Abstract

Rational choice theory provides a straightforward and powerful defense of political democracy. It asserts that democracy gives people roughly the same power in public life that markets give them in private life: the power to implement preferred social outcomes. However, individual voters have virtually zero probability of affecting the outcome of an election. Thus rational choice models of voter behavior dramatically underpredict voter turnout in all but the smallest elections (Geys 2006). Fiorina (1990) has called this fact “the paradox that ate rational choice theory.” It is the central target of Green and Shapiro’s (1994) powerful critique of rational choice methodology in political science. The standard rational choice defense of democracy is thus incoherent.

Yet voters widely behave in ways that aggregate into strategically rational outcomes. This paper proposes a form of social rationality that strengthens the classical rational actor model. Socially rational voter behavior is a form of what I term distributed effectivity, according to which individuals behave as though they were self-regarding members of a very small electorate. Distributed effectivity explains the central statistical regularities concerning voter turnout and the historical regularities concerning large-scale collective action.
1 Introduction

Rational choice theory provides a straightforward and powerful defense of political democracy. It asserts that democracy gives people roughly the same power in public life that markets give them in private life: the power to implement preferred social outcomes. However, individual voters have virtually zero probability of affecting the outcome of an election. Thus rational choice models of voter behavior dramatically underpredict voter turnout in all but the smallest elections (Geys 2006). Fiorina (1990) has called this fact “the paradox that ate rational choice theory.” It is the central target of Green and Shapiro’s (1994) powerful critique of rational choice methodology in political science. The standard rational choice defense of democracy is thus incoherent.

Yet voters widely behave in strategically rational ways. This paper proposes a form of social rationality that strengthens the classical rational actor model. Socially rational voter behavior is a form of what I term distributed effectivity, according to which individuals behave as though they were self-regarding members of a very small electorate. Distributed effectivity explains the central statistical regularities concerning voter turnout and the historical regularities concerning large-scale collective action.

We can summarize distributed effectivity as follows, assuming a majority-rule election with two alternatives. A rational choice model of voting suggests that individual $i$ will vote for his preferred alternative if

$$b_i p \geq c_i, \tag{1}$$

where $b_i$ is the net payoff to winning, $c_i$ is the cost of voting rather than abstaining, and $p$ is the probability that $i$ is a pivotal voter; that is, with probability $p$ his preferred alternative wins if he votes but loses if he abstains. The rationality assumption places no constraints on $b_i$ or $c_i$. The benefit $b_i$ can be self-regarding, other-regarding, or purely moral, and can be expressive or purely instrumental. The cost $c_i$ can include material costs, which increase $c_i$, as well as feelings of social obligation and social signaling, which lower $c_i$.

Note that (1) considers only the value of winning and losing an election. This abstracts from the desire to register support for a candidate independent from its contribution to the outcome. This signaling motive for voting could be included in our analysis with some added notational complexity.

In a large election, where the probability of a single voter being pivotal is infinitesimal, classical rationality implies that even if an agent believes the other members of his set exhibit distributed effectivity, he will vote only if his cost of voting is infinitesimal. Distributed effectivity, which implies voting even when
there are substantial costs of participation, thus entails a moral, materially costly but personally rewarding, commitment to collective action.

There is a tradition in political theory that identifies rationality with self-regarding instrumental behavior (Conn and Press 1973, Coleman 1990). Rational choice in this paper, by contrast, is based on the standard treatment in analytical decision theory (von Neumann and Morgenstern 1944, Savage 1954), which stresses choice consistency and Bayesian updating. This notion of rationality can model any pattern of moral and self-regarding preferences (Gintis et al. 2005, Bowles and Gintis 2011).

2 Public and Private Spheres

The private sphere is the locus of everyday transactions in the private lives of individuals operating in civil society. An agent’s private persona is the set of preferences and beliefs that govern his behavior in the private sphere. The public sphere is the locus of activities that create, maintain, transform, interpret, enforce and execute the rules of the game that define society itself. An individual’s public persona is the set of preferences, beliefs, and social relations that govern his behavior in the public sphere. Political theory is the study of the public sphere.

The private and public spheres are closely interrelated in individual decision-making. A public sphere transaction may have private sphere costs and benefits that a participant in the public sphere may take into account in deciding how to act. For instance, an individual may not vote if queues at the polling station are very long, or may decide to skip a collective action in which the probability of physical harm is very high.

By contrast with the private sphere, critically important public sphere choices are fundamentally nonconsequential: an agent’s public sphere decisions have no individual payoffs and no discernible effect on social outcomes. Consider, for instance, voting. Estimates of the probability that a single voter’s decision will determine the outcome of a large election are between one in ten million and one in one hundred million (Good and Mayer 1975, Chamberlain and Rothschild 1981, Gelman et al. 1998, Fischer 1999). In a compendium of close election results in Canada, Great Britain, Australia, and the United State, no election in which more than 40,000 votes were cast has ever been decided by a single vote. In the Massachusetts gubernatorial election of 1839, Marcus Morton won by two votes out of 102,066 votes cast. In the Winchester UK general election of 1997, Mike Oaten won by two votes out of 62,054 votes cast. The result was annulled and in a later by-election, Oaten won by 21,000 votes. In smaller elections, a victory by a very small margin is routinely followed by a recount where the margin is rarely
less than twenty five (Wikipedia, List of Close Election Results, November 2014).

There is thus virtually no loss in accuracy in modeling voting behavior in large elections as purely nonconsequential in the sense that a single individual’s decision to vote or abstain, or for whom to vote, has no effect on the outcome of the election (Downs 1957a, Riker and Ordeshook 1968).

By a canonical participant in a decision process I mean an individual whose choice is nonconsequential: his behavior affects the outcomes infinitesimally or not at all. According to the data presented above, voters in a large election are canonical participants. Individuals who participate in a large collective actions are similarly canonical participants, as are those who volunteer to fight or otherwise contribute to one side in a war between nations. Of course, there are some public sphere activities that are non-canonical, such as running for office, organizing a voter registration drive, or contributing considerable amounts of money to a particular party or candidate. But many participants in the public sphere are canonical. Ignoring the infinitesimal probabilities that canonical participants affect outcomes is a useful and harmless simplification, akin to ignoring the force of gravity in analyzing the electronic circuitry of a computer or ignoring the light from distant stars in calculating the effectiveness of a solar panel.

Canonical public sphere activities are at the center of the structure and dynamics of modern societies. If citizens did not vote, or voted in an uninformed or random manner, liberal democratic societies could not function. Moreover, modern liberal democracy was achieved through collective actions in thwarting the autocratic ambitions of despotic regimes over centuries. These collective actions have been successful because of the cumulative impact of canonical participants who incurred significant personal costs, often death, in opposing arbitrary authority (Tilly 1981, Bowles and Gintis 1986).

Canonical participants consider their behavior as rational goal-oriented behavior. When questioning someone in a queue at the polling booth as to why he is standing there, or when questioning someone in a group protesting political corruption why he is chanting and holding a sign, he will think the question absurd. He will reply that he is there, of course, to register his support for various candidates for office, or to help topple a hated regime. After pointing out that his personal contribution will make no difference to the outcome, he will likely respond that this reasoning is faulty because if everyone followed it, no one would vote and no one would fight to topple a hated regime. After persisting in asking why he personally votes, noting that the other participants do not follow this reasoning, and his abstention will not affect the decision of others, he may well judge this thinking process bizarre and illogical, precisely because accepting the same sort of reasoning would lead virtually all citizens to abstain from voting.

The classical axioms of rational choice theory cannot explain the behavior of
a canonical participant in the public sphere because these axioms cover only sit-
uations in which meaningful choices are *consequential* in the sense of leading to
distinct entries in the agent’s preference function (von Neumann and Morgenstern
1944, Savage 1954). The behavior of canonical participants in the public sphere is
thus not classically rational. We shall, however, argue that canonical participants
are *socially rational* in an analytically clear sense.

### 3 Classical and Social Rationality

Before presenting a model of socially rational canonical public sphere behavior, I
will present some rather simpler principles of social rationality ignored by classi-
cal decision theory. Several economists, decision theorists, and philosophers have
explored a more socially relevant form of rationality than those embodied in the
classical axioms of von Neumann and Morgenstern (1944) and Savage (1954).
They term these forms variously “we-reasoning,” “team reasoning,” and “collect-
ive intentionality” (Bacharach 1987, 1992, 2006; Bacharach et al. 2006; Bratman
1993; Colman et al. 2008; Gilbert 1987, 1989; Hurley 2002; Searle 1995; Sugden
2003;Tuomela 1995). I will present several analytically clear examples of such
choice behaviors that should appear in any plausible account of social rationality.
There are many more subtle but equally weighty that are worthy of exploration.

First, consider a two-player game illustrated in Figure 1. Assuming Bob is
perfectly self-regarding, classical rationality suggests that he is indifferent between
choosing Up or Down. We may call Bob’s preferred choice of Down *prosocial
default*, a very elementary form of social rationality. A socially rational agent
exhibits prosocial default if, whenever he is classically indifferent to choices $A$ and
$B$, but $A$ Pareto-dominates $B$ for the other players, then he chooses $A$. Prosocial
default appears to be lacking in many animals, including our closest relatives in the
primate world. Indeed, chimpanzees appear to choose Up and Down with roughly
equal frequency in such situations, although some other primate species behave
like humans in this regard, regularly choosing the prosocial action (Silk et al. 2005,

Second, classical rationality is incapable justifying the choice of a Pareto-
efficient Nash equilibrium in a pure coordination game with a unique Pareto-efficient
equilibrium. For instance, consider the game depicted in Figure 2. The Pareto-
efficient {Down,Down} equilibrium cannot be justified by a classical rationality
argument. For instance, if Bob believes Alice will play Up, his best response is
Up. Bob may believe this because he believes Alice believes he will play Up. And
so on. Similarly, Alice may be perfectly classically rational in playing Up. But
this is not socially rational. If social rationality is mutually known, then the unique
Figure 1: Any move in this game is classically rational, but Down is the only socially rational prosocial default Nash equilibrium is the Pareto-efficient choice \{Down, Down\}.

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<thead>
<tr>
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<th>Alice</th>
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<tr>
<td>Up</td>
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<td>Down</td>
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Bob

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<tr>
<td>Up</td>
<td>0,0</td>
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<tr>
<td>Down</td>
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Figure 2: Socially Rational Choice in a Coordination Game

We say a strategy profile \( \sigma = \{\sigma_1, \ldots, \sigma_n\} \) in an \( n \)-player game \( \mathcal{G} \) strictly dominates a strategy profile \( \tau = \{\tau_1, \ldots, \tau_n\} \) if the payoff to \( \sigma_i > \tau_i \) for \( i = 1, \ldots, n \). If \( \sigma \) strictly dominates all other strategy profiles, and \( \sigma \) is a Nash equilibrium of \( \mathcal{G} \), we call \( \mathcal{G} \) a coordination game. In an \( n \)-player coordination game with strictly dominant Nash equilibrium \( \sigma = (\sigma_1, \ldots, \sigma_n) \), we say that player \( i \) is a socially rational cooperator if he chooses strategy \( \sigma_i \). If a player \( i \) believes that the other players in \( \mathcal{G} \) game are socially rational cooperators, then player \( i \)'s unique best response is \( \sigma_i \), so a classically rational player \( i \) will choose \( \sigma_i \), and himself will be a socially rational cooperator. Thus if all players are classically rational and each believes the others are socially rational cooperators, then the Pareto-dominant strategy profile \( \sigma \) will be played.

Brian Skyrms (2004) and Michael Tomasello (2014) have suggested a notion closely related to socially rational cooperation, which Tomasello calls collaboration. The idea is inspired by Rousseau's famous stag hunt game related in his A Discourse on Inequality. Consider \( n \) hunters who, if they all cooperate, can hunt stag with expected payoff 2 each, but if at least one of them chooses to go off alone and hunt rabbit, the lone hunters each have expected payoff 1, and those who hunt
stag have payoff zero. Clearly this is a coordination game in which rationality and mutual belief in socially rational cooperation implies that all hunters go after the stag.

Skyrms (2004) and Tomasello (2014) argue that this coordination game characterizes the situation facing early hominins, and that this accounts for our success as a species. This reasoning leads these authors to assert that collaboration in a coordination game rather than altruistic cooperation in a public goods game (Bowles and Gintis 2011), accounts for our success as a species. This argument posits an implausible model of social coordination in which a single defector completely undermines the cooperative effort. In most cooperative endeavors involving several participants, and certainly in the cooperative hunting practiced by our hunter-gatherer forbears (Whiten and Erdal 2012, Gintis et al. 2015), any single hunter could defect with a high probability of not being observed free-riding, yet the hunt would still be sufficiently productive to render defection profitable. But in this case, cooperation cannot be sustained at all, because each hunter, if self-regarding, will defect.

The following is a more plausible model of collaborative rationality that combines the insights from the stag hunt game and the public goods game. I will present a two-player version of the game, but it will be clear how this might be extended to an \( n \)-player version. In Figure 3, a player can defect (D) hunting rabbit with payoff two, or can collaborate with high (CH) or low (CL) energy. If both players collaborate and play CH, they each earn four, but each collaborator has an incentive to free-ride, playing CL and earning five, while his CH partner then earns only one. Thus the subgame involving only CH and CL is a prisoner’s dilemma in which self-regarding agents will defect. Thus collaboration with self-regarding agents is less productive than uncooperative rabbit-hunting. If both players place a high moral commitment to collaboration, the CH/CH strategy profile will become a Nash equilibrium. This represents a form of non-self-regarding social rationality that helps explain our success as a species.

4 The Social Rationality of Voter Turnout

As in the cases treated in the previous section, socially rationality in the public sphere generally strengthens rather than contradicts classical rationality. The assertion that electoral behavior is rational is most clearly supported by the phenomenon of strategic voting (Cox 1994, Franklin et al. 1994). Strategic voting includes ignoring candidates that have no hope of winning, or voting for an unwanted candidate in order to avoid electing an even less preferred candidate (Niemi et al. 1992, Cox 1994). It also includes Duverger’s Law (Duverger 1972), which
asserts that plurality rule elections tend to favor a two-party system, whereas a double ballot majority system and proportional representation tend to multipartyism. Voting also has a strong social element, including a rather ubiquitous social network effect: individuals who are more solidly embedded in strong social networks tend to vote at a higher rate (Edlin et al. 2007, Evren 2012), and they are likely to vote the interests of the social networks to which they belong (Weeden and Kurzban 2014).

To explore the nature of the social rationality of canonical participant behavior, I will follow Ledyard (1981) and Palfrey and Rosenthal (1985), who developed the currently most widely recognized, and I think most plausible, model of rational pivotal voter behavior. Suppose an election is determined by majority rule, with a tie vote decided by a fair coin toss. There are \( m \) agents who choose simultaneously to vote for Alternative 1, vote for Alternative 2, or abstain. Alternative 1 is preferred by \( m_1 > 0 \) voters and Alternative 2 is preferred by \( m_2 = m - m_1 \geq 0 \) voters. We assume \( m_1 \geq m_2 \). If \( b_i \) is the payoff to agent \( i \) who supports Alternative \( j \) if his alternative wins, with payoff zero if his alternative loses, and if \( c_i \) is the cost of voting as opposed to abstaining for agent \( i \), then \( i \) will vote rather than abstain if

\[
b_i \left( p_j^j + \frac{p_1^j}{2} \right) \geq c_i
\]

(2)

where \( p_1^j \) is the probability that a supporter of Alternative \( j \)'s vote leads to a tie, and \( p_2^j \) is the probability that this supporter's vote breaks a tie. Defining the pivotal probability

\[
p^j = p_2^j + p_1^j / 2
\]

(3)

and the net cost of voting \( \gamma_i = c_i / b_i \) for agent \( i \), (4) simplifies to

\[
p^j \geq \gamma_i.
\]

(4)
Note that (4) is a slight generalization of (1). It is clear that agent $i$ will vote precisely when $\gamma_i$ exceeds a threshold $\hat{\gamma}_i = p^j$. Recall that $b_i$ need not be determined by pure self-interest, but may be affected by altruistic or spiteful attitudes towards others, as well as by purely ethical considerations concerning justice and equity. Similarly, $c_i$ may include moral as well as self-interest motives, such as the citizen’s duty to vote, signaling one’s status as a good citizen, and garnering the good will of social network members.

Suppose $F_j(\cdot)$ is the cumulative distribution of $\gamma_i$ for supporters of Alternative $j$. Then the probability $q_j, j = 1, 2$, that a supporter of Alternative $j$ will vote is given by

$$q_j = F_j(p^j) \quad \text{for } j = 1, 2,$$

where $p^j$ is defined in equation (3). We assume for simplicity that $b_i$ is uniformly distributed on the intervals $[0, b^1]$ and $[0, b^2]$ for Alternative 1 and Alternative 2 supporters, respectively. Similarly, we assume $c_i$ is uniformly distributed on the interval $[0, c^1]$ and $[0, c^2]$ for Alternative 1 and Alternative 2 supporters, respectively. Thus the net cost of voting $\gamma_i$ is uniformly distributed on the intervals $[0, b^1/c^1]$ and $[0, b^2/c^2]$, respectively.

Suppose agent $i$ supports Alternative 1. The probability $p_1(k_1, k_2)$ that $k_j$ votes are cast for Alternative $j, j = 1, 2$, not including the vote of agent $i$ (should he vote), is given by

$$p_1(k_1, k_2) = \binom{m_1 - 1}{k_1} \binom{m_2}{k_2} q_1^{k_1} q_2^{k_2} (1 - q_1)^{m_1 - k_1 - 1} (1 - q_2)^{m_2 - k_2}.$$ \hspace{1cm} (6)

The probability that Alternative 1 wins when agent $i$ votes is then

$$\sum_{k_1=1}^{m_1-1} \sum_{k_2=0}^{m_2} p_1(k_1, k_2) + \sum_{k_1=0}^{m_2} p_1(k_1, k_1) + \frac{1}{2} \sum_{k_1=0}^{m_1-1} p_1(k_1, k_1 + 1).$$ \hspace{1cm} (7)

The first (double) summation in (7) is the probability $i$’s alternative wins but $i$ is not pivotal, the second summation is the probability that $i$ breaks a tie, and the final summation is the probability $i$ creates a tie and the coin flip favors Alternative 1. The probability that Alternative 1 wins when this agent $i$ abstains is similarly

$$\sum_{k_1=1}^{m_1-1} \sum_{k_2=0}^{m_2} p_1(k_1, k_2) + \frac{1}{2} \sum_{k_1=0}^{m_2} p_1(k_1, k_1).$$ \hspace{1cm} (8)
Subtracting (8) from (7) we see that the probability of an Alternative 1 supporter changing the outcome of the election by voting rather than abstaining is given by

$$\pi(m_1, m_2) = \frac{1}{2} \left( \sum_{k_1=0}^{m_2} p_1(k_1, k_1) + \sum_{k_1=0}^{m_2-1} p_1(k_1, k_1 + 1) \right). \quad (9)$$

Therefore the probability $q_1$ that an Alternative 1 supporter votes is given by

$$q_1 = F_1(\pi_1(m_1, m_2)). \quad (10)$$

Repeating this argument for the case where agent $i$ prefers Alternative 2, we have

$$\pi_2(m_1, m_2) = \frac{1}{2} \left( \sum_{k_1=0}^{m_2} p_i(k_1, k_1) + \sum_{k_1=0}^{m_2} p_i(k_1 + 1, k_1) \right). \quad (11)$$

Therefore the probability $q_2$ that an Alternative 2 supporter votes is given by

$$q_2 = F_2(\pi_2(m_1, m_2)). \quad (12)$$

Equations (9) and (11) jointly determine a Nash equilibrium of the voting game in which the probabilities $p_1(m_1, m_2)$ and $p_2(m_1, m_2)$ are mutually determined by the stipulation that Alternative 1 supporter $i$ votes precisely when the expected gain $b_i p_1(m_1, m_2)$ exceeds his private cost of voting $c_i$.

This Nash equilibrium predicts the major empirical regularities of voter turnout, both in small-scale real-world and in laboratory (Levine and Palfrey 2007) elections. Rather than deriving the comparative statics of this voter turnout model analytically, which may or may not be possible, I have generated numerical solutions using the Mathematica software program (Wolfram Research, Inc. 2014). These solutions assume the cumulative distribution $F_j(\cdot)$ of $\gamma_i$ for $j = 1, 2$ is the uniform distribution on the unit interval.

The first regularity is the electoral size effect: voter turnout declines with increasing size of the electorate (Lijphart 1997). For instance, national elections have larger turnout rates that local elections. Figure 4 illustrates this phenomenon in our model with electorate sizes of 18 to 36, where the difference between the majority and minority voters is two. Similar results hold, however, for higher ratios of majority and minority voters. Note that these are clearly small election results because voter turnout declines rapidly towards zero for even moderately large electorate sizes.

The second and third electoral regularities are the voting cost effect and the importance of election effect: when the cost of voting increases, fewer people vote,
Figure 4: The Electoral Size Effect: Voter turnout rates decline as electorato size increases.

and when the stakes are higher, more people vote. The reason given by our model is that an increase in the net cost of voting, \textit{ceteris paribus}, entails a higher cutoff \( \gamma_j^* \), and a higher benefit to a voter from winning lowers the net cost of voting cutoff \( \gamma_j^* \). We can represent both of these effects, assuming they are experienced equally by all agents, by replacing \( \gamma_i \) by \( \alpha \gamma_i \) in equation (4), where \( \alpha < 1 \) corresponds to a decreased cost-benefit ratio. The results for an electorate of size 20 where the majority consists of between 11 and 20 voters is given Figure 5. Note that there is positive turnout even when Alternative 2 has no supporters. This is because all agents want to avoid having the outcome determined by a coin flip.

The fourth electoral regularity is the \textit{competition effect}: turnout is higher when the election is expected to be close (Shachar and Nalebuff 1999). The reason in our model is that the probability that there will be a pivotal voter is higher when the election is expected to be close. It should be noted that this appears to be true, as illustrated in Figure 6, but it is not obvious why this is the case.

The fifth electoral regularity is the \textit{underdog effect}: in a two-party election, turnout is generally higher among voters for the less popular alternative. In our model, this is because when the election is decided by a single vote, a minority voter is more likely to be pivotal. Figure 7 illustrates the underdog effect, which also is far from obvious.

5 \textbf{The Logic of Distributed Effectivity}

Comparative static voter turnout phenomena, verified analytically for a very small electoral size in the previous section, but reflecting voter behavior in large elect-
The vertical axis shows the percentage increase in turnout when the net cost of voting is lowered by one third. The horizontal axis shows the size of the majority coalition.

People appear to follow a logic that may be described as distributed effectivity: in canonical public life, maximize utility assuming your probability of having a pivotal effect on the outcome is high (Levine and Palfrey 2007).

I have stressed that distributed effectivity is rational and is so considered by those who embrace it. Acting on the false belief that large elections are small elections is, however, clearly irrational. Moreover, it is not true that voters generally believe they are likely to be pivotal. The following is a more plausible analytical representation of distributed effectivity.

Suppose there are a relatively small number of voter types \( \{s_{j1}, \ldots, s_{jm}\} \) for \( j = 1, 2 \) such that all voters of type \( s_{jk} \) prefer Alternative \( j \) and have similar political philosophies. We can illustrate how distributed effectivity with a large electorate can lead agents to behave as though the electorate is small with a simple example. Suppose there are \( v \) members of each voter type, and voters of type \( s_{jk} \) share a common payoff from winning \( b_{jk} \) and cost of voting \( c_{jk} \). Suppose the net cost of voting \( \gamma_{jk} = c_{jk}/b_{jk} \) is uniformly distributed on the unit interval. Then each of the members of \( s_{jk} \) votes for Alternative \( j \) provided the probability that the \( v \) votes of type \( s_{jk} \) voters is pivotal is greater than \( \gamma_{jk} \). Then if we simply assume that each voter of each type contributes \( 1/v \) votes to the tally when voting for his preferred alternative, we obtain the same model as described in Section 4, but with
Figure 6: The Competition Effect: The closer in size the majority and minority coalitions, the higher the probability of voting. The election size is twenty.

an electorate of size $vm$ rather than $m$.

For a more detailed model of distributed effectivity, assume that voters of a given type $s_{jk}$ accept a common net cost of voting cutoff $\gamma_{jk}$ such that all members $i$ of $s_{jk}$ for whom $y_i = c_i/b_i \leq \gamma_{jk}$ vote provided that $\gamma_{jk}$ is less than the probability that type $s_{ji}$ voters are pivotal for the election. Suppose the frequency of type $s_{jk}$ in the supporters of Alternative $j$ is $\alpha_{jk}$, so the number of members of $s_{jk}$ is $\alpha_{jk}m_j$. Consider a single voter type $s_{1k}$. Let $q_{1k}$ be the fraction of type $s_{1k}$ agents who vote, provided any type $s_{1k}$ agents vote. Thus $v = \alpha_{1k}m_1q_{1k}$ type $s_{1k}$ agents vote if any such agent votes.

The probability that Alternative 1 wins if $s_{1k}$ members vote is given by

$$
\sum \{p_1(k_1, k_2) | k_1 = 1, \ldots, m_1 - v, k_2 = 0, \ldots, k_1 - 1 \} \\
+ \frac{1}{2} \sum \{p_1(k_1, k_1 + v) | k_1 = 0, \ldots, m_2 - v \} \\
+ \sum \{p_1(k_1, k_2) | k_1 = 0, \ldots, m_1 - v, k_2 = 0, \ldots, k_1 + v - 1 \}. \quad (13)
$$

The first term represents the probability of winning without the $s_{1k}$ votes, the second term is the probability of winning if there is a tie including the $s_{1k}$ votes, and the third term is the probability that Alternative 1 wins including the $s_{1k}$ votes. If
the $s_{1k}$ types abstain, the probability of Alternative 1 winning is given by

$$\sum \{ p_1(k_1, k_2) | k_1 = 1, \ldots, m_1 - v, k_2 = 0, \ldots, k_1 - 1 \} + \frac{1}{2} \sum \{ p_1(k_1, k_1) | k_1 = 1, \ldots, m_2 - v \}. \quad (14)$$

The difference between (13) and (14) is the probability that voting will turn a defeat into a victory for Alternative 1. In this difference, the probabilities of a tie are infinitesimal and can be ignored. The difference thus becomes

$$\pi_1 = \sum \{ p_1(k_1, k_2) | k_1 = 0, \ldots, m_1 - v, k_2 = 0, \ldots, k_1 + v - 1 \}, \quad (15)$$

where we define $p_1(k_1, k_2) = 0$ for $k_1 < 0$ or $k_2 < 0$. The fraction of type $s_{jk}$ members who vote is given by $q_{jk} = F_j(\gamma_{jk})$, and we have for $j = 1, 2$

$$q_j = \sum_{k=0}^{m_j} \alpha_{jk} q_{jk} = \sum_{k=0}^{m_j} \alpha_{jk} F_j(\gamma_{jk}). \quad (16)$$

Now (16) and (6) complete the specification of (15). Note that $\pi_1$ in (15) is equal to one for $v$ sufficiently large. This analysis shows that distributed effectivity can explain high voter turnout even in large elections, where classical rationality implies extremely low turnout.

The importance of distributed effectivity is difficult to overstate. The character of our species as *Homo ludens* emerged from an extended evolutionary dynamic
during which, until very recently, humans lived in small hunter-gatherer bands in which all political activity was doubtless consequential (see Section 8). In such settings the logic of distributed effectivity might well differ from classical rationality with self-interest supplemented by other-regarding and universalist preferences (see Section 7) in relatively minor ways. Even the rise of settled trade and agriculture some 10,000 years ago, followed by the appearance of states and empires, might well have proceeded with little need for so strong a notion of social rationality as that embodied in distributed effectivity. But the collective actions that overthrew despotic authorities and augured the emergence of democratic political orders dedicated to the rule of law and the protection of individual freedoms lie completely outside the range of classical rational choice theory. Distributed effectivity, nurtured in the formative years of our species’ history, made the modern world possible.

Distributed effectivity is related to rule-consequentialism (Harsanyi 1977, Coate and Conlin 2004, Roemer 2010, Hooker 2011). Rule-consequentialism is the principle that like-minded agents may collectively choose a rule that maximizes the net payoff to group members. By contrast, distributed effectivity is agnostic as to the nature of the benefit $b_{jk}$ that is shared by voter types $s_{jk}$. The moral dimension of distributed effectivity lies in the commitment to contribute to common social goals rather than in embracing any particular sort of goal. For instance, a socially rational voter type can be perfectly self-regarding in its choice of the benefits, or can be perfectly universalist and altruistic.

We can confirm socially rational reasoning not only through the regularities of social behavior, but by the testimony of social actors themselves, for instance the conversation described above with a voter at the polling booth. By contrast, rule-consequentialism is a complex philosophical theory that is foreign to the minds of most canonical participants.

6 Comparison with Other Explanations of Voter Behavior

The most obvious alternative to distributed effectivity is that canonical participants believe their actions are consequential even when they are not (Quattrone and Tversky 1988), so they act as though their actions determine outcomes with substantial probability. This is the most common, though rarely explicitly stated, assumption in the political science literature. For instance, Duncan Black’s famous median voter theorem (Black 1948) implicitly assumes that a self-interested citizen will vote and this vote will register his personal preferences. Similarly, Anthony Downs, a pioneer in the application of the rational actor model to political behavior (Downs 1957a) describes his model as follows:
Every agent in the model—whether an individual, a party or a private coalition, behaves rationally at all times; that is, it proceeds toward its goals with a minimal use of scarce resources and undertakes only those actions for which marginal return exceeds marginal cost. (Downs 1957b, p. 137)

And yet, almost immediately after stating this assumption, he writes:

[We assume that] voters actually vote according to (a) changes in their utility incomes from government activity and (b) the alternatives offered by the opposition (Downs 1957b, p. 138).

These two assumptions are compatible with classical rationality only if agents believe that their votes are consequential.

But in fact canonical participants generally do not believe that their behavior is consequential. For instance Enos and Fowler (2010) report a study in which the median respondent to the question as to the chance their vote will change the outcome of a presidential election gave the answer 1 in 1000, which although small, is in fact too large by a factor of at least 10,000. The authors write:

However…over 40% of regular voters know that the chances of a pivotal vote are less than one in a million…. [Moreover], the less likely you are to think your vote will actually matter, the more likely you are to vote.

An alternative is that people consider voting a social obligation (Riker and Ordeshook 1968, Fedderson and Sandroni 2006, Li and Majumdar 2010, Ali and Lin 2013). Abstaining in this view an unethical act of free-riding on the altruism of others. Indeed, in an American survey, when asked if the good citizen must always vote, the level of agreement is just slightly lower than obeying the law and paying taxes (Dalton 2008). In an Annenberg study of the 2000 election, 71% of Americans agreed that they felt guilty when they failed to vote. Even among those who reported that they had not voted, nearly half said they felt guilty. Blais (2000) reports that more than 90% of respondents in two Canadian provinces agree that “it is the duty of every citizen to vote.” Clarke et al. (2004) similar findings for British voters.

However, the duty to vote theory cannot explain the observed regularities of voting. Duty cannot explain strategic voting, or the size of election, competition, importance of election, or underdog effects described in Section 4. Duty can plausible explain the social network effect and the voter cost effect, but the other indications of voter rationality make no sense when agents know that their actions are
nonconsequential. Moreover, to the extent that voters are motivated by duty concerns, which some clearly are, they can be included in the cost of voting variable $c_i$.

Another theory is that canonical participants are altruistic, voting out of concern for the well-being of others who will be affected by the outcome of the electoral process (Schram and Sonnemans 1996, Fowler 2006, Fowler and Kam 2007, Edlin et al. 2007, Faravelli and Walsh 2011, Evren 2012). Even if voting is only infinitesimally consequential, when the election impacts millions of individuals, the extremely low probability of being a pivotal voter multiplied by the number of people thereby affected may become a large number. Formally, altruism can be expressed as a very large benefit $b_i$ to agent $i$ from winning, which is equivalent to a very small net cost of voting $\gamma_i$. Were the altruism assumption plausible, then, our comparative static results could be reproduced even with large electorate size. However, it is implausible that large numbers of canonical participants act from a charity motive. Many canonical participants have interests that are far narrower than the citizenry as a whole, and often act to promote the interests of one small group of citizens at the expense of society as a whole. Indeed, it is common to hear a small group of voters deemed “selfish” because they promote their own parochial interest above the good of society. Perhaps more telling, the altruism model cannot explain the strategic rationality of voters and the comparative static results reported in Section 4. Moreover, the altruism aspect of voting, to the extent that it exists, is incorporated directly into the distributed effectivity model.

A related alternative is that voters seek approval from their social network members (Knack 1992, Harbaugh 1996, Gerber et al. 2008, Gerber and Rogers 2009, Fosco et al. 2011, Ben-Bassat and Dahan 2012, Aytimur et al. 2014). Like the altruism theory, this is likely to be minimally true, but people do not generally much care whether or not their colleagues, relatives, or neighbors vote. Moreover, even should voting send a desirable signal to others, there would be no reason to vote strategically. Nor would the observed comparative static results follow unless rather ad hoc assumptions concerning social approval are deployed. Finally, the approval effect can be incorporated in the cost of voting variable $c_i$.

A final alternative to distributed effectivity is expressive theory, according to which canonical participants abandon instrumental rationality in favor of expressive actions from which they derive direct utility (Sears et al. 1980, Brennan and Lomasky 1993, Rotemberg 2009, Schuessler 2000, Hamlin and Jennings 2011). Expressive models explain many of the key social aspects of canonical behavior in the public sphere, including the social network effect and the responsiveness of agents to exhortation by activists. But they do not explain why people consider participating a prosocial act and feel guilty having failed to participate. They also fail to explain why people are rewarded with social approval when they participate.
Finally, they explain none of the rational behavior described in Section 4. Most important, they do not explain strategic voting without invoking *ad hoc* preferences.

7 Self-Regarding, Other-regarding, and Universalist Rational Action

Rational actors exhibit three types of motives in their daily lives: *self-regarding*, *other-regarding*, and *universalist*. Self-regarding motives include seeking personal wealth, consumption, leisure, social reputation, status, esteem, and other markers of personal advantage. Other-regarding motives include valuing reciprocity and fairness, and contributing to the well-being of others. Universalist motives are those that are followed for their own sake rather than for their effects. Chief among universalist goals are *character virtues*, including honesty, loyalty, courage, trustworthiness, and considerateness. Of course, in the private sphere such universalist goals have consequences for those with whom one interacts, and for society as a whole. But one undertakes universalist actions *for their own sake*, beyond any consideration of their effects.

Agents will generally trade off among these various motives. For instance, being honest may be personally costly or reputationally rewarding, and may either hurt or benefit others whose well-being one values. Universalist motives thus do not reduce to self- or other regarding motives, but they do trade off against these other motives.

7.1 Private and Public Persona

The individual immersed in consequentialist everyday life expresses his *private persona*, while his behavior in the public sphere reveals his *public persona*. Individuals acting in the public sphere, are, then a different sort of animal, one which Aristotle called *zoon politikon* in his *Nicomachean Ethics*. The concept of a non-consequentialist *public persona* suggests a two by three categorization of human motivations, as presented in Figure 8. In this figure, the three columns represent three modes of social interaction. The *self-regarding* mode represents the individual whose social behavior is purely instrumental to meeting his personal material comfort, while the *other-regarding* represents the individual who is embedded in a network of significant social interactions with valued others, and the *universal* represents the individual who values moral behavior for its own sake. The two rows represent the agent’s *private persona* of social relations in civil society, and the agent’s *public persona* of political relationships in the public sphere.

*Homo economicus* is the venerable rational selfish maximizer of traditional economic theory, *Homo socialis* is the other-regarding agent who cares about fair-
ness, reciprocity, and the well-being of others, and *Homo vertus* is the Aristotelian bearer of non-instrumental character virtues. The new types of public *persona* are *Homo parochialis*, who votes and engages in collective action reflecting the narrow interests of the demographic, ethnic and/or social status groups with which he identifies. There is strong evidence, in fact, that voters are generally swayed not so much by their personal experience, say with unemployment, but rather by the experiences of members the social networks within which they are embedded and with which they identify (Markus 1988, Abrams et al. 2011).


Non-canonical agents acting in the political sphere, for instance politicians, are properly located in the private *persona* row. The individual whose private *persona* is other-regarding is generally considered altruistic, whereas the individual whose public *persona* is other-regarding (*Homo parochialis*) is often considered selfish, acting in a partisan manner on behalf of the specific interests of the social networks to which he belongs. In terms of our typology, however, *Homo parochialis* is in fact altruistic, sacrificing on behalf of the interests of members of these social networks.

### 8 Evolutionary Emergence of the Public Sphere

Like Aristotle’s *zoon politikon*, we are political creatures by nature, and are unique in this respect. How might a species incorporating an important public sphere have arisen?

The social life of most species, including mating practices, symbolic communication, and power relations, is expressed in genetically-grounded stereotypical form (Alcock 1993, Krebs and Davies 1997). *Homo sapiens* is unique in adapting its social life in highly flexible and deeply collaborative ways to environmental and social challenges and opportunities (Richerson and Boyd 2004). This flexibility is based on two aspects of our mental powers. The first is our ability to devise new
rules of social life, and to base our social interactions on these new rules. This capacity, absent in other species, makes us *Homo ludens*: man the game player. This capacity is possessed even by very young children who invent, understand, and play games for fun. In adult life, this same capacity is exercised when people come together to erect, maintain, and transform the social rules that govern their daily transactions. Broadly speaking, then, we see the public sphere as the arena in which society-wide rules of the game are created, evaluated, and transformed, and politics as the cooperative, conflictual, and competitive behaviors through which rules are established and individuals are assigned to particular public positions.

The emergence of bipedalism, cooperative child care, and lethal weapons (stones and wooden spears) many hundreds of thousands of years ago in the hominin line, together with favorable climate change, made the collaborative hunting and scavenging of large game fitness enhancing (Whiten and Erdal 2012, Tomasello 2014, Gintis et al. 2015). Lethal weapons are the most unique of these innovations, for other predators, such as lions, tigers and other big cats, wolves, foxes and other canines, use only their natural weapons—sharp claws and teeth, powerful jaws and great speed—in hunting, while none of these endowments was available to early hominins.

Lethal hunting weapons, moreover, transformed human sociopolitical life because they could be applied to humans just as easily as to other animals. The combination of the need for collaboration in hunting and the availability of lethal weapons in early hominin society undermined the social dominance hierarchy characteristic of primate and earlier hominin groups, which was based on pure physical prowess: the alpha male was the strongest member of the group and had dictatorial powers. The successful sociopolitical structure that ultimately replaced their ancestral social dominance hierarchy was an egalitarian political system in which lethal weapons made possible group control of leaders, group success depended on the ability of leaders to persuade and motivate, and of followers to contribute to a consensual decision process. The heightened social value of non-authoritarian leadership entailed enhanced biological fitness for such leadership traits as linguistic facility, ability to form and influence coalitions, and indeed for hypercognition in general (Boehm 1999, Gintis et al. 2015).

This egalitarian political system persisted until some 10,000 years ago when cultural changes in the Holocene involving settled trade and agriculture led to the accumulation of material wealth, through which it became possible once again to sustain a social dominance hierarchy with strong authoritarian leaders who could buy a modicum of protection and allegiance from well-rewarded professional soldiers and clansmen (Richerson and Boyd 2001). Yet, despite the power of authoritarian states, the *zoon politikon* that social evolution had nourished over tens of thousands of years has not been erased by a few thousand years of Holocene
history. Indeed, the extremely high level of tribal and clan warfare ubiquitous until recent centuries and is still present, doubtless favored groups whose members conserved the hunter-gatherer mentality of political commitment and the desire for personal political efficacy (Pinker 2011).

9 Conclusion

This paper has provided evidence for a model of human behavior based on a socially rational actor model, in which individuals have both private and public persona, and their preferences range over self-regarding, other-regarding, and universalist modes in both the private and the public sphere. Morality in this model is defined in behavioral terms: moral choices are those made in social and universalist modes. The public sphere in this model is an arena where preferences and actions are primarily nonconsequentialist. The other-regarding preferences of Homo Socialis and the character virtues of Homo Vertus are underpinnings of civil society, while Homo Parochialis and Homo Universalis make possible the varieties of political life characteristic of our species.

Three points are of particular importance. First, despite the ubiquity of the assumption that individuals are classically rational, yet have personal interests that they register through electoral processes and collective actions, the notion is incoherent. Private persona individuals, whether Homo economicus, Homo socialis, or Homo vertus, will simply not participate in such processes, and those who do are canonical participants whose political preferences are constituted by the social networks in which they are embedded as Homo parochialis, and the higher-level moral principles to which they adhere as Homo universalis.

Second, private sphere costs and benefits may play a large role in whether an individual participates in electoral processes or collective actions, but these costs and benefits may be deeply social and moral as well as self-regarding. Thus abstract moral principles may trump economic interests in individual economic decisions.

Finally, distributed effectivity is an extension of classical rationality that brings the behavior of canonical participants in the political sphere into the purview of rational behavior.

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