The Complexity of Turnout: An Agent-Based Simulation of Turnout Cascades.

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Abstract

Using an agent-based simulation of electoral participation this paper examines the cascading effects of an exogenous increase in turnout. We simulate the voting behaviour of agents in a pool of 1,000 households with characteristics based on survey data and whose rules about interactions and behaviours are dictated by existing evidence. This model simulates the interplay between many factors important to understanding individual turnout. Unlike previous applications of agent-based modelling in political science, we adopt a descriptively complex rather than a simple model of behaviour. Thus factors affecting the turnout of agents include individual-level characteristics (e.g., socio-demographic characteristics, socialisation processes, habit and inertia, ‘rational behaviour’, political interest, social norms and values (e.g. civic duty), relational attributes and overlapping social networks (with a focus on political discussion and household influences), mobilisation (interpersonal and party based), and external shocks. The focus of the simulations is to gauge the cascade effects of election-day mobilisation based on exogenous GOTV initiatives on the turnout of individuals and others in their social networks. Experimenting with different levels of mobilisation allows us to examine the extent to which mobilisation spreads beyond the primary mobilisation target both across the population and whether it survives over time.
Introduction.

One way or another election campaigns matter, not necessarily because they persuade voters to change their minds, but because they persuade people to vote.\(^1\) Get out the vote campaigns have been subject to considerable amount of research most of which shows that that mobilisation efforts are effective\(^2\). Estimates of treatment effects in GOTV experiments are normally based on the difference in turnout between a control and treatment group (the Average Treatment effect or ATE) at one point in time. However as Gerber and Green and others have pointed out some of this effect survives to subsequent elections, through the development of habit or inertia\(^3\). Moreover treatment effects may spill over to members of the social network of the primary recipients of the treatment. For example David Nickerson estimates that 60% of the average treatment effect is passed on to the spouse of the primary recipient\(^4\). James Fowler\(^5\) refers to these as turnout cascades.

The dimensions of turnout cascade are spatial and temporal. The crucial ingredients of turnout cascade are therefore social influence (for spatial contagion) and habit (for temporal spill over). In recent years, researchers have revisited the effect of socialization processes and social networks in studies of political behaviour, building on early work from the Columbia school which highlighted the role of social influences on electoral behaviour\(^6\). A significant body of research has shown that both the household and the neighbourhood are sources of contextual influences on voting\(^7\). Contextual voting theories hold that people follow similar patterns of political behaviour when they live in close proximity, interact, share day-to-day experiences, and belong to the same social networks. These theories are now being applied more specifically to models of electoral participation\(^8\). Scholars have also begun to explore the individual level dynamics of turnout, examining the role of habit and in

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conjunction with network influences. This paper explores the interaction of these social and micro level dynamical processes using an agent-based simulation of electoral participation. The model simulates the interplay between many factors important to understanding individual turnout. Unlike previous applications of agent-based modelling in political science, we adopt a descriptively complex rather than a simple model of behaviour. Thus factors affecting the turnout of agents include many individual-level characteristics including socio-demographic characteristics, socialisation processes, habit and inertia, ‘rational behaviour’, political interest, social norms and values, relational attributes and overlapping social, mobilisation, and exogenous political shocks. More specifically we look at the effect of different degrees of party mobilisation in presence of intra-household mobilisation on voting behaviour. We estimate the cascade effects of election-day mobilisation based on exogenous GOTV initiatives on the turnout of individuals and others in their social networks. Experimenting with different levels of interpersonal mobilisation allows us to examine the extent to (and the conditions in) which mobilisation spreads beyond the primary mobilisation target both across the population and whether it survives over time. Moreover, we are able to explore the channels through which turnout cascades operate – for example through reinforcements of civic duty or the development of habit. We go on to test the extent to which this varies according to assumptions about the strength of interpersonal mobilisation. Finally we assess the long term effects of party mobilisation in the presence of interpersonal mobilisation.

This paper makes two important contributions to the literature on turnout. First we develop a dynamic model of voting which is both descriptively complex and readily applied to a number of different research puzzles. Second, under a number of different assumptions, we quantify the second order (cascade) effects of a GOTV intervention in a realistic, complex scenario where voters have multiple motivations and barriers to voting and are subject to contextual influences in their decision making. In doing this we are able to get the most realistic estimate of the true potential total effect of GOTV interventions. We argue that spill over effects may be rather small than previously thought because voters most affected are those most likely to vote for other reasons. This only becomes apparent in a complex (rather than simple) simulation model of turnout.

Theoretical underpinnings of the model

There are many theories of turnout reflecting different approaches to political participation in general and with turnout in particular. In building an agent-based model of turnout it is important for us to learn from as many theories and is much evidence as possible. People vote for a variety of reasons, including the fulfilment of civic duty or group norms; to express support or disapproval for a particular party; and the desire to affect the outcome in respect of policy. Equally there are many reasons why people abstain, including indifference about the alternatives, ambivalence, alienation, lack of resources or an unwillingness to bear the costs of voting. Unlike many analyses of observational empirical data, which are designed to show support or otherwise for specific theories, an agent-based model is based upon a number of theoretical assumptions and can be used to test

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those assumptions. Whilst many analytical researchers set one theory against another in some kind of ‘shoot-out’ (on the basis that only one theory can be correct) an agent-based approach encourages us to explore how different models of voter behaviour can operate side-by-side and interact with one another to produce complex and sometimes unexpected effects. Thus in this research our models draw on a number of rich intellectual inheritances, each of which has something to teach us about why people vote or abstain.

According to sociological theories of voting behaviour, political attachments are assumed to be shaped by voters’ social and psychological characteristics, social group belonging, and the social context in which individuals grow up, live and work. Voting is, in essence, the expression of those loyalties. Whilst there is an array of different theories within the sociological framework, what distinguishes them is that political attachments are shaped by a voter’s social characteristics, belonging to a specific social group or social class and by the social context in which an individual lives and works. Influential accounts have, for example, explained participation by reference to perceptions of equity or fairness, social capital, civic voluntarism and resources (material or cognitive). The early sociological studies of the Columbia school emphasised the importance of interpersonal influences and flows of information within social networks on voting. When individuals make electoral choices, they take into account the values, expectations, and preferences of others, including: family, friends, work colleagues, and neighbors. This interpersonal influence, at the heart of early social article models voting, forms a core part of our own model of voting and is discussed further below. In social-psychological approaches (typified by the influential Michigan school) the importance of social group membership is re-enforced by early socialisation experiences that foster the development of partisan attachments or party identification associated with social class membership. In turn these influence the propensity to vote as well as party choice. Thus, in the sociological framework, the act of voting is an act of allegiance, and therefore a potential explanation for abstention is a lack of such group attachment.

Instrumental or choice based models focus on the individual focus on the costs and benefits accrued from voting. Classic rational choice theories explain non-voting as the rational course of action when the benefits of voting are expected to be outweighed by the costs. Although the costs of voting are usually minor they are often considered to exceed the expected benefits due to the extremely low probability that any one individual’s vote will be decisive. This leads to the well-known ‘paradox of voting’. The paradox is that, given the chance of affecting the outcome is normally vanishingly small, rational, self-interested actors should not vote, yet people do vote in their millions. There may be no paradox if voting is considered as an act of consumption (‘expression’) rather than one of investment, however, because the benefit is not discounted, although some commentators suggest

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that non-probabilistic consumptive benefits are not properly part of a rational choice theory. Another solution to the paradox is to consider voters as members of groups or networks rather than as individuals. This gives rise to a number of formulations in which group members have enhanced incentives to vote compared to individuals.\(^{15}\) The reformulation may derive from enhanced rational incentives (e.g. relational benefits and bloc voting) or the fulfilment of shared social norms and the avoidance of associated social sanctions. Notwithstanding this, the expected utility from voting is a function of the relative difference between the utility of a vote cast for one party instead of another. Without a preference for one party over the other(s) there can be no relative utility differences and non-voting may occur because of indifference\(^ {16}\). Even if the elector is not indifferent, abstention may occur through alienation (when electors perceive too great a ‘distance’ between their own preferences and those of even the closest of the parties on offer). The cognitive mobilisation model\(^ {17}\) links political participation with political satisfaction (or dissatisfaction), which is shaped by the level of interest and knowledge of electors. In turn this is linked with levels of education and exposure to information.

Our model, and the broader conceptualisation of voting it is based on, incorporates all of these processes and theories, but more importantly it is a dynamic and relational model of voting. It is dynamic in the sense that voting on any occasion is causally linked with voting on other occasions in an individual’s lifetime. We therefore draw on the dynamic concepts of inertia and habit to understand how turnout evolves over the political life of individuals\(^ {18}\). The core argument is that voting at one occasion leads to an increase in the probability of voting at a subsequent election after allowing for observed and unobserved characteristics of voters. Voting is relational in the sense that the turnout of any individual’s causally linked with the turnout of other individuals in a social network or geographical space. Verba et al. suggested that that people do not vote for three reasons: ‘because they can’t; because they don’t want to; or because nobody asked’\(^ {19}\). Whilst the former two reasons are encapsulated in the sociological, socio-psychological and economic approaches described above, the latter is at the heart of mobilisation theory and the relational dimension of voting. According to this, “the key to understanding who takes part of it is not, when


they take part or when they do not is mobilisation.”

Mobilisation can be divided into two main interrelated components. First, political parties and candidates attempt to mobilise supporters through election campaigns and get-out-the-vote (GOTV) initiatives. There is plentiful evidence, including much from field experiments, to demonstrate that GOTV drives are effective in persuading electors to turn out to vote. There is also an enormous literature about the effectiveness of party campaigns (for example measured by campaign spending) in respect to both increasing vote share and increasing turnout. Second, there is the impact of interpersonal mobilisation whereby turnout is encouraged by friends, families, neighbours and the wider social networks of voters. Mobilisation can happen as a result of shift in an individual’s focus of attention towards, or level of interest in an election when it becomes a topic of discussion by others, especially at election. Thus inter-personal influence can lead to enhanced interest (or disinterest) in politics. Equally, mobilisation can occur as a result of individuals being asked to vote either by friends and acquaintances. Understood as a social activity simply having someone to walk to the polling station on election day may be the difference between voting and abstaining. Indeed, understanding the extraordinarily high levels of correspondence in turnout within families and households must draw on theories of interpersonal mobilisation since this correspondence cannot be fully explained by shared characteristics. Linking these two sets of mechanisms we may expect spill over effects form party-based mobilisation, as electors mobilised by parties may then mobilise others in their network.

In summary, drawing from these rich intellectual traditions, we develop a model which is based on a dynamic and relational model of voting which combines rational instrumental motivations with sociological processes. Linking the processes of party mobilisation and inter-personal mobilisation with individual and network dynamics, we use the model to test the degree to which party based mobilisations spills over through social networks, and over time.

Agent-based models

Most previous analysis of turnout had been based on the analysis of observational data using ‘top-down’ statistical methods such as regression. These methods are suitable testing hypotheses where processes are linear and additive. However in political science, the situation is often much more messy than such models can accommodate. Processes overlap and interact in a complex and unpredictable ways. Agent based models, unlike analytical statistical methods, are built from bottom up and accommodate the possibility that human groups (in our case voters) “may be highly complex,

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21 E.g. Gerber and Green, "The Effect of a Nonpartisan Get-out-the-Vote Drive: An Experimental Study of Leafleting."; Cutts, Fieldhouse, and John, "Is Voting Habit Forming? The Longitudinal Impact of a Gotv Campaign in the Uk."
non-linear, path dependent, and self-organising. Agent-based simulations are often used to explore inherent possibilities (e.g., thought experimentation) and may be validated by empirical data. In terms of the research question posed about, about the magnitude of turnout cascades, agent-based models allow us to extrapolate the likely effects of mobilising a given proportion of voters, given what we know about how voters behave. This is not self-evident and cannot be simply inferred from individual responsiveness to party mobilisation efforts. The size of the effect on turnout at the micro-level will depend not just on the effectiveness of the campaign or the receptiveness of voters but the extent to which voters influence each other, and the longevity of that influence.

Thus an agent-based model is relational insofar as behaviour of each agent depends on the behaviour of other agents. Moreover, it is dynamic in the sense that electors (or agents) are adaptive: that is the respondent change due to processes occurring within the model. Adaptation can occur at the individual level or the group level, and means that processes are potentially subject to feedback effects and path dependence. While agents are autonomous and self-organising, they respond to properties of the whole, which in turn are more than the sum of the parts (a process of emergence). So, for example, by adding up everything we know about voters, we cannot accurately extrapolate either individual or macro-level relationships from one context to another, a phenomena that gives rise to the current pre-occupation with contextual effects in political science. As Durkheim noted “the hardness of bronze lies neither in the copper, nor the tin, nor in the lead which have been used to form it, which are all soft or malleable bodies. The hardness arises from the mixing of them.”

As well as autonomy, interdependence, and adaptivity, agents normally follow simple (or not so simple rules). These rules are a computational description of a given process, in this case the decision to vote. Our behavioural rules for voters are set out in more detail below. First however, we say little about our approach to modelling employed in this research.

The central dilemma in modelling social phenomena is rooted its sheer complexity – there is simply no guarantee that we will be able to understand any model that adequately captures what is being modelled. There are broadly two approaches to this difficulty: KISS (“Keep It Simple Stupid”) and KIDS (“Keep It Descriptive Stupid”) approaches.

The former hope that progress will result from the formulation of relatively simple models that will approximate human social behaviour sufficiently well to be somewhat useful guides. Such models are sufficiently simple that their behaviour can be comprehensively analysed, possibly using analytic techniques. Such models are characterised by a use of random “proxies” for aspects of human social behaviour that are either poorly understood or too complicated. Another way of putting this is that the assumptions used are pretty strong and often controversial. These kinds of model are, in general, at some “distance” from observed social behaviour so that they tend to be used more as a model of a theory of behaviour, a way of explicitly representing and understanding a set of ideas about social mechanisms and how they might interact. What results is akin to an analogy, albeit in

26 Durkheim, 1901, cited in Ibid.
computational form, the model does not relate directly to the data but rather captures an idea which is then used to understand society in a rich, analogous but imprecise manner. To summarise, the KISS approach has rigour, in that the model can be well analysed and understood, but tends to lack close relevance to what is observed. This is generally the form of ABM used in political science.\(^{28}\)

The second approach seeks to build simulations that more reflect what is observed to occur. Such an approach almost always results in relatively complex simulations, maybe with several social processes occurring and some representation of complex cognition in the computational representation of social actors. Here the assumptions tend to be of a weaker and more “mundane” type and the elements of the simulation correspond in a more natural way to what is observed. The simulations developed in this paper are of this type. The advantage of such simulations is that they can be related more directly to the available evidence at both the micro-level evidence as well as macro-level aggregate data – “cross-validated”\(^{29}\). The disadvantage of the KIDS approach is that the simulation models that result are slow and complex – sufficiently complex that one can never say that one completely understands the interactions within the model and almost always too complex to analyse analytically. Thus, although this approach produces an explicit model of the complex interaction of social processes, it may not result in a full understanding of them. The

The model.

The simulation used to measure the turnout cascade is based on a holistic model incorporating not only turnout but also all essential attributes relevant to the evolution of a hypothetical electorate. The scenario we are built is for a single constituency/single candidate election in an imaginary geographical location with a population of approximately 1000 households. The model includes population dynamics (e.g. fertility and mortality), the evolution of the population (immigration, household formation, moving house etc), social network formation (including factors such as homophily and propensity), individual values norms (e.g. civic duty, partisanship, voting habits and intentions), network influence and discussion (in respect to values and norms), and political behaviour (turnout and party choice). The characteristics of the population are drawn from the 1992 British Household Panel Study (BHPS)\(^{30}\) and represent a microcosm of Great Britain for a period beginning at that time. The population is allowed to evolve according to the population dynamics rules, which are based on official population statistics (e.g. fertility and mortality rates). The initial values in respect to political values and norms, vision characteristics et cetera, are also based on real values from the BHPS. All electors live in households which may or may not include other electors and non-electors (including children). The household structure characteristics also reflect real population data, taken from the 2001 Census of Population.\(^{31}\) The population inhabits a


\(^{31}\) Office for National Statistics, "2001 Census: Standard Area Statistics (England and Wales) [Computer File]," (ESRC/JISC Census Programme, Census Dissemination Unit, Mimas (University of Manchester)).
(x by x) grid which allows for spatial dependence, in that social groups have a tendency to locate in spatial clusters, and agents may develop social networks within neighbourhoods (i.e. equality spatial proximity). As noted by Johnson et al. voters are subject to cross-cutting pressures from interlocking social networks, which allows disagreement in networks to survive despite pressures towards conformity\(^32\). In our model, settings for social networks in addition to the household include voluntary organisations/leisure activities, schools, neighbourhoods and workplaces. Figure 1 provides a pictorial representation of the model.

**Figure 1. Screenshot of model in NetLogo**

![Screenshot of model in NetLogo](image)

**Rules of behaviour for agents**

As noted above the rules that agents follow are critical to the behaviour of the model. The rules are based on a set of causal stories which in turn reflect theory and evidence established by over 60 years of electoral research (as discussed above). The rules are too numerous and too complex to recount in full detail but some of the key ones are summarised here. Whilst agents follow a large number of fairly simple rules, these rules are based on hypothesised causal relationships, for example between partisanship and voting or between education and civic duty. Other relationships

\[^32\] Johnson and Huckfeldt, "Agent-Based Explanation for the Survival of Disagreement in Social Networks."
which may be observed as outcomes from the model (and in real life) are not pre-programmed but rather are emergent properties. For example differences in turnout between ethnic groups or age groups emerge from processes in the model and the relevant characteristics of members of those groups. Readers interested in scrutinising the assumptions and mechanics of the model can find a more detailed account of these rules in the supplementary materials, available upon request.

According to our model electors intend to vote (or abstain) for a variety of reasons (see table 1). First, voters may vote out of a sense of civic duty. Civic duty is acquired through discussion within social networks and is hence subject to network influence. It is also influenced by levels of education and can be reinforced by voting and by discussion, but like other endorsements can be forgotten. Second, people vote because they care about who wins. More formally, agents vote for instrumental reasons (including expressive benefits) which are determined by the strength of party preference or having an established habit of voting for the same party at repeated elections (party loyalty) and previous experience of voting (satisficing). Partisanship is itself determined by autoregressive network influence, and its strength by the level of interest in politics. Third, people vote if they are politically involved which in turn is dependent on the level of political interest and the presence of partisanship. This could be thought of as representing party membership for example. Finally, they vote out of habit – that is once they have voted in three consecutive elections they are considered to establish the habit of voting.

Whatever their reason for intending to vote, in keeping with the theory of planned behaviour, the intention to vote may or may not be fulfilled. Agents with no party preference will not vote regardless of their intention. In this sense of abstention can be rational just like voting. This extent reflects the level of indifference or alienation in the electorate. Factors which may disturb or interrupt voting intention include losing a job, moving house, giving birth and illness. These all carry a certain probability of causing agents to fail to vote despite a positive intention. Conversely, those

34 J. Bendor, D. Diermeier, and M. Ting, "A Behavioral Model of Turnout," American Political Science Review 97, no. 2 (2003); Fowler, "Habitual Voting and Behavioral Turnout."
35 Political interest and involvement are part of important internal states of the agents, and are themselves the result of internal levels of noticing politics. In order to have a certain level of political involvement and interest, agents first need to have noticed politics, which is not a given and is dependent on the level of political interest in the household and among their friends. Once an agent notices politics, then it is never forgotten and then it can develop a bias toward certain issues, which is shaped by various life events and interactions within personal networks. The bias is not unidirectional but can change across the agents’ life course. The levels of political interest or involvement are as follows: (0) Does not notice politics; (1) Notices Politics (whether they notice political events and talk at all); (2) Holding a view on politics (a political bias towards issues but not normally expressed (except events such as elections)); (3) Politically interested (will talk about politics to like-minded friends at any time); (4) Politically Involved (involved in political process, leafleting, may talk politics to acquaintances).
36 This formulation is used by Franklin, 2004.
38 Brody and Page, "Indifference, Alienation and Rational Decisions: The Effects of Candidate Evaluations on Turnout and the Vote."
without the intention to vote can be mobilised by family and friends or by political parties on election day.

### Table 1. Voting intention criteria

<table>
<thead>
<tr>
<th>Factor</th>
<th>Effect on Intention to Vote</th>
<th>Post-Intention Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civic duty</td>
<td>Voting intention = 1 if have civic duty</td>
<td>Going to vote unless disturbed</td>
</tr>
<tr>
<td>Generalised habit</td>
<td>Voting intention = 1 if have generalised habit</td>
<td>Going to vote unless disturbed</td>
</tr>
<tr>
<td>Involved in politics</td>
<td>Voting intention = 1 if involved in politics</td>
<td>Going to vote unless disturbed</td>
</tr>
<tr>
<td>Strong party identification</td>
<td>Voting intention = 1 if strong party identification and meet the satisficing rule</td>
<td>Going to vote unless disturbed</td>
</tr>
<tr>
<td>Loyal support</td>
<td>Voting intention = 1 if loyal supporter and meet the satisficing rule</td>
<td>Going to vote unless disturbed</td>
</tr>
<tr>
<td>Satisficing</td>
<td>Voting intention = 1 if satisficed and either strong party identification or loyal supporter</td>
<td>Going to vote unless disturbed</td>
</tr>
</tbody>
</table>

As noted above, key factors in the voting decision are subject to network influence. For example civic duty can be passed from one person to another on a probabilistic basis, in an autoregressive process\(^{39}\). Similarly party preference can change depending on the content and frequency of discussions with partisans of other parties. Following Johnson and Huckfeldt, network influence is autoregressive. The likelihood of switching allegiance from one party to another, for example, is dependent on not just the content of the most recent discussion but also the content of previous discussions held with other agents. For changes of allegiance it is not sufficient, for example, to receive the same endorsement repeatedly from the same agent. This message must be reinforced by other agents.

### Preliminary results

The model was run in Netlogo over 200 years simulation period with elections occurring every four years. We examined the property of the networks which as noted in previous literature reflected properties commonly associated with political discussion networks\(^{40}\) (table 2). The key features are

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\(^{40}\) Fowler, 2004, ibid.
that average degree is relatively low reflecting the fact that political discussion networks are quite small (a low average degree), and that the average path length is quite high.

**Table 2. Network properties**

<table>
<thead>
<tr>
<th></th>
<th>$t_1$</th>
<th>$t_2$</th>
<th>$t_3$</th>
<th>$t_4$</th>
<th>$t_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Order</strong></td>
<td>765</td>
<td>1040</td>
<td>1000</td>
<td>987</td>
<td>1008</td>
</tr>
<tr>
<td><strong>% in Main Component</strong></td>
<td>90</td>
<td>82</td>
<td>77</td>
<td>81</td>
<td>77</td>
</tr>
<tr>
<td><strong>Components</strong></td>
<td>78</td>
<td>180</td>
<td>191</td>
<td>167</td>
<td>212</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>0.006</td>
<td>0.003</td>
<td>0.003</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Weighted Clustering Coefficient</strong></td>
<td>0.189</td>
<td>0.131</td>
<td>0.125</td>
<td>0.139</td>
<td>0.135</td>
</tr>
<tr>
<td><strong>Average Degree (SD)</strong></td>
<td>4.5 (2.7)</td>
<td>3.6 (3.3)</td>
<td>3.13 (2.9)</td>
<td>2.9 (2.5)</td>
<td>2.8 (2.5)</td>
</tr>
<tr>
<td><strong>Median Path Length (reachable pairs)</strong></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Longest Path Length (reachable pairs)</strong></td>
<td>10</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>16</td>
</tr>
</tbody>
</table>

In order to test the impacts of party mobilisation, and in particular its indirect or spillover effects, we repeated the model multiple times under a number of different scenarios. In the first scenario – the baseline model – the parties are inactive and is represented by the blue line in Figure 2. Under three variations on this, 10%, 25%, and 50% of party identifiers without the intention to vote were mobilised to vote by their preferred party at elections between year 100 and year 150. This is not equivalent to 20/50% of all voters since many agents do not have a party identification. The idea that party’s target the supporters is well-established in the literature as campaigns are generally focused on mobilising known supporters rather than persuading non-supporters to switch allegiance. These simulations allow us to examine the impact on turnout via the turnout cascade with and without party mobilisation.

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As can be seen in figure 2, party mobilisation substantially boosts turnout especially when it reaches a relatively large proportion of non-voting partisans (mobilisation =0.5). Figure 2 also shows that the effects of mobilisation persist well beyond the period in which the parties are active (represented by the shaded area). Eventually this turnout announcement dwindles as agents who established the habit of voting or who develop high levels of political interest and civic duty, begin to die off. Interestingly, low levels of mobilisation appear to have relatively more long term cumulative effects, whereas the impact of higher levels of mobilisation is more immediate. What is not obvious here, is the mechanisms by which cascade effects work this is explored in figure 3.

Figure 2. Turnout with interpersonal mobilisation and party mobilisation

Figure 3. Reasons for voting under different mobilisation scenarios
Figure 3 shows the primary reasons agents voted before during and after the 50 year period of mobilisation. Unsurprisingly, as can be seen, by the green lines, a small number of agents directly persuaded to vote by political parties. However, the increasing numbers of agents voting for civic duty and habit under the party mobilisation scenarios, illustrates how temporal spillover may operate. By establishing voting amongst agents who are not normally inclined to vote, parties create an environment in which more agents develop a habit of voting (by virtue of increasing turnout) or indirectly by creating high levels of civic duty, which may be stimulated by political discussion amongst voters around election time. It is important to remember these are simulations based on specific assumptions about interpersonal discussion and network effects, but they do give a vivid illustration of how turnout cascades may work. Figure 3, in fact, is mainly illustrative of individual level dynamics. Figure 4, by contrast, illustrates the impact of mobilisation on interpersonal mobilisation on election day. The blue, red and green lines represent those mobilised by partners, family and friends respectively under different mobilisation scenarios. Although the effects are quite small, there is clearly an increase in partner-based mobilisation in particular during the mobilisation period, and the period immediately following this. In other words party-based mobilisation leads to second-order effects amongst the partners of those mobilised to vote, and this boost to turnout persists well beyond the period of mobilisation. Large cascade effects might be anticipated were the assumed mechanisms for interpersonal influence stronger. This will be explored in further applications (see below).

Conclusions based on preliminary results
We set out to illustrate how social networks and micro-level dynamics can generate turnout cascades. As noted by Gerber and Green\textsuperscript{42} and others, party-based mobilisation has effects that last well beyond the single election. We showed that long-term effects of party mobilisation persist a long time – up to 50 years – after the parties have stopped working in an area. This persistence arises from the development of habit of voting or pro-voting norms amongst those mobilised, and indirectly their family and friends. While the size of these effects is dependent on the assumptions of the model, we would argue that all the assumptions are based on strong empirical evidence, and even notwithstanding the precise magnitude of the cascades, the longevity of these effects is unlikely to be highly dependent on their size. In other words whether these effects are smaller or larger than we estimate it here, that assistance is likely to reflect the lifespan of voters.

Whilst evidence for temporal persistence is quite clear, the magnitude of contemporaneous cascade effects exist - that through social networks and households - is perhaps more limited than anticipated, and much less widespread than that suggested by Fowler’s agent-based simulations\textsuperscript{43}. This may be because of the level of interpersonal influence that is assumed in the model. This is the subject of further investigation (see below). Notwithstanding this, it should be noted that these second-order or spillover effects are approximately the same size as the first-order mobilisation effects. That is, as many or more people are being mobilised indirectly, as are being mobilised by the parties. Further research currently being conducted will attempt to provide a measure of the average size of these spillover effects under different conditions (see below). Spillover seems to work primarily through habit, and pro-voting social norms more than they do through secondary personal mobilisation. This is surprising given that our expectations were that there would be substantial household and network effects.

Further research will attempt to identify the contexts in which these interpersonal effects are larger or smaller, and also to test the extent to which this is sensitive to alternative assumptions about interpersonal mobilisation. In particular we will allow some ‘imitation’ or contagion in voting intention. In the model’s presented above agents can pass pro-voting norms (‘civic duty’) through discussion and can mobilise people to vote on polling day. However there is no traditional interpersonal mobilisation in the sense that agents may copy the voting intention of network members. Because this could in theory happen at any discussion, it might generate cumulative spillover effects at the election in question. This would not however be carried forward to subsequent elections, except through habit and enhanced political discussion. In contrast, civic duty is a social norm which agents carry beyond the specific election but is not directly switched on by party mobilisation. This type of interpersonal mobilisation is also very different to election-day mobilisation (‘dragging’), because the latter can only be passed between a single voter and a network member and cannot be passed on again by the recipient (i.e. it only affects one person does and does not spread through the network). Without this ability to pass on vote intention (except through civic duty) the secondary (spillover) effects of party mobilisation are more limited than might be found under alternative assumptions.

\textsuperscript{43} Fowler (2004) ibid
Further Planned Analysis

The model is run for a variety of different scenarios in order to test the impact of turnout cascades on the difference assumptions about party mobilisation. In the baseline model there is no direct mobilisation by political parties. In the first variation (scenario A1) the parties continuously mobilise at a rate of 20%. This means each party mobilises 20% of its supporters (agents with a corresponding party identification) before every election. In scenario A2 the right of mobilisation supporters is raised to 50%. This is not equivalent to 20/50% of all voters since many agents do not have a party identification. The idea that party’s target the supporters is well-established in the literature as campaigns are generally focused on mobilising known supporters rather than persuading non-supporters to switch allegiance. These simulations allow us to examine the impact on turnout via the turnout cascade with and without party mobilisation. The second set of scenarios (B1 and B2) is one-shot party mobilisation campaigns, again at different levels of mobilisation (20%, 50% respectively). In the one-shot scenarios parties simply run a single get out the vote campaign at one election. The third set of scenarios is based on a continuous period of mobilisation. Again the proportion of party supporters mobilised varies from 20% (C1) to 50% (C2) but the campaign is run at 10 successive elections.

We re-run these scenarios with a modified level of election day interpersonal mobilisation (see Table x) and the influence rate (the frequency of political discussion) to see how the cascade is dependent on different aspects of interpersonal influence. In the baseline model the level of inter-personal mobilization on election day is shown in table x. The figures in each cell of the table show the probability that an agent who intends to vote will persuade a partner, and other family member or a friend to vote. The figures in parentheses show the revised probability in the high mobilisation scenario. Since mobilisation only affects those not intending to vote, the politically involved are not affected. It is important to note that only those not intending to vote but with a party preference (partisanship) are subject to possible mobilisation. In each of the scenarios we compare the level of turnout in each scenario with the baseline model, averaged over 25 runs the model. We also calculate their spill over rate for each scenario.

Table x. Election day inter-personal mobilisation.

<table>
<thead>
<tr>
<th>Person mobilised</th>
<th>Characteristics of mobilising agent</th>
<th>Not interested</th>
<th>Interested</th>
<th>Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partner</td>
<td>0.35 (.5)</td>
<td>0.50 (0.95)</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>Family</td>
<td>0.10 (.25)</td>
<td>0.25 (0.5)</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Friends</td>
<td>0.00 (.1)</td>
<td>0.10 (0.2)</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses denote level of dragging in high mobilisation scenario

The size of the turnout cascade (the spill over) is measured as the number of agents indirectly mobilised as a proportion of those directly contacted by a political party. We can estimate the size of the spill over effect by comparing the average difference in turnout between the average number voting in baseline model and average number voting in each scenario minus the average number directly mobilised by the parties. We then divide the number affected indirectly by the number mobilised by the party to give an average spill over effect.

More formally:

If, S=spill-over, T1=turnout in scenario 1, T0 = turnout in base model, PM = number mobilised by party

Then,

\[ S = \frac{(T_1 - PM) - T_0}{PM} \]

References


