_{ix} = -c - d_{ie} + S_{i0} - S'_i E^1_{ix} \sum_{j \neq i} N_j d_{ij}. \tag{2}$$

where the cost c is incurred only if the individual votes. While this functional form appears like a reasonable first step for analyzing the impact of other people's opinions on a person's well-being, it is important to stress that the available psychological evidence is not sufficient to pin down the details of this dependence. It is possible, for example, that well-being depends on the average rather than the total distance. This topic is discussed again briefly below.

An individual's vote has no effect on his own expectation of how many people of each type there are, so its only possible effect on (2) is through the effect on d_{ie}. On the other hand, other peoples' votes do affect an individual's y_{ix} insofar as they affect the individual's estimates of the number of people of types different from his own. One complexity here is that, because individuals know their own type and not that of others, they do not all have the same estimate of the number of people of each type. Nonetheless, the shift of one person from abstaining to voting for a particular candidate has the same effect on everyone else's estimate of the N_j's. The reason is that everyone agrees on the probability that an abstainer is of type j (where this probability is denoted by $P(j|A)$) and everyone agrees on the probability that someone who votes for candidate k is of type j (where this probability is denoted by $P(j|k)$). The shift by one person from abstaining to voting for k thus raises all other people's expectation of N_j by $[P(j|k) - P(j|A)]$.

The probabilities $P(j|k)$ and $P(j|A)$ depend on two ingredients. The first is the unconditional probability that people are of type j. Under the assumption that the p's are known parameters, this is p_j. The second is the probability that people of type j vote for candidate k, and I denote this probability by z_j^k. The total probability that an individual of type j votes is then $z_j = \sum_k z_j^k$. These probabilities of voting need to be determined in equilibrium. To derive the equilibrium conditions that these probabilities must satisfy, I study the effects of voting on y_i by taking these probabilities as exogenous.

Using Bayes rule, the probability that a person who votes for k is of type j equals

$$P(j|k) = \frac{p_j z_j^k}{\sum_i p_i z_i^k}. \tag{3}$$

In the simple case where people of type k only vote for candidate k and no other type votes for this candidate, z_i^k is zero except when $k = i$ so that $P(k|k) = 1$ and $P(k|j) = P(j|k) = 0$ for $j \neq k$. A vote for k is then fully informative about the type of the voter.

For an individual who does not vote (or abstains), the probability that he is of type j is

$$P(j|A) = \frac{p_j(1 - z_j)}{\sum_i p_i(1 - z_i)}. \tag{4}$$

If every type was equally likely to vote, all the z_i's would be the same and this would reduce to the *ex ante* probability p_j.

Voting matters in this model because $[P(j|k) - P(j|A)]$ can be non-zero even though the *ex ante* probability that a voter is of a given type is known by everyone. This is perhaps most transparent when there are two types and two candidates, with all the voters of type a voting for candidate a and all the voters of type b voting for candidate b. In this case, $P(a|a) = P(b|b) = 1$ and, if both types are equally likely to vote, $P(a|A) = p_a$. Thus, the probability that people assign to an individual being of type a moves from p_a to 1 if this individual moves from abstaining to voting for a. While individual votes are not observable, vote totals are. Thus, an individual that stops abstaining and votes for a raises everyone's expectation of N_a by $1 - p_a$.

The change in y_{ix} when someone other than individual x moves from abstaining to voting for candidate k is thus δ_i^k where

$$\delta_i^k = -S_i' \sum_j d_{ij} \Big[P(j|k) - P(j|A)\Big]. \tag{5}$$

These δ's represent externalities from voting, and lead altruists to vote. The nature of this externality can be understood from equations (3), (4) and (5). When people of a type j that is distant from i tend not to vote for candidate k, their $P(j|k)$ is low, and a vote for k indicates that they are not of type j. As a result, people of type i experience an increase in utility when there is an additional vote for this candidate. In addition, the more people of type i vote (do not abstain), the larger is $P(j|A)$ so that it is more likely that abstainers are distant from i. This raises i's gain from a vote for k.

People are assumed to be more concerned with the welfare of those that they agree with. Thus, the altruism of an individual of type i for an individual of type j is given by λ_{ij}, which is declining in d_{ij}. Consistent with the evidence in Andreoni (1989), I suppose that the altruism in is of the "warm glow" variety so that individual x derives utility from his own kind acts towards others while his utility does not depend on the pleasure that others derive from actions that x does not control.[8] When individual x of type i votes, he maximizes

$$u_{ix} = E^0_{ix}\Big[y_{ix} + (N_i - 1)\lambda_{ii}\hat{y}_{ix} + \sum_{j \neq i} N_j \lambda_{ij} y_j\Big], \tag{6}$$

where the expectation E^0_{ix} has a zero superscript to denote that it is based on information available before the election, $\hat{y}_{ix}$ is the material payoff of the people other than x that are of type i, y_j is the common material payoff of people of type j, and λ_{ii} is the altruism that people of type i have for each other. Thus, the gain in utility for a person of type i when switching from abstaining to voting for k is

$$u^k_i = -\Delta^k(d_{ie}) - c + E^0_i\left[\lambda_{ii}(N_i - 1)\delta^k_i + \sum_{j \neq i} \lambda_{ij} N_j \delta^k_j\right]. \tag{7}$$

In this equation, $\Delta^j(d_{ie})$ is the expected increase in the distance between type i and the type of the elected representative e when one additional vote is cast for j, and E^0_i is the expectation held by all people of type i before voting (when they all have the same information set). Since the voting probabilities z^k_j are known in equilibrium, equations (3), (4), and (5) imply that δ^k_i is known with certainty before voting takes place. This implies that (7) can be written as

$$\begin{aligned} u^k_i &= -\Delta^k(d_{ie}) - c + (N-1)\sum_j \lambda_{ij} p_j \delta^k_j = -\Delta^k(d_{ie}) - c + G^k_i \qquad (8) \\ &\text{where} \qquad G^k_i \equiv (N-1)\sum_j \lambda_{ij} p_j S'_j \sum_m d_{jm}\Big[P(m|A) - P(m|k)\Big]. \end{aligned}$$

The first equality is based on the fact that $E^0_i N_j$ equals $(N-1)p_j$ when $i \neq j$ while $E^0_i N_i$ equals $1 + p_i(N-1)$ because people know their own type. The second equality is the result of substituting equations (5) into the first equation of (8). Since (3) and (4) imply that the

[8]This assumption does not affect the analysis of voting nor the comparative statics results. It does, however, reduce the benefits that individuals receive when others agree with him.

conditional probabilities $P(m|k)$ and $p(m|A)$ depend on the z's, the incentive to vote does as well.

If people of type i vote, they vote for candidates whose u_i^k is as large as possible. In principle, there can be more than one such candidate, so it is useful to define the set V_i of the preferred candidates of type i:

$$V_i = \{k : G_i^k - \Delta^k(d_{ie}) \geq G_i^m - \Delta^m(d_{ie}), m \neq k\}.$$

Any member of type i for whom u_i^k is positive for the candidates k belonging to V_i wishes to vote for one of these candidates. Thus, the fraction of people of type i that wish to vote is the fraction for whom the cost of voting c is below the highest value of $G_i^k + \Delta^k(d_{ie})$. In equilibrium, all the people who wish to vote do so. Thus, an equilibrium is a set of z_j^m's for all types j and all candidates m such that

$$z_i = F(c_i^*) \qquad \text{where} \qquad c_i^* = G_i^k - \Delta^k(d_{ie}) \qquad \text{if} \qquad k \in V_i \tag{9}$$

In this definition, the c_i^*'s are the cutoff levels of voting cost such that people vote when their costs are below this and abstain when their costs exceed this. If $c_i^* < \underline{c}$, the benefit of voting is less than the smallest cost of voting and no person of type i votes. I show below that this can occur for some types in equilibrium. It is easy to see, however, that there cannot be an equilibrium without votes under the weak and standard assumptions that the benefits of having an elected official of one's own type exceeds the minimum voting costs $\underline{c}$.

In much of the analysis, I let F be invertible, and thus strictly increasing. The cutoff cost levels c_i^* are then equal to $F^{-1}(z_i)$. In this case, any increase in type i's benefits of voting $G_i^k + \Delta^k(d_{ie})$, lead to an increase in the turnout z_i. It sometimes simplifies the analysis, however, to suppose that some types find themselves in equilibrium at cutoff cost levels c_i^* that don't correspond to any individual's level of voting cost. This can occur when F has a flat area so that no one has costs between c_1 and c_2, and one of these is below the equilibrium c_i^* while the other is above. In this case, small changes in $G_i^k + \Delta^k(d_{ie})$ do not affect type i's equilibrium turnout.

3 Two-Candidate Equilibria

This section considers the standard case where people can be of two types and there are two candidates. Subsection 3.1 concentrates on equilibria where, as in spatial voting models, each type votes for its favorite candidate. Subsection 3.2 then considers equilibria where they do not, and shows that these often exist but are less robust to plausible modifications of the model.

3.1 Equilibrium where people vote for their favorite candidate

Let the two types and candidates be denoted by a and b and, while p_a need not equal p_b, these types are symmetric with $S'_a = S'_b = S'$, $d_{ab} = d_{ba} = d$, and $\lambda_{aa} = \lambda_{bb} = \lambda_0$. Suppose first that the two types feel neither altruism nor spite for one another so that $\lambda_{ab} = \lambda_{ba} = 0$. The vicarious benefit of voting G_i^k is particularly easy to compute in this case because the double summation in (8) reduces to one term.

For type a, the vicarious benefit of voting equals $(N-1)\lambda_0 S' d[P(b|A) - P(b|k)]$. This says that the larger is the difference between the probability that an abstainer supports b and the probability that a person voting for k supports b, the more useful is voting for k as a signal that indicates that there are fewer supporters of b. Since people of type a prefer to have an elective representative of type a, a sufficient condition for them to vote for a is that G_a^a exceed G_a^b, which requires that $P(b|b) > P(b|a)$ or, using (3),

$$\frac{p_b z_b^b}{p_a z_a^b + p_b z_b^b} > \frac{p_b z_b^a}{p_a z_a^a + p_b z_b^a} \qquad \text{or} \qquad z_a^a z_b^b > z_a^b z_b^a. \tag{10}$$

This shows that people of type a are more attracted to candidate a, the more other people of type a vote for a and the more people of type b vote for b. Since the same analysis applies to type b, there is positive feedback in that increases in the fraction of people of type i that vote for candidate i lead people of type i to be more inclined to vote for i. This logic implies that mixed strategy equilibria tend to be unstable. It also implies that there always exists a pure strategy equilibrium where, consistent with spatial theories of voting, people vote for their favorite candidate and $z_a^b = z_b^a = 0$.

I now analyze this equilibrium. Since a vote for a indicates one is not of type b and viceversa, $P(a|b) = P(b|a) = 0$. Thus, the equilibrium conditions in (9) when F is invertible become

$$\frac{F^{-1}(z_a) + \Delta^a(d_{ae})}{N-1} = \lambda_0 p_a S'dP(b|A) = \lambda_0 p_a S'd \frac{p_b(1-z_b)}{p_a(1-z_a) + p_b(1-z_b)} \tag{11}$$

$$\frac{F^{-1}(z_b) + \Delta^b(d_{be})}{N-1} = \lambda_0 p_b S'dP(a|A) = \lambda_0 p_b S'd \frac{p_a(1-z_a)}{p_a(1-z_a) + p_b(1-z_b)}, \tag{12}$$

where the second equality for each equation is obtained using (4). Ignoring the effects on the election outcome Δ, this has the symmetric solution

$$F^{-1}(z_i) = (N-1)\lambda_0 S'dp_a(1-p_a) \qquad i = a, b. \tag{13}$$

While this equation cannot be expected to hold exactly if the Δ's are nonzero, it should provide a good approximation for the large turnout rates that are observed. It has the remarkable implication that both types turn out with the same probability and that this probability rises with the tightness of the election (with $p_a(1-p_a)$ reaching a maximum when $p_a = .5$). The intuition for this result is that an increase in p_a has two opposing effects on the extent to which a supporter of r_a finds it attractive to vote. On the one hand, it raises the expected number of people that gain from hearing that there is one more person of type a. On the other hand, an increase in p_a also implies that the "good news" component of such a vote is reduced, since it leads abstainers to become more likely to support r_a as well. Indeed, when turnout rates are the same for both groups, this "good news" component is proportional to $1-p_a$ so that the vicarious benefit from voting is proportional to $p_a(1-p_a)$. The same logic applies to b since $p_a = 1 - p_b$.

Equation (13) can also be used to obtain estimates of the benefits of voting at a symmetric equilibrium. These are given by the right hand side of this equation. Suppose that λ_0 is equal to .05 so that each individual puts .05 as much weight on the utility of like-minded people as he does on his own. Suppose also that $S'd$ equals .001 of a penny so that an individual gains a penny when he discovers that another 1000 people agree with him and that, analogously to the US case, N equals 150 million. This corresponds to an individual gaining \$15 when he learns that an additional 1% of the population agrees with him. In a tight election with $p_a = .5$, the right hand side of (13) is then equal to \$18.75. This implies that all those for whom c_i is lower than \$18.75 should vote in national elections. Turnout should thus be substantial if, as argued by Blais (2000 p. 84-87), voting costs are fairly modest.[9]

For variations in the closeness of elections of the magnitude observed in advanced democracies, (13) implies that changes in p_a should have small effects in turnout rates. If $p_a = .55$, the odds facing candidate b become vanishingly small even with quite small turnout rates. Still, keeping the previous parameters, all individuals whose costs of voting is lower than \$18.56 should still vote. The exact fall in turnout thus depends on the fraction of people with voting costs between \$18.56 and \$18.75. Still, the predicted falls in turnout are probably not dramatic for plausible choices of the pdf F. This fits with the conclusion of Blais (2000, p. 137-8) that "a gap of ten points between the leading and the second parties seems to reduce electoral participation by only one point."

Equation (13) implies that turnout should be increasing in the number of eligible voters N. For a given S', that is for a given increase in the utility of voters when there is one additional person that agrees with them, a larger N implies that more people benefit from this additional vote so that voters derive more vicarious utility from voting. This result hinges crucially on the supposition that people care about the total distance D as opposed to caring about other functions of the d's. If, for example, people cared about the *average* distance between themselves and other voters, the analysis above would remain valid but S' would be proportional to $1/(N-1)$.[10] Predicted turnout rates would then be independent

[9] It might be imagined that rounding would destroy this result. This is not the case when the size of rounding errors is unpredictable before the election and unknown thereafter. Suppose, in particular that votes are rounded to the nearest 100 (or that voters ignore the last two digits in the reported results) but that voters expect the last two digits of the actual number of votes to be uniformly distributed between 00 and 99. By voting for a candidate they thus have a 1/100 chance of raising the last two digits from 49 to 50 and thus increasing by 100 other people's expectation regarding this candidates' vote total. Their expected benefit from one vote is thus 1/100 times the expected benefit from 100 votes. For linear S, this is equal to the benefits calculated in the text.

[10] It might be thought that if people cared about the average distance, elections would not contain any useful information given that people are assumed to already know the probabilities associated with all the

of N. Thus, as discussed above, the model's implications regarding the effect of changes in the population depend on aspects of preferences about which more information is needed.

The analysis has treated each voter as caring equally for all members of the population that sher the voter's opinion. This raises the substantive question of whether it would not be more accurate to treat people as caring only about those individuals who are relatively closely connected to them. One version of this idea would imply that people care almost exclusively about the messages that they send to the inhabitants of their town, district or state rather than about the messages that they broadcast to the whole country. If this were the case, turnout in national elections should be no larger than than turnout in local elections. If, instead, people cared for the welfare and opinions of non-local voters and also cared somewhat about the size of the audience for their votes, turnout should be larger in national elections. In fact, Blais (2000, p. 40) shows that, indeed, turnout in (sub-national) legislative elections is generally lower than in presidential ones.

By the same token, concern with non-local voters implies that the closeness of the election that determines turnout is the closeness at the national level. This should be true even if, as in the U.S. presidential election, a national official is elected indirectly with voters choosing state-wide representatives to the electoral college. The closeness at the state level, which determines the members of the electoral college, should be less important. Consistent with this, Foster's (1984) shows a negligible cross-sectional correlation between a state's turnout and the closeness of the U.S. presidential election at the state level.[11] Moreover, Blais (2000, p. 76) shows that a person's stated intention to vote in the 1996 British Columbia

types. The reason this is not the case, is that people do not know the sample realization of the mean distance. It is true that the law of large numbers leads the mean distance from the sample that is realized by voting to converge to the expected distance based on the *ex ante* probabilities. However, when this mean is multiplied by the number of people that care about it, a single vote matters. Some intuition for this result may be obtained by recalling that the mean multiplied by the square root of the sample size has a non-degenerate distribution.

[11] Unfortunately, a time series analysis of national turnout in these elections is made difficult by the paucity of observations and the presence of low frequency movements in turnout. As a suggestive anecdote, it is worth mentioning that the total number of voters in Massachusetts and New York rose by 12% and 9% respectively from the presidential election of 1996 to the much closer presidential election of 2004. This occurred even though the populations in these two states were stagnant and even though the electoral college results in all four of these elections were a foregone conclusion at the time.

parliamentary election was more tightly correlated with the person's perceived closeness of the election at the provincial level than with her perceived closeness at the level of the constituency.

So far, I have let people of each type be altruistic only towards other people of their own type, and have supposed that they are neutral - neither altruistic nor spiteful - towards people of the other type. Attitudes towards people that have different views than one's own can vary a great deal however. Moreover, one implication of the model that is not shared by alternatives is that these attitudes have an important effect on turnout. At a general level, this is evident from the definition of G_i^k in (8), which shows that the vicarious benefits of voting depend on the altruism of i for all other types.

Suppose now that altruism for people of a different type is nonzero so that $\lambda_{ab} = \lambda_{ba} = \lambda_1$. Then, continuing to focus on the equilibrium where people of type i vote for candidate i and using (3),(4) in (8), we have

$$\begin{aligned} G_a^a &= (N-1)\left\{\lambda_0 p_a S' d\left[\frac{p_b(1-z_b)}{p_a(1-z_a)+p_b(1-z_b)}\right] + \lambda_1 p_b S' d\left[\frac{p_a(1-z_a)}{p_a(1-z_a)+p_b(1-z_b)} - 1\right]\right\} \\ &= \frac{(N-1)S' d p_b(1-z_b)}{p_a(1-z_a)+p_b(1-z_b)}\Big[\lambda_0 p_a - \lambda_1 p_b\Big]. \end{aligned} \tag{14}$$

The equivalent calculation for G_b^b yields

$$G_b^b = \frac{(N-1)S' d p_a(1-z_a)}{p_a(1-z_a)+p_b(1-z_b)}\Big[\lambda_0 p_b - \lambda_1 p_a\Big]. \tag{15}$$

This shows that animus towards people who support the other candidate (*i.e.* a negative λ_1) increases the vicarious benefits of voting, and thus increases turnout as a result of (9). If people that one dislikes are made unhappy by hearing that more people disagree with them, one can increase one's own utility by signaling one's disagreement with them.

Conversely, altruism towards people of the other type, (*i.e.* a positive λ_1) reduces turnout. Similarly, reductions in the perceived distance d across the types reduce G_a^a and G_b^b (even if $\lambda_1 = 0$) so that they reduce turnout as well. This serves to confirm that this theory of turnout and voting is based on the two psychological assumptions that I stated in the introduction. People must dislike it if other voters disagree with them and they must have more altruism for those that agree with them. The weakening of either force reduces turnout. Because neither d nor λ_{ij} have been subject to extensive measurement, it is difficult to know at this stage whether these variables explain differences in turnout rates in different locations or at different times.

The equilibrium in (9) is based on the standard assumption that voting costs vary in the population, so that those whose costs are relatively high end up abstaining. This model also allows the resulting equilibria to be interpreted somewhat differently, however. Equation (8) implies that a type a individual votes if

$$c \leq (N-1)S'\lambda_0 dp_a \frac{(1-p_a)(1-z_b)}{p_a(1-z_a)+(1-p_a)(1-z_b)} - \Delta^a(d_{ae}).$$

In equilibrium, the fraction of people that satisfy this inequality must be equal to z_a, and I have induced this probabilistic voting through the standard assumption that c random across the population. It can equally well be induced by letting everyone have the same cost of voting and supposing that people differ in their altruism. There is then a cutoff value of λ_0 that leaves people indifferent between voting and not voting and equilibrium requires that a fraction z_a of people of type a have altruism levels larger than this cutoff value.

This alternative has a desirable feature. This is that individuals with large values of λ_{aa} do not just want to vote, they are also willing to spend resources on activities whose effectiveness at increasing the utility of those that agree with them is more modest. These activities could include, for example, wearing political buttons or putting signs on their lawns that provide further support for individuals that share their beliefs. This fits with the finding of Copeland and Laband (2002) that people who carry out such activities are more likely to vote.[12] As I discuss in the conclusion, a variant of this model where people vary in their altruism may also provide an explanation for why people feel social pressure to vote.

[12] This raises the general question of how this model relates to the "expressive voter" model that Copeland and Laband (2002) see as being supported by their evidence. The model of this paper shares with expressive voter models such as Brennan and Buchanan (1984) the idea that voters vote to express an opinion (rather than to affect the election outcome). Where the current model differs is in supposing that this desire to express oneself is the result of seeking to help others, as opposed to being directly useful to the self. This is the source of the comparative statics implied by the model.

3.2 Eliminating multiple equilibria

The equilibrium in subsection 3.1 involves a turnout that is so large that people can people can neglect their influence on the voting outcome. This means that, if turnout rates were equally large but (10) were violated so that G_a^b was somewhat larger than G_a^a and G_b^a was somewhat larger than G_b^b, each type would prefer to vote for the candidate that they like least. In effect, the signaling value of these "wrong" votes would outweigh the negligible effect of individual votes on the election's outcome. In this subsection, I demonstrate that there generally does exist an equilibrium of this type. I also argue that this equilibrium is not as robust as the one considered in subsection 3.1.

At an equilibrium of this sort, everyone expects people of type a to vote for b and viceversa, so that $P(a|a) = P(b|b) = 0$. Using (8), type a's vicarious benefit from voting for the "wrong" candidate G_a^b, is equal to $(N-1)S'dp_aP(b|A)$, which is identical to a's vicarious value of voting for a in the previous section. By the same token, type b's vicarious benefit from voting for a equals $(N-1)S'dp_bP(a|A)$.

Thus (9) implies that the equilibrium turnout rate for a is given by (11) once again, with $\Delta^a(d_{ae})$ replaced by $\Delta^b(d_{ae})$ while that for b is given by (12) with $\Delta^b(d_{be})$ replaced by $\Delta^a(d_{be})$. As long as λ_0, and $S'd$ are as large as before, the resulting equilibrium turnout rates are large enough that the differences between these Δ's are negligible. The equilibrium turnout rates are then approximately equal to the previous ones, which I denote by z_a^* and z_b^*.

Nonetheless, equilibria where people all vote for the candidate they dislike are unattractive. They probably arise in this model because it neglects two important real-world phenomena. The first is the process by which candidates get selected, which usually requires that like-minded people make a consistent effort in favor of a candidate. The second is the opportunity that at least some people have to credibly communicate their voting intentions.

A modification of the model that incorporates elements of these two phenomena does not have these these unappealing equilibria. The basic idea is to solve the voters' coordination problem by following Farrell and Saloner (1985). To do this, let a group of n_i individuals of type i have publicly observable votes. These individuals vote in sequence and do so before other people vote. Under some additional assumptions, these n_i individuals are guaranteed to vote for i and the unique equilibrium has all supporters of r_i vote for i. In particular

Proposition 1. *Suppose that people neglect the information about N_i contained in n_i while n_i exceeds half the expected votes for candidate i, so that it exceeds $p_i z_i^* N/2$.*[13] *Then, even if individuals neglect their influence on voting outcomes, the unique equilibrium has people of type i voting only for i.*

Proof: If people neglect the information about N_i contained in n_i, (9) determines equilibrium turnout. Because $n_i > p_i z_i^* N/2$, it follows that (10) holds when all n_i vote for candidate i even if all other supporters of r_i are expected to vote for the other candidate. Thus, if all members of n_i vote for i, every other person of type i that votes does so as well. Similarly, if all members of n_i vote for the candidate who does not favor r_i, all other supporters of r_i do so also.

If all members of n_a and of n_b were to support the same candidate k, this candidate would win the election. To see this, note first that k would be getting more than half of the votes that would have been forthcoming if each type voted for its own candidate. This election advantage is only strengthened if, for either i, the supporters of r_i that are not members of n_i were to vote for k as well. If the supporters of r_a and r_b that are not in n_a or n_b were to vote for the other candidate instead, both candidates would receive votes of both types. For given turnout rates, $P(i|A) - P(i|m)$ would be lower for each i and m equal to either a or b than it would be if i were known not to vote for candidate k. The vicarious benefits of voting, and overall turnout, would thus be lower. Therefore, the votes by n_a and n_b for k would be decisive once again.

[13] It cannot be literally true that n_i contains no information about N_i since we must have $N_i \geq n_i$. However, this information can be mostly irrelevant in equilibrium. Suppose, for example that there are fixed numbers n_i^* determined in advance and that a person's cost of voting and types are determined in sequence (with each person having a probability p_i of being of type i). Then, suppose that n_i is the minimum of n_i^* and the number of people who would vote for i in an equilibrium where no vote is observed. Then, n_i conveys information that could affect equilibrium beliefs about about N_i only when $n_i < n_i^*$, and this occurs quite seldom when n_i^* is substantially below $p_i N$.

Suppose without loss of generality that the majority prefers r_a. The n_a supporters of r_a then want to vote for a to ensure that the elected official has their own tastes. It is thus a dominant strategy for the last member of n_a to vote for a if all previous members did so. Reasoning by backwards induction, voting for a is also a dominant strategy for previous members of n_a since they know that subsequent members will follow by voting for a.

Given that the n_a have a dominant strategy, the n_b individuals of type b expect that a will win the election whether they vote for a or for b. If they vote for b, all other supporters of r_b will do so as well. The result is a larger value of $P(a|A) - P(a|b)$ than the value of either $P(a|A) - P(a|a)$ or $P(a|A) - P(a|b)$ that results from having the n_b individuals vote for a. By voting for b, therefore, the n_b supporters of r_b raise the "warm glow" utility of r_b supporters. This means, again, that it is a dominant strategy for the last member of n_b to vote for b if all previous members have done so. Similarly, it is a dominant strategy for earlier members of n_b to vote for b as well. $\square$

4 Three-way contests

As discussed in the introduction, Lacy and Burden's (1999) evidence suggests that third party candidates are capable of simultaneously raising turnout and taking votes from major candidates. To be faithful to these observations, one needs a model with at least four different types of people. Such a model allows two types to be loyal voters for the two major candidates while one type can switch its votes from a major candidate to the third-party candidate when this became possible. The last type can then fill the role of voting for the third-party candidate while abstaining in a two-way race. An example with four types having these features is discussed in subsection 4.2. Before presenting this example, it is useful to consider in somewhat more generality a situation with three types, two of whom are popular. This is the subject of subsection 4.1.

Even with three types, the basic issues that arise with three candidates can be studied. If the third type votes for the third candidate in a three-way election but would have voted for a major candidate in a two-way election, one can say that the third candidate "stole" some votes from a major one. If, instead, the third type continues to vote for the major party candidate in a three-way race that includes a candidate of his own type, we have a version of "strategic voting," in that people are not voting for their favorite candidate and are voting instead for a more popular one. Lastly, if the third type does not vote in a two-way election but does vote when his favorite candidate is present, we have the "turnout effect" discussed by Lacy and Burden (1999).

The advantage of focusing on three types is that the conditions on the parameters that give rise to these phenomena are more transparent. There are, on the other hand, two advantages of the example with four types considered in subsection 4.2. The first is that the minor candidate is then able to attract some votes even when "strategic voting" leads some of his supporters to vote for a more electable candidate. The second is that the presence of four types allows one to demonstrate a new source of positive feedback in the support of third party candidates. The more votes these candidates attract, the less a vote for them is construed as a vote against mainstream views, and this increases the third party's vote total. This bandwagon effect implies that the presence of minor candidates can make election outcomes more unpredictable.

4.1 Three types

In this subsection, types a and b vote for their favorite candidates and there is a new type, labeled g, whose membership is small so that p_g is substantially smaller than either p_a or p_b. Without loss of generality, I treat g as being closer to a than to b. More specifically, type g has the same relationship with b than does type a, so the distance between b and g is d and the altruism parameter λ_{bg} is set to zero like λ_{ab}. The distance between a and g, on the other hand, is denoted by $\hat{d}$ and is supposed to be no larger than d. The altruism these two types have for each other is denoted by $\hat{\lambda}$, and this is no greater than λ_0, the altruism that people have for members of their own type. Lastly, the extent to which type g cares about changes in D, S'_g, is allowed to be potentially different from $S'_a = S'_b = S'$. This turns out to be critical for the viability of minor party candidates.

The focus of this section is on the votes of members of type g. Still, it is worth starting by analyzing briefly how types a and b respond to the introduction of type g and to the actions of the members of this type. Using (9), the equilibrium turnout rate type b individuals obeys

$$F^{-1}(z_b) + \Delta^b(d_{bb}) = (N-1)\lambda_0 p_b S' d\Big[P(a|A) + P(g|A)\Big] = (N-1)\lambda_0 p_b S' d(1 - P(b|A)),$$

where the second equality follows from the fact that abstainers must be of types a, b, or g. This equation is identical to (12) in the case where there are only two types because, in this case, $P(a|A) = 1 - P(b|A)$. Thus, the behavior of type b individuals is affected by additional types only insofar these change the extent to which an abstention indicates that one is of type b.

Because people of type a care for people of type g and because people of type g may vote for a, the effect on z_a is more complex. Using (9), z_a solves

$$\begin{aligned}\frac{F^{-1}(z_a) + \Delta^a(d_{aa})}{N-1} &= \lambda_0 p_a S' \Big\{ dP(b|A) + \hat{d}\Big[P(g|A) - P(g|a)\Big]\Big\} \\ &\quad + \hat{\lambda} p_g S'_g \Big\{ dP(b|A) + \hat{d}\Big[P(a|A) - P(a|a)\Big]\Big\}.\end{aligned}$$

If people who support r_g switch their votes from g to a, they raise $P(g|a)$ while lowering $P(a|a)$ correspondingly. The net effect of such a change is to reduce the right hand side of this equation if $\lambda_0 p_a S' > \hat{\lambda} p_g S'_g$. This effect comes about because increases in type g's vote for a dilute the extent to which such a vote signals that one is of type a and this can reduce type a's benefit from voting. In other words, a candidate's support by a "special interest" (g) can erode his support by people that agree with him. This implies that it is conceivable that a candidate could increase his vote total by preventing a special interest from voting for him. A countervailing force is that, in this model, this effect is large only when p_g is sufficiently large that $P(g|a)$ is affected significantly by the change in g's votes. When p_g is large, however, the votes of people of type g can help candidates win the election.

In the case where p_g is small, the effect of changes in g's votes on the right hand side of this equation is smaller. To simplify the analysis of this section, I henceforth neglect the effect of g's actions on z_a and z_b. As discussed above, this neglect would be justified for small

p_g if the F function had flat areas near the turnout rates that constitute an equilibrium for a and b when g does not vote. More generally, this can be regarded as an approximation that is increasingly valid as p_g is reduced.

Focusing now on people of type g, (8) implies that their utility gain from voting for candidate k rather than abstaining is

$$\begin{aligned} u_g^k &= -\Delta^k(d_{ge}) - c + G_g^k \\ \frac{G_g^k}{N-1} &= \lambda_0 p_g S_g' \left\{ d\Big[P(b|A) - P(b|k)\Big] + \hat{d}\Big[P(a|A) - P(a|k)\Big]\right\} \\ &\quad + \hat{\lambda} p_a S \left\{ d\Big[P(b|A) - P(b|k)\Big] + \hat{d}\Big[P(g|A) - P(g|k)\Big]\right\}. \end{aligned} \tag{16}$$

Ignoring any effects on the outcome of the election, this means that g prefers voting for k rather than m if $G_g^k > G_j^m$, or

$$\begin{aligned} d\Big[\lambda_0 p_g S_g' + \hat{\lambda} p_a S\Big]\Big[P(b|m) - P(b|k)\Big] \;>\; & \hat{d}\Big\{\lambda_0 p_g S_g'\Big[P(a|k) - P(a|m)\Big] \\ & + \hat{\lambda} p_a S\Big[P(g|k) - P(g|m)\Big]\Big\}. \end{aligned} \tag{17}$$

This implies that,

Proposition 2. *People of type g find that, even if they neglect their effect on the election outcome, voting for b is strictly dominated by voting for a if p_g is sufficiently small.*

Proof: Because types a and b vote for their favorite candidates, $P(a|b) = P(b|a) = 0$. Using this in (17), $G_g^a > G_g^b$ if

$$\lambda_0 p_g S_g'\Big[dP(b|b) - \hat{d}P(a|a)\Big] > \hat{\lambda} p_a S\Big\{\hat{d}\Big[P(g|a) - P(g|b)\Big] - dP(b|b)\Big\}.$$

For p_g sufficiently small, $P(a|a)$ and $P(b|b)$ are arbitrarily close to one so the left hand side of this equation is nonnegative. A small p_g also implies that $P(g|a)$ is smaller than $P(b|b)$ so that the right hand side is negative and the inequality holds. □

This proposition implies that g votes for either a or g (when the latter is available). One interesting aspect of this result is that people of type g vote for the candidate that is closer to them even if they do not take into account their probability of changing the election

Table 1: Preference parameters and Third-party voting patterns

	$u_g^a \leq 0$	$u_g^a > 0$
$u_g^g \leq u_g^a$	Permanent absention	"Strategic voting"
$u_g^g > u_g^a$ and $u_g^g > 0$	"Turnout effect"	"Vote stealing"

outcome. It also implies that the parameters can be decomposed into four quadrants, as in Table 1.

I start by studying conditions under which one finds oneself in the left column of Table 1 so that type g does not vote for a in two-candidate contests. For this to be an equilibrium, u_g^a must be negative when z_g^a is zero. When z_g^a is zero, $P(g|a)$ is zero as well so that, using (16), an equilibrium with this property exists if

$$\left\{\lambda_0 p_g S_g' \Big[dP(b|A) + \hat{d}(P(a|A) - 1)\Big] + \hat{\lambda} p_a S \Big[dP(b|A) + \hat{d}P(g|A)\Big]\right\} + \frac{\Delta^a(d_{ge}) - \underline{c}}{N-1} < 0. \quad (18)$$

As long as one neglects the effect on the election outcome Δ, this is satisfied for any positive c in the limit where g is independent of a so that $\hat{d} = d$ and $\hat{\lambda} = 0$. The reason is that, in this case, the expression in curly brackets is negative because $p_a + p_b < 1$. On the other hand, reductions of $\hat{d}$ and increases in $\hat{\lambda}$ raise this expression and can eliminate equilibria where g does not vote for a in a two candidate race.

Because the conditional probabilities in (16) change when z_g^a rises, equilibria where people of type g vote for a may exist even if (18) is satisfied. A sufficient condition for this not to be the case is provided by the following

Proposition 3. *Suppose that g is independent of a, $z_a = z_b = \bar{z}$ and the the costs of voting become prohibitively large for type g when z_g is equal to $\bar{z}$. There then exists no equilibrium where type g votes for a if*

$$\left[\frac{\lambda_0 S_d' p_a p_b p_g}{1-p_b}\right] + \frac{\Delta^a(d_{ge}) - \underline{c}}{N-1} < 0. \quad (19)$$

Proof: In the independent case, (16), (3), and (4) imply that

$$\frac{G_g^a}{N-1} = \lambda_0 p_a S_d' \left[\frac{p_a(1-z_a) + p_b(1-z_b)}{p_a(1-z_a) + p_b(1-z_b) + p_g(1-z_g)} - \frac{p_a z_a}{p_a z_a + p_g z_g}\right].$$

This is increasing in z_g. Thus, G_g^a reaches its highest value when z_g equals $\bar{z}$, the value of z_a and z_b. Some algebra implies that this is then equal to the expression in square brackets in (19). Condition (19) thus ensures that even the person with the lowest costs of voting is unwilling to vote for a under the conditions that make this as attractive as possible. □

Notice that, because p_g is small, condition (19) is easy to satisfy even if (13) implies that supporters of a and b are willing to incur fairly substantial costs of voting for their own candidates. The reason is simple: for a member of type g, voting for a is not nearly as good a signal of agreement with other people of type g.

This brings us to the conditions under which one finds oneself in the second row of Table 1 so that people of type g vote for candidate g in a three-way race. This requires both that voting for g be superior to voting for a and that voting for g be better than abstaining. Since $P(a|g) = 0$, (17) implies that the former is satisfied if

$$[\lambda_0 p_g S'_g - \hat{\lambda} p_a S][1 - P(g|a)] > 0. \tag{20}$$

Equilibria where all members of type g abstain exist only if u_g^g is negative when evaluated at $z_g^g = 0$. At this point, $P(g|g) = 1$ so that (16) implies people would deviate from such an equilibrium and vote for g if

$$\left\{\lambda_0 p_g S'_g \hat{d}\Big[1 - P(g|A)\Big] + \Big[\lambda_0 p_g S'_g + \hat{\lambda} p_a S\Big](d - \hat{d}) dP(b|A)\right\} + \frac{\Delta^g(d_{ge}) - \underline{c}}{N-1} > 0. \tag{21}$$

If conditions (20) and (21) are satisfied, people of type g vote for g in three-candidate races. It is now apparent that these conditions do not bear a strong relationship to conditions (18) and (19) under which people of type g fail to vote for a in two-candidate races. The latter require that people of type g fail to care for people of type a while (20) and (21) are satisfied as long as S'_g is relatively large so that people of this type derive a lot of utility from learning that others share their views. One can thus find parameters for all four quadrants of Table 1.

One question that remains, though, is whether S'_g has to be unreasonably large to justify voting for small parties whose p_g is correspondingly low. An estimate of the S'_g that is needed can be obtained from (21). Ignoring Δ^g, and taking the case where $\hat{d} = d$, this condition requires the minimum cost of voting to be no larger than $(N-1)\lambda_0 p_g(1-P(g|A))S'_g d$, which is approximately $(N-1)\lambda_0 p_g S'_g d$ for small p_g. In a population of 150 million, a person with an altruism λ_0 equal to .05 and an \$5 cost of voting would be willing to vote for a party whose p_g is .001 (so that it has an expected 150,000 supporters) if his $S'_g d$ were .00067. This would require that supporters of g gain \$1.00 if they heard that g had an additional 1 percent (*i.e.* 1500) supporters. While this requires that members of fringe political groups derive nontrivial gains from learning that others agree with them, the size of these gains does not seem implausibly large.

One final implication of the analysis that is worth highlighting is the effect of p_a, the popularity of a, on the likelihood that people of type g vote for a in three-way elections. Inequality (20) demonstrates that, for fixed S'_g and positive $\hat{\lambda}$, a higher p_a makes it more likely that these individuals vote for a. The reason is that people of type g care somewhat for each person of type a so they are more inclined to send a signal that people of type a would like to hear if they expect these supporters to be more numerous.

This fits at least broadly with results in the empirical literature on strategic voting. Abramson *et al.* (1992), for example, run a regression explaining the likelihood that individuals plan to vote for their preferred candidate and show that this is increasing in the extent to which respondents perceive this candidate to have a chance to win. Naturally, candidates have a higher chance to win if their support is higher so this is tantamount to saying that type g respondents are more likely to vote for a the higher is p_a relative to p_g.

4.2 A simple example with four types

One somewhat special consequence of allowing for only three types is that a three candidate race allows each type to vote for a candidate that fully shares its views. When the number of minor candidates is smaller than the number of small groups that disagree with a and b, some people can face a more difficult choice. To underline this difficulty, this section shows that the behavior of a group without its own candidate can be unstable when this group cares about more than one type. As more of them vote for one candidate, they find voting for this candidate more desirable.[14]

To show this I consider a stripped down setup with an additional type h that is committed to candidate h. Types a and b continue to have their own candidates, while people of type g no longer have a candidate of their own. People of type g are assumed to feel close to both a and h though these two groups do not have much affinity for each other. The key insight is that, as more members of type g vote for h, their gain from voting for h rises. The reason is that people of type a regard a vote for h as a less bad signal the more people of type g vote for h. Similarly, people of type h regard a vote for a as a worse signal the more people of type g vote for h. Both these changes make voting for h more desirable for people of type g. In other words, the reason a group can end up voting for either the mainstream or the fringe candidate is that the more this type votes for the fringe candidate, the less badly these votes are seen by the mainstream, and the worse mainstream votes are seen by people who are committed to the fringe candidate.

I capture these effects by making extreme assumptions regarding λ and d, though the forces discussed here remain relevant in more complex settings. I suppose, in particular, that types a, b and h all see each other as being separated by a distance d and have neither altruism nor spite for one another. By contrast, $d_{ag} = d_{gh} = 0$ and $\lambda_{ag} = \lambda_{gh} = \lambda_0$. While extreme, this setup where a and h both see themselves as identical to g while a and h see themselves as being far from each other is particularly simple to analyze. It implies that a person of type g derives the same utility when someone else votes for a than when someone else votes for h. As a result, (8) implies that the difference between type g's vicarious benefit

[14] This instability is reminiscent of Bartels (1987), where people support their favorite candidate only if they think this candidate will receive substantial votes from others. It might be imagined that this problem can arise also when there are three types and two candidates, so that the type without candidate can end up supporting either. When the type without candidate has a relative small membership, however, Proposition 2 implies that this is not possible. The reason is that, in this case, the benefit that members of a small group have from joining other members who happen to be voting for the "wrong" candidate are swamped by the benefit of signaling their allegiance to the large group that they prefer.

of voting for h and type g's vicarious benefit of voting for a, $G_g^h - G_g^a$ equals

$$(N-1)\lambda_0 d\Big[p_h S_h' P(a|a) - p_a S' P(h|h)\Big] = (N-1)\lambda_0 d\Big[\frac{p_h S_h' p_a z_a}{p_g z_g^a + p_a z_a} - \frac{p_a S' p_h z_h}{p_g z_g^h + p_h z_h}\Big], \quad (22)$$

where the equality follows from (3). Within the expressions in square brackets, the first terms relate to the losses to people of type h as a result of a vote for a while the second terms relate to the losses to people of type a as a result of a vote for h. Equation (22) is rising in z_g^h and falling in z_g^a. There are thus parameters such that the equation is negative when g only votes for a, which rationalizes voting for a, and positive if g only votes for h, which rationalizes voting for h. Note that such parameters exist even if p_g is small because the last term in (22) is quite sensitive to z_g^h even for small p_g as long as p_h is small as well.

5 Conclusion

The model of voting in this paper is both derived from assumptions about human psychology that have some empirical support and predicts patterns of voting that fit with some existing empirical evidence. It is important to stress, however, that the model's assumptions and predictions could both be subject to much sharper tests than those that have already been carried out in the literature. Indeed, one of the principal strengths of the model is that seems to be possible to check not only its qualitative predictions but also some of its quantitative ones.

In this conclusion, I discuss two additional areas that deserve further work. The first concerns the modeling of the information available to voters. Consistent with most of the formal voting literature, I have assumed that people know the probability that any one person will favor a particular candidate. Given the realistically large turnout rates implied by the model, the agents in the model cannot be left in doubt about the outcome of the election. This is to some extent a strength of this modeling assumption. Particularly in the case of the minor party candidates that I have discussed at length, the electoral failure of many candidates is a foregone conclusion. On the other hand, people are undoubtedly uncertain about the outcome of many elections and it would be attractive to have a model that included this uncertainty while also having large turnout rates.

It should be possible to incorporate this uncertainty into the current model, particularly because this uncertainty seems compatible with the Bayesian approach that the agents in the model use to compute their expected distance from the rest of the population. This uncertainty could even raise slightly people's incentive to vote if they felt that, by voting, they were able to affect other people's perception of the proportion of abstainers that favor their own position. This effect may well be small, however, and uncertainty also complicates the analysis in other ways. For example, this uncertainty implies that there is a positive correlation between the success of a candidate and the extent to which people who abstain are expected to support this candidate. This can create a correlation between the number of people who react favorably to a vote and the information content of a vote. Still, the main effect discussed here should be preserved. Whether there is uncertainty *ex ante* about the support of a candidate or not, there is always uncertainty *ex post* about where abstainers stand. The model in this paper relies just on this *ex post* uncertainty. The reason people vote in the model is to resolve some of this *ex post* uncertainty in the direction that is attractive to those who agree with them.

A different direction in which it would be worthwhile to extend the model is to incorporate people's dislike for those that they regard as insufficiently altruistic. As discussed in Rotemberg (2008), spite against people who appear insufficiently altruistic can explain numerous field and experimental observations in which people spend resources to punish ungenerous behavior. In the context of voting, this may explain the evidence of Knack (1992) and Gerber *et al.* (2008) that some people vote because they fear that others would disapprove if they didn't. As discussed earlier, the current model can be interpreted as one where people vary in their altruism, and the more altruistic people vote.[15] This means that, if people disapprove of those who are not altruistic towards anyone, they disapprove of non-voters. A model incorporating this disapproval should have higher turnout. Its voters

[15]Knack (1992) provides some evidence for this because he shows that people who give more to charity are more likely to vote.

would not be confined to those who are actually altruistic, but would also include those that pretend to be.

6 References

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