



<b>Title</b>	The international diffusion of democracy
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<b>Publication date</b>	2011-05-25
<b>Publication information</b>	Elkink, Johan A. "The International Diffusion of Democracy." Sage Publications, May 25, 2011. <a href="https://doi.org/10.1177/0010414011407474">https://doi.org/10.1177/0010414011407474</a> .
<b>Publisher</b>	Sage Publications
<b>Item record/more information</b>	<a href="http://hdl.handle.net/10197/2978">http://hdl.handle.net/10197/2978</a>
<b>Publisher's version (DOI)</b>	10.1177/0010414011407474

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# The international diffusion of democracy

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Keywords: democratic diffusion, democratization, norm diffusion, polarization, agent-based modeling.

## Abstract

The idea that democracy is contagious, that democracy diffuses across the world map, is now well established among policy makers and political scientists alike. The few theoretical explanations of this phenomenon focus exclusively on the political elites. This article presents a theoretical model and accompanying computer simulation that explains the diffusion of democracy on the basis of the dynamics of public opinion and mass revolutions. On the basis of the literatures on preference falsification, cascading revolutions and the social judgment theory an agent-based simulation is developed and analyzed. The results demonstrate that the diffusion of attitudes, in combination with a cascading model of revolutions, is indeed a possible theoretical explanation of the spatial clustering of democracy.

# 1 Introduction

In empirical work, it has been repeatedly established that autocratic countries that are surrounded by democracies have a higher chance of democratizing than countries that do not (Gleditsch & Ward, 2006). This holds even when there are sufficient controls for common explanations of democratic transitions, such as the level of economic development or the strength of civil society (Doorenspleet, 2001). While this has been observed empirically in various studies, few offer a theoretical explanation beyond the idea that democracy might be seen as a technological innovation (Modelski & Perry, 1991, 2002) or that the geographical clustering might be an artifact of cooperation between democracies in a hostile international environment (Cederman & Gleditsch, 2004). This paper provides an alternative explanation, based on existing models of opinion formation and the translation of these attitudes into protesting behavior, that explains the geographical clustering (Gleditsch, 2002) that we observe. The diffusion of democracy is therefore explained using a model of individual, mass level behavior. It should be emphasized that this article is not an attempt to falsify other explanations of democratic diffusion, but rather to demonstrate that a model based on individual attitudes towards democracy *can* explain the observed levels of geographic and temporal clustering. A possibility result is provided demonstrating that it is theoretically possible to explain the democratic diffusion we observe in this fashion – an empirical study into the validity of this explanation is beyond the scope of this article. In current explanations of democratic diffusion, an elite based perspective is generally taken by default.

Empirical research in political science and international relations shows that the regional context matters in democratization. When controlling for other explanations of

democratization, most importantly the level of economic development, the fact that geographically contiguous countries are democratic is still a significant factor in whether or not a country democratizes. Countries surrounded by democracies have a higher chance of democratizing; whole regions follow each other in their democratization in short periods of time (Gleditsch & Ward, 2006), most visibly in Eastern Europe and at times in Latin America; and the democratization of the world occurs in temporal waves (Huntington, 1991) - all indicators of a process of diffusion or contagion of democracy. Although empirical studies have repeatedly shown that these patterns exist, there is a significant lack of theoretical models explaining the diffusion of democracy, with the notable exceptions of Cederman and Gleditsch (2004) and Gleditsch and Ward (2006).

Geographical patterns of democratization are patterns at a macro-level. It is the democratization of countries as a whole, in their international region, that shows these patterns. Democratization, however, to state the obvious, is in the end a micro-level process. It is individuals that alter constitutions, decide to organize elections, decide to protest against their regime, or decide whether or not to suppress the opposition. A proper understanding of the macro-level patterns of democratization cannot do without a proper understanding of these individual behavioral patterns. This linkage of macro- and micro-level patterns has always been notoriously difficult in the social sciences and by far most studies of social behavior focus on either of the two levels. One attempt to deal with this linkage has been the relatively recent introduction of agent-based modeling in the social sciences. Although early applications exist (see, for example, Schelling, 1978), the real popularity of agent-based modeling has only come about with the recent increase in easily accessible computing power (Axelrod, 1997; Cederman, 1997, 2002).

In this article an agent-based model of the diffusion of democracy is presented where the focus is on this linkage between individual behavior and global geographical dynamics. The central actors or agents of the model are individual citizens of an imaginary set of countries. On the basis of existing models of public opinion dynamics and the role of private and public opinions in popular protests, a model is developed that, while keeping regime transitions not caused by popular protest exogenous, describes the relation between these transitions, their effect on public opinion in neighboring areas, and subsequent popular regime transitions.

A number of different theoretical models has been used as the foundation of this article. The first is the concept of cascading revolutions as introduced by Granovetter (1973) and further developed in the theories of the spiral of silence (Noelle-Neumann, 1993) and preference falsification (Kuran, 1995). In these models, the public expression of individual preferences is contingent on the strength of this attitude and the extent to which other individuals express similar attitudes. The stronger the preference, the fewer other public expressions are needed before an individual decides to make his or her own preferences public. Since strengths of attitudes among individuals differ, small changes in this distribution can have a cascading effect where more and more individuals publicly express their opinions.

The social judgment theory of persuasion (Sherif & Hovland, 1961; Jager & Amblard, 2004) suggests that in communication between individuals, the extent to which an argument is persuasive depends on the distance between one's attitude and the received message. When one is communicating with someone who is close in ideological outlook, one is more likely to be convinced and become even closer, while communication with

someone very different often confirms those differences and makes one distance oneself even more. Agent-based models of this theory suggest that under certain conditions, this can lead to a persistent diversity of attitudes (Jager & Amblard, 2004).

It will be demonstrated that a combination of these two models with democracy promotion by democratic states results in a model of democratic diffusion that *could* explain the geographical clustering we observe in empirical data. It cannot be stressed enough that this is a possibility result – it is not an empirical test of a particular theory, nor does it claim to be the only or main explanation of the observed geographical clustering. Various theories have been put forward that explain democratic diffusion, which are briefly discussed in the next section, and the model presented here provides an additional possible explanation.

## 2 Democratic diffusion

A spirit of democratization seems to have gone around through much of Eastern Europe over the past few years. Several successful and failed attempts at ‘stunning elections’ (Markoff, 1996, pp. 113-114) took place successively in Serbia, Georgia, Ukraine, Belarus, and Kyrgyzstan. Albeit with democratic constitutions, these countries had or have leaders solidly in power supported by non-democratic means. Opposition parties of various strengths tried to win the elections by a majority substantial enough to make it impossible for the current leader to stay in power. The successes in some cases became examples for other countries in the region. Representatives from opposition groups in one country became active as mobilizers and advisors to democracy groups in other countries. The various attempts to revert to a democratic order after autocrats tried to control the elections cannot

be seen in isolation and are closely connected to each other.

That brings us to the core concept of this research, the diffusion of democracy. When observing a map of the world, in which countries are colored according to whether they have a democratic regime or not, one can see clear clusters of countries. Large areas where most countries are democratic and large areas where they are not. Furthermore, when one would look at this map over time, observing the changes in regimes, one would again find clear regional patterns. Whole areas democratize at the same time, or neighboring countries experience collapses of democratic regimes one after the other. Latin America forms the most striking example with countries virtually simultaneously democratizing, reverting to dictatorship, and democratizing again during the past century (Markoff, 1996). In more statistical terms: “Since 1815, the probability that a randomly chosen country will be a democracy is about 0.75 if the majority of its neighbors are democracies, but only 0.14 if the majority of its neighbors are non-democracies” (Gleditsch & Ward, 2006, p. 916). This observation has been confirmed repeatedly in quantitative empirical research (Starr, 1991; Ward *et al*, 1996; O’Loughlin *et al*, 1998; Ward & Gleditsch, 1998; Gleditsch & Ward, 1997, 2000, 2006; Brinks & Coppedge 2006; Gleditsch, 2002; Elkins, 2003; Doorenspleet, 2001, 2004; Wejnert, 2005; Fordham & Asal, 2007).

After the publication of *The Third Wave of Democracy* by Huntington (1991), a lot of attention in the literature on democratization has been paid to the waves of democracy he describes. These waves reflect periods during the past two centuries in which processes of democratization were particularly prevalent, followed by periods of democratic breakdown (Huntington, 1991; Markoff, 1996; Doorenspleet, 2001). When plotting the number of democracies over time, these waves are indeed clearly visible. We will refer to spatial or

geographical clustering when countries close to each other are likely to have similar political regimes and to temporal clustering when countries in the same time period affect each other globally in their regime transitions.

Various explanations are possible that could explain one or both of these types of clustering. Among these explanations are the military-strategic oriented domino theory, which has been applied to the diffusion of communist (*The President's News Conference of April 7, 1954*) and democratic (Starr, 1991) regimes alike, or simply the democratization as a result of occupation, like in Germany and Japan after the Second World War. Democracy has been presented as a technological innovation, imitated by more and more countries (Modelski & Perry, 1991, 2002; Starr, 1991). Conditionality for aid or membership of international organization has been an important factor for democratization and its geographical clustering (Kopstein & Reilly, 2000; Levitsky & Way, 2005; Gleditsch & Ward, 2006). Alternatively, the clustering can be explained as a spurious effect, where clustered domestic variables explain the level of democracy. For example, economic development has often been suggested as an explanation of democracy (Lipset, 1959; Cutright, 1963; Burkhart & Lewis-Beck, 1994), while economic development itself spills over to neighboring countries (Hak, 1993).

In the to my knowledge only other existing agent-based model of the diffusion of democracy, Cederman and Gleditsch (2004) model the clustering as an effect of the higher chances of survival for clustered democracies in a hostile environment. Countries that democratize in an area surrounded by non-democracies have a high chance of succumbing in subsequent wars, while democracies that are contingent to each other help each other militarily and help each other survive. Clustered democracies create zones of peace and do

not fight each other (Cederman, 1997; Gleditsch, 2002), while sharing resources to defend against neighboring regimes.

This article does not claim to provide the only or most important explanation of the clustering of political regimes. Various explanations can be valid or can operate simultaneously. This article will concentrate on an explanation that focuses on the diffusion of ideas among individual citizens. The main contribution of this article to the literature on democratic diffusion is indeed the demonstration, through simulations, that a theoretical explanation of the observed patterns of diffusion is possible through a bottom-up approach, through modeling the behavior of individual citizens instead of the behavior of political elites. The basic assumption is that popular opinion towards a political regime matters. That regimes where there is a very strong opposition among the population are unlikely to survive. Regimes are likely to try to convince their citizens that their regime is the right approach, and less democratically minded politicians<sup>1</sup> will try to limit the information supply that undermines their authority, but once the publicly visible level of discontent rises above a certain threshold, the regime will not be able to stay in power. The second underlying assumption of the model is that attitudes towards the regime change as a result of communication among individuals. If the likelihood of communication between citizens of different countries is larger for countries that are adjacent or proximate to each other, one would expect to see the spatial clustering of democracy as described above.

Most definitions of diffusion focus on the spread of ideas between individuals or groups of people (Welsh, 1984; Rogers, 1995; Kopstein & Reilly, 2000). Kopstein and Reilly state that “[d]iffusion, after all, is a complex process that involves information flows, networks of communication, hierarchies of influence, and receptivity to change.” (Kopstein & Reilly,

2000, p. 12). Although abstracting from some details of Kopstein and Reilly's definition, the concept of diffusion in this article is similarly concerned with the spread of ideas between individuals, with varying degrees of receptivity and affected by geographical realities.

To see the spatial clustering one could simply observe maps as described above, were it not that it is difficult to distinguish random clustering from a significantly clustered pattern. To make this possible a statistical measure originally developed in time series analysis, Moran's  $I$ , can be used.<sup>2</sup> Moran's  $I$  is higher than its expected value when units are more often adjacent to similar units than one would expect under a random pattern and lower when units tend to be adjacent to dissimilar units. Figure 1 clearly demonstrates the presence of such clustering during most of the nineteenth and the entire twentieth century.

Figure 1 about here

### 3 Theoretical underpinnings of the model

In *The Spiral of Silence*, Noelle-Neumann develops a theory of the fear of isolation that leads individuals to hide their preferences when they are incongruent with the perceived majority view. Kuran (1991, 1995) develops, seemingly independently, a similar theory whereby individuals hide preferences that are dissimilar to the preferences expressed by others. This theory can be straightforwardly applied to the study of public protest and democratization studies. Taking the example of the Orange Revolution in Ukraine, a striking feature of this revolution is the discrepancy between the reputation of the Ukrainian population of being relatively apathetic to the political regime and the

sudden large protest movement in the streets of Kiev. Given the spiral of silence, two factors are likely to explain this surprising dynamic: the campaign might have affected the attitudes of some citizens and this possibly small change in their attitudes might have triggered a cascade of protest. For some citizens, the little change in attitude as a result of campaigning might have been just that little bit needed to bring people over a threshold from not protesting to protesting. In other words, their attitude was already very close to that of the protesters, but just needed that tiny little push. For other citizens, that had pro-democratic attitudes but were just not passed the threshold to protest, their reluctance to protest will have become significantly lower once they saw larger numbers of people on the street. Suddenly, they had somewhat less to fear from the authorities, as they would not be standing there on their own in the streets, but in a crowd, and suddenly they knew that they were not the odd exception, but that they had the support of many people in their country. The more people protest, the more those with a slightly higher threshold felt safe enough to take to the streets as well. This is the mechanism of the cascading revolution (Granovetter, 1978; Kuran, 1991, 1995; Lohmann, 1994).

Although the revealed preferences in these models depend on the context, on the preferences revealed by other agents in the same ecology, the 'real' or private preferences are assumed to be fixed. To explain the diffusion of democracy, the international spread of attitudes towards democracy, the cascading model of revolutions is therefore insufficient. The theory used in this article to explain the changes in attitudes themselves through communication is the social judgment theory (Sherif & Hovland, 1961): "Whereas the quality of arguments may determine the extent to which one is being persuaded by another person, often people respond quite simple by favoring positions close to their own, and

rejecting more distant positions” (Jager & Amblard, 2004, p. 295). When confronted with the attitudes of another person, an individual adjusts his or her own attitude depending on the difference in opinion. When the advocated position is close to that of the receiving individual it is said to be within the *latitude of acceptance* and the individual is likely to change attitude somewhat towards the advocated position. On the other hand, when confronted with a position entirely different from one’s own, within the *latitude of rejection*, the individual will emphasize the difference and move slightly away from the advocated position. In between there is a *latitude of non-commitment* where the individual is not affected by the advocated position (Jager & Amblard, 2004, p. 295-296; Perloff, 2003, p. 60-61; Petty & Cacioppo, 1996, p. 109-122). Although debate exists on the finer details of the theory and in particular the role of *ego-involvement* (Perloff, 2003, p. 61-62; Edwards & Smith, 1996), which is of little relevance to the model presented here, various primarily experimental studies have confirmed the importance of prior beliefs or attitudes on the persuasive effect of messages (see, e.g., Lord, Ross & Lepper, 1979).

The combination of the theory of the spiral of silence and the social judgment theory allows us to model the international diffusion of democratic norms and the subsequent configuration of political regimes. Unlike most existing explanations of the observed clustering, we have a model focusing on micro level dynamics in democratic diffusion. The remainder of the article will demonstrate, through simulations, how this model could, theoretically speaking, be an explanation, and under what parameter configurations this is the case.

## 4 An agent-based model

An agent-based model is a computer simulation to perform the equivalent of a thought experiment (Holland, 1995, p. 156) where a large number of agents interact on the basis of a few relatively simple rules. Whereas game theory is usually a solid approach to understand the outcome or dynamics of games with few actors, the results of large numbers of actors that interact with each other and where the actions of one actor affect that of all other actors are generally difficult to trace analytically. Computer simulations can help to understand the dynamics of such models. Furthermore, these simulations can shed light on the circumstances under which particular outcomes do or do not occur. By varying the parameters of the simulation, we can observe the impact of those changes on the outcome, in this case the clustering patterns. This is not unlike the way the impact of parameter changes are studied in experimental research.<sup>3</sup> In an agent-based simulation the rules of behavior are usually simple and there are few types of different actors. While the rules are simple, the resulting patterns in the system as a whole can be highly complex and often surprising given the rules of interaction, hence the term *emergence* (Holland, 1998; Johnson, 2001). Examples of such models in political science are a model of democratic survival and geographic clustering (Cederman & Gleditsch, 2004), models on cooperation (Axelrod, 1997), a model of secessionism in multi-cultural states (Lustick, Miodownik & Eidelson, 2004), a model endogenizing the international state system (Cederman, 1997), and a model of policy and party competition (Laver, 2005).

This model on democratic diffusion revolves around a number of key concepts. This section will discuss these concepts theoretically, while a more detailed and technical description of the model and its parameters is provided in the appendix. A schematic overview of the model is presented in Figure 2. The first concept is the political regime of

the country. Abstracting from the complexities in the classification of political regimes, regimes are divided in two categories, democracies and non-democracies.

The second concept that is crucial to the simulation is that of an individual's attitude towards democracy. The idea is that any person has a particular attitude on a scale from strong support for democracy to strong opposition to democracy. In reality, it is unlikely that such a scale exists within someone's political outlook. Rather, the attitude towards one's own current political regime and that towards the concept of democracy in general is likely to be a complex combination of a multitude of different attitudes, expectations, experiences, and beliefs. The intricacies of such psychological and ideological preferences are assumed to be of little relevance to the overall pattern of democratic diffusion, however, and a relatively simple scale should therefore suffice. The attitude towards democracy scale measures the actual attitude towards the regime of an individual citizen, rather than the demonstrated preferences.

Through communication, the third concept underlying the model, these individuals change their attitudes. By talking to others about democracy and about their ideological outlook on the world, one can gradually change one's own opinion towards democracy. This communication takes most likely place between citizens of the same country and to a lesser extent between randomly selected citizens of neighboring countries. The underlying assumption is that geographical distance matters for the frequency of interpersonal contact.<sup>4</sup> The direction of this change, according to the social judgment theory, depends on the similarity between the two individuals at the outset. Individuals that have opinions very similar to one another are likely to refine their attitudes through the interaction and to move closer towards each other in terms of their attitudes and beliefs, while individuals with

very different attitudes will diverge even more.

Regimes will not helplessly watch how citizens change their attitudes. Instead, they are likely to attempt to influence those attitudes. Especially democratic countries tend to make a serious effort trying to stimulate democratization abroad. Sometimes by using pressure towards foreign political leaders, but often also by stimulating grass-roots organizations in non-democratic countries or by providing alternative news sources to those provided by autocratic governments. A good example would be *Radio Free Europe*, which presented regional news from the Western perspective across Eastern Europe. In the model this element has been labeled broadcasting, for lack of a better term, which encompasses all forms of attempts by democratic governments to stimulate positive attitudes towards democracy in (neighboring) non-democratic countries. Radio broadcasting is a good example, but this also includes supporting local organizations, distributing newspapers or pamphlets, or any other form of ‘educating’ individuals abroad by democratic governments. The presence of Serbian advisors in the Ukrainian Orange Revolution is another good example.

Autocratic countries are likely to be concerned, to varying degrees, with the restriction of this information flow to their citizens. North Korea and China are prime examples, where access to the Internet is highly restricted and filtered for political purposes, as was the Soviet restriction on a large number of publications. These policies isolate citizens from foreign influences, including those that promote democratization. In this model, this enforced isolation of the citizens of non-democratic regimes limits the effects of broadcasting attempts by neighboring countries and lowers the chances of cross-border communication between individuals of the country and foreign individuals. Democratic

regimes are assumed not to limit any international communication. In terms of implementation, the effects of broadcasting and isolation are what distinguish democracies from authoritarian regimes.

The sixth concept of the model is what has been labeled protesting. Similar to broadcasting, protesting should here be seen as an abstraction of a broad spectrum of forms of political action. It includes all those publicly visible manifestations of individuals' attitudes towards democracy, or rather, the current political regime. Protests might literally mean protesting on the street, like in the Ukraine or the demonstrations in the DDR before the fall of the Berlin Wall, but they might also include dissenter writings or other forms of protesting art, mobilization for political action, like Solidarity in Poland, or votes for an opposition party in limitedly competitive elections. The protests have to be public, however, to qualify for this protest category, as the mechanism of the spiral of silence or preference falsification requires the visibility of these protests. Observing fellow individuals having the courage to take to the streets, literally or figuratively, might lower the threshold for opponents of the regime to join the protests.

Finally, regimes can change, democracies can turn authoritarian or vice versa. Such transitions can be largely due to actions by the political elite (Burton & Higley, 1987), or due to a public demonstration of a serious lack of support among the general population. The former are not part of this particular model and are considered exogenous to it. More in general, coups in this model encompass all those regime changes that are not explained by the level of protest in a country. The chances for such a regime change that is not explained by public protest is assumed to be higher directly after a regime change took place. This models the concept of regime consolidation (Linz & Stepan, 1996). The second form of

regime change is right at the core of the model. Regimes make a transition when all individuals in the capital protest, which will be labeled revolutions.

After the provinces, country borders, and citizens have been initialized, each simulation will run through 8000 iterations. Each iteration the following steps will take place, in this order: the level of isolation for each non-democracy will change following a random walk; a random set of individual citizens will communicate with randomly selected fellow citizens; each citizen will determine whether or not to join the anti-regime protest; one randomly selected democratic capital will broadcast a pro-democratic message; and for each country it will be determined whether there are sufficient protesters for a revolution, or whether a random, exogenous coup will take place.

Figure 2 about here

## 5 Simulation results and discussion

Once the model as described has been implemented in a computer program,<sup>5</sup> we can study the results from two different perspectives. The first relates most directly to the main question of this paper, namely to what extent and under what parameter configurations can the model as described be a possible explanation of the international spatial and temporal clustering as observed? This will shed light on the extent to which the model maps on the empirical data and it will give some clues as to the conditions under which we do or do not observe the various clustering patterns, given the model. The second question that is of interest is, if we assume the model to be realistic, under what conditions can we expect a further spread of democracy across the world on the long term, and under what conditions

are such prospects less likely?

The results are based on a parameter sweep. As one can see, most parameters have been set at a fixed setting for all simulation runs, with the exception of the theoretically most interesting parameters, which are related to the mechanism of the diffusion of democracy itself.<sup>6</sup> These include the effect size of the broadcasting mechanism ( $B$ ), which captures the activity of democracy promotion by democratic governments; the effect size of regular communication between individual citizens ( $\delta$ ), which captures the diffusion of norms among individuals; and the chance of such individual communication taking place across international borders ( $\tau$ ). Note that when any of these parameters is set to zero, an entire aspect of the model is disabled. When  $B = 0$ , democracies do not promote democracy abroad; when  $\delta = 0$ , citizens do not communicate; and when  $\tau = 0$ , citizens only communicate within sub-national regions. The one additional parameter that we vary is the random chance of coups ( $K$ ), which can be interpreted as the ‘error term’ of the model, or, alternatively, as a mechanism of exogenous shocks to the system.

Above we made a clear distinction between two types of clustering of political regimes: spatial and temporal. The first of these are the (static) spatial clustering patterns we observe. When one observes the spread of democracy across the world at any point in time, one can observe significant geographical clusters of democracy. In the empirical analyses we measured this by using Moran’s  $I$  and we will do the same for the analysis of the simulation results. We will look at the average deviation of Moran’s  $I$  across the simulations from the expected value. Table 1 presents the results of this analysis.

Table 1 about here

The standard deviations in the table show that there is substantial variation between simulation runs, due to random elements in the simulation. The cases where clearly most simulations result in spatial clustering are all cases where  $\delta = 0$ , as well as where  $\delta = 1$  and  $B = 5$ . In the case of  $\delta = 0$  and  $B = 0$ , the level of spatial clustering is very low and substantively insignificant. The starkest level of spatial clustering is visible for the case where  $\delta = 1$  and  $B = 5$ , where both are positive and the effect of broadcasting is stronger than the effect of inter-personal communication. The former generates the international clustering patterns, while the latter is too weak to bring the average attitude in a country back to where it was before the broadcasting effect, while at the same time being strong enough to reinforce local attitudes. It is striking that the effect of  $\tau$  is negligible. Whether or not norms diffuse between individuals across (sub)national borders has, given this model, no effect on the extent to which democracies cluster geographically. The key mechanisms are the broadcasting by democratic regimes to promote democracy abroad and the interpersonal communication between citizens of the same country to stabilize or reinforce attitudes within the country.

To measure the presence of temporal clustering, or waves, we will simply look at the first order autocorrelation in the worldwide number of democratizations. Each iteration of the simulation we count the number of transitions to democracy and the number of transitions away from democracy, adding both coups and popular revolutions together. We then look at the extent to which the number of transitions at time  $t$  correlates to that at time  $t-1$ . Because of the small movements per iteration in each simulation run, the iterations

have been divided in blocks of 100 time periods and the autocorrelation between blocks of size 100 are presented. The conclusion to be drawn from these analyses is that the simulation results do not reproduce the waves of democratization that we observe in empirical data. Although the model provides a *possible* explanation of how the diffusion of individual attitudes towards democracy can affect the international geographical clustering of processes of democratization, the same individual diffusion of attitudes does not appear to explain the global waves, at least not in the model as analyzed here.

Although not presented in these tables, the parameter sweep also varies the random chance of experiencing a coup,  $K$ . No effect is visible when taking this variation into account. This is a rather striking result. Coups were implemented to add the equivalent of a statistical error term to the model. Although the coups could not themselves explain the spatial or temporal clustering patterns in the data, since they are modeled as effects purely independent of events in either neighboring countries or in the past of the same country, they would still be expected to have an effect on the form temporal clustering takes. One would expect that a coup that is random for as far as the model is concerned could still instigate a regional or global wave of democratization. In other words, they could take the effect of external shocks to the system, which initiate the temporal clustering without having an effect on the process of diffusion itself. No such pattern is visible in the simulation results, however. The absence ( $K = 0$ ) or presence ( $K = \frac{1}{10000}$  or  $K = \frac{1}{5000}$ ) of this type of exogenous shock does not affect the absence or presence of temporal waves of democracy.

From their analysis of the diffusion of democracy as a technological innovation, Modelski and Perry (1991, 2002) conclude that the beginnings of an S-curve of

democratization is visible, suggesting that eventually all countries will become democratic. Although predicting the future is a hazardous activity for social scientists, it is interesting to see under what conditions, given the model, the diffusion of democracy will lead to a fully democratic, or a fully autocratic world. To study the convergence to equilibrium of either democracy or non-democracy, we will look at the average proportion of citizens living in countries that are democratic in the last ten percent of iterations in a simulation. Table 2 provides the results of our simulations.

Table 2 about here

The resulting pattern is fairly clear and shows an interaction effect between democracy promotion and the diffusion of norms through individual communication. Strikingly, the extent to which the world on the long run democratizes is negatively related to the amount of communication among individuals. When individuals share norms, and the effect of democratic promotion is no stronger than the effect of this individual communication ( $B \leq \delta$ ), the world eventually turns almost entirely autocratic. On the other hand, when there is no individual communication at all ( $\delta = 0$ ), and the mechanism of democracy promotion is in play ( $B > 0$ ), the world eventually turns entirely democratic. The forces that could counter this trend are disabled and there is no effect of the presence on autocratic norms in the population on the spread of democracy. Another striking result is that the presence or absence of cross-border communication between individuals has absolutely no bearing on the diffusion of democracy. Whether  $\tau = 0$  or  $\tau = \frac{1}{2}$ , the results and standard deviations are identical. Communication within national borders has an

important effect on the diffusion of democracy, negating weak democracy promotion, but cross-border communication has no bearing on this process.

## 6 Conclusion

The simulations give a picture of how the key factors under study relate to each other. We have seen how the active promotion of democracy by democratic regimes across country borders and more informal communication between citizens of countries relate to the temporal and spatial clustering of political regime types. We have observed the interaction of these mechanisms of democracy promotion with the presence of regime changes exogenous to this model, mostly covering elite level explanations of regime transitions. Although these simulation results suggest some tentative hypotheses concerning the relations and interactions between these variables, there is still plenty of room for further study and the results also beg for a more empirical validation of the results. Based on the imaginary world of the computer simulation, these results can indeed be seen as exactly that: fruitful, but tentative hypotheses for further research.

If the diffusion of democracy is indeed driven to a significant extent by the broadcasting effect of a democratic regime, and if democratic regimes indeed are likely to invest in policies to promote democracy in the near abroad, this would suggest that it might have a serious positive impact to democratize a country in a non-democratic area, contrary to what the survival model of Cederman and Gleditsch (2004) suggests. Of course, one can never see the model in isolation and there are many other factors that affect popular attitudes, including those towards democracy. Not only the policies of a pro-democratic force in the region matter, also, for example, the popular image of the actors that generated

the democracy in the first place. The model does imply, however, that islands of democracy matter for the spread and diffusion of democracy. Not only does it imply that single countries can have an impact on their region, it also suggests that since the private opinion towards democracy matters, policies that promote democratic ideas abroad matter. Initiatives along the lines of *Radio Free Europe* can have significant positive impacts on democratization. While the effects might be difficult to discern initially, the increase in the hidden mass of public support for democracy can suddenly be tipped into a revolution that topples the regime. The dynamics of the cascading revolutions hide part of the positive effects of promoting democracy.

The global clusters of democracy can theoretically be partially explained by a combination of the spiral of silence, cascading revolutions, and social judgment mechanisms. Democratic regimes should stimulate the establishment of democratic regimes in clusters of autocracies and should promote positive ideas about democracy among the populations of such regimes, in order to stimulate the global spread of democracy. Further empirical research is necessary to validate these theoretical claims.

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## Acknowledgements

The author gratefully acknowledges financial support from the Irish Research Council for the Humanities and Social Sciences. The author thanks Alexander Baturo, Kenneth Benoit, Andreas Dür, James Fowler, Fabrizio Gilardi, Joop van Holsteyn, Kristin Kanthak, Michael Laver, Eduardo Leoni, James McCann, Gail McElroy, Aintzane Legarreta Mentxaka, Covadonga Meseguer, Slava Mikhaylov, Scott Page, Orit Rapaport-Gertzek (and other participants of the “Diffusion of Policies and Institutions” workshop at the ECPR Joint Sessions of Workshops in Nicosia, April 2006), Michel Schilperoord, participants of the EITM Summer School (UCLA, July 2007), and the two anonymous reviewers for their useful comments to this article and its earlier incarnations.

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## Appendix: Model implementation

### The setup

In the setup stage three key elements are created and initialized: provinces, countries, and citizens. The citizens form the main agents of the model. The provinces form the cells of what is commonly known as cellular automata with size width  $W$  by height  $H$ . Cellular automata are a grid of adjacent square cells which keep changing state using simple rules, on the basis of information from the previous state of the cell and adjacent cells. The cells at the edges of the map are directly adjacent to those on the opposite edge - similar to creating cellular automata on the surface of a torus.

Once the provinces have been created country borders are added to the map. The country borders are created by an algorithm where countries “conquer” neighboring provinces which become part of the country of the conquering province, unless this leads to a fragmented country that the province is originally from.  $W \times H \times M$  times a random combination of two neighboring provinces,  $P_1$  and  $P_2$ , is selected.  $M$  is a configurable parameter, whereby a larger  $M$  leads to larger countries. If  $C_{P_1} \neq C_{P_2}$ , thus if the two provinces are located in different countries,  $C_{P_1}$  will conquer  $P_2$ , unless this leads to a disconnected former  $C_{P_2}$ . This algorithm results in a somewhat realistic looking map. Each country  $C$  is subsequently assigned a random level of isolation,  $\phi_0 \sim N_{[0,100]}(\phi_{mean}, \phi_{std})$ .<sup>7</sup> With a probability  $\pi$ , the country is set to be a democracy ( $\Omega = 1$ ), otherwise it is set to be an autocracy ( $\Omega = 0$ ). Randomly one of the provinces of the country is assigned as the capital.

For each province a random number of citizens, each with an initial attitude  $\alpha$  and each with thresholds for the social judgment theory are set:

$$\begin{aligned} N_{\text{citizens}} &\sim N_{[1,\infty)}(C_{\text{mean}}, C_{\text{std}}) \\ \alpha_i &\sim N_{[0,\lambda-1]}(A_{\text{mean}}, A_{\text{std}}) \\ t_i &\sim N_{[0,\infty)}(T_{\text{mean}}, T_{\text{std}}) \\ u_i &\sim N_{[0,t_i]}(U_{\text{mean}}, U_{\text{std}}), \end{aligned}$$

where  $t_i$  refers to the latitude of rejection and  $u_i$  the latitude of acceptance. Two communicating agents with a distance in  $\alpha$  of less than  $u_i$  will thus become more similar, while with a distance in  $\alpha$  of more than  $t_i$  they become more dissimilar. At the start, a citizen is not protesting,  $\psi_i = 0$ .

#### The iteration

Once all initial values have been set, the series of iterations starts. Each iteration five steps are taken:

1) The level of isolation for each country is updated. It is reasonable to assume, perhaps even true by definition, that democracies do not limit the communication of their citizens with foreigners. For this reason, each country that is a democracy in this model resets the level of isolation to zero. For all other countries, the level of isolation is modeled as a straightforward random walk:

$$\varphi_{t+1} = \begin{cases} 0 & \text{if } \Omega = 1 \\ \varphi_t + U, U \in \{-1,0,1\} & \text{otherwise,} \end{cases}$$

Whereby  $\varphi_{t+1}$  is truncated to  $[0,100]$ .  $U$  is a uniform random draw from the set  $\{-1,0,1\}$ .

2)  $\frac{N_{citizens}}{10}$  times a random citizen ( $S$ ) is selected to initiate communication. The

probability for each of the four provinces  $P$  in the Von Neumann neighborhood that a citizen will be targeted from this province is:

$$\Pr(P) = \begin{cases} \tau/4 & \text{if } C_p = C_s \\ (\tau/400)\max(\varphi_{C_s}, \varphi_{C_p}) & \text{otherwise,} \end{cases}$$

$\tau$  is a model parameter indicating the probability of cross-border communication. The maximum level of isolation between the two countries is taken, as it is assumed that what really matters for communication to occur is whether the more restricted of the two countries can be reached.<sup>8</sup> If a neighboring province is selected, a citizen ( $R$ ) will be randomly selected from this province, otherwise this will be done from the province of  $S$ . Once a sending ( $S$ ) and a receiving ( $R$ ) citizen have been selected, given that their attitudes towards democracy differ, the attitude of  $R$  is updated in line with the social judgment model of communication:

$$\alpha_R = \begin{cases} \alpha_R + \text{sign}(\alpha_S - \alpha_R) \times 1 & \text{if } |\alpha_S - \alpha_R| < u_R \\ \alpha_R - \text{sign}(\alpha_S - \alpha_R) \times 1 & \text{if } |\alpha_S - \alpha_R| > t_R \\ \alpha_R & \text{otherwise,} \end{cases}$$

whereby  $\alpha_R$ , the attitude towards democracy, is truncated to  $[0, \lambda - 1]$ . The sign function is a function that takes on the value  $+1$  when the input is positive and  $-1$  when the input is negative.

3) After the order in which citizens are being processed has been randomized, each citizen determines whether or not to start or stop protesting. In line with the cascading model of revolution as described above, a citizen will join the protest if the attitude against

the current regime is strong enough relative to the proportion of protesters in the citizen's province to dare to risk the costs of protesting.

$$\psi_i = \begin{cases} 1 & \text{if } \Omega_{C_i} = 0 \& Y \leq \frac{\alpha_i}{\lambda} \text{ or} \\ & \text{if } \Omega_{C_i} = 1 \& Y \geq \frac{\alpha_i}{\lambda} \\ 0 & \text{otherwise,} \end{cases}$$

where  $Y$  is the average level of  $\psi_i$  in the province of citizen  $i$ ;  $\psi_i$  is 1 when citizen  $i$  is protesting and 0 otherwise.

One randomly selected democratic capital will broadcast its democratic values to citizens in neighboring provinces. All nine provinces that are either in the Von Neumann neighborhood or diagonally adjacent, including the capital itself, are affected. For each of the nine provinces, the probability of receiving the broadcast is one when the province is part of the same country and one minus the maximum level of isolation of the two countries involved otherwise. For a province that receives the broadcast, all citizens update their attitude towards democracy by  $B$ .

Each country determines whether or not a revolution or coup will take place:

$$\Omega_{t+1} = \begin{cases} 1 - \Omega_t & \text{if } Y_{capital} = 1 \& D \geq s \text{ or} \\ & \text{with probability } \max(K, \beta e^{\gamma s}) \\ \Omega_t & \text{otherwise,} \end{cases}$$

where  $s$  is the time since the last revolution or coup,  $K$  the base probability of a coup,  $D$  a fixed number of iterations that a revolution cannot take place, and  $\beta$  and  $\gamma$  are parameters that determine the decay function of regime instability after a regime changed.

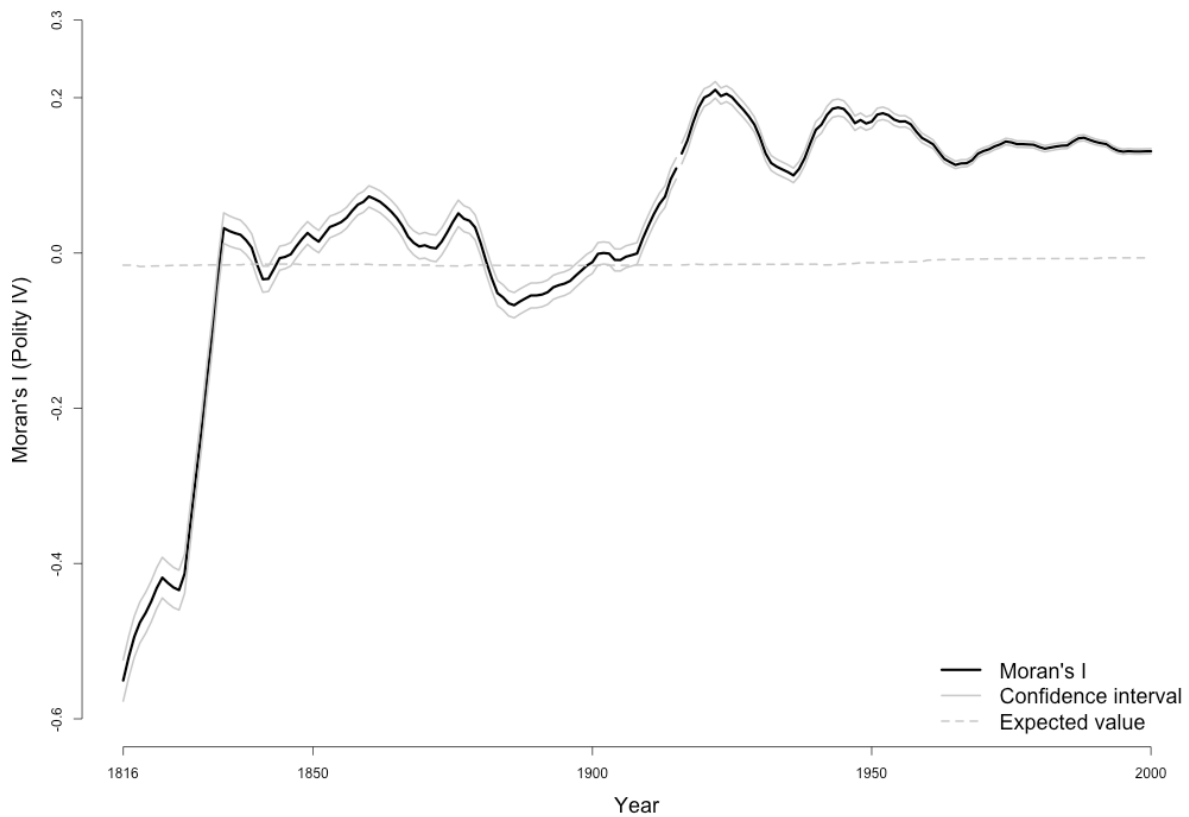


Figure 1: Moran's  $I$  on Polity IV (Jagers and Gurr 1995; Marshall and Jagers 2002) scores, 1800-2003. The solid line is a smoothed representation of the level of clustering, with around it the 95% confidence interval lines. The dashed line is the expected value of  $I$ .

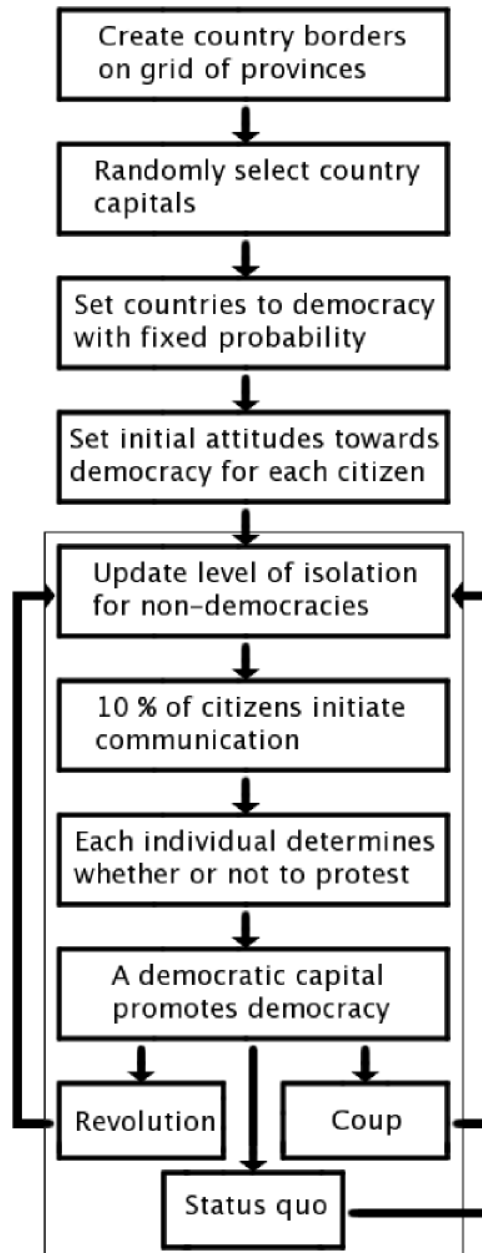


Figure 2: Schematic overview of the agent-based model.

Cross-border chance ( $\tau$ ) Communication effect ( $\delta$ )	Broadcast effect ( $B$ )		
	0	1	5
$\tau = 0, \delta = 0$	.008 (.001)	.060 (.031)	.074 (.034)
$\tau = 0, \delta = 1$	.006 (.008)	.018 (.028)	.187 (.057)
$\tau = \frac{1}{2}, \delta = 0$	.008 (.001)	.059 (.034)	.074 (.034)
$\tau = \frac{1}{2}, \delta = 1$	.006 (.007)	.026 (.038)	.184 (.054)

Table 1: Average deviation from expected Moran's  $I$ .  
Standard deviations across simulations in parentheses.  
Based on 3600 simulations.

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Cross-border chance ( $\tau$ ) Communication effect ( $\delta$ )	Broadcast effect ( $B$ )		
	0	1	5
$\tau = 0, \delta = 0$	.01 (.00)	.98 (.02)	.98 (.02)
$\tau = 0, \delta = 1$	.01 (.01)	.01 (.01)	.73 (.06)
$\tau = \frac{1}{2}, \delta = 0$	.01 (.00)	.98 (.02)	.99 (.01)
$\tau = \frac{1}{2}, \delta = 1$	.01 (.01)	.02 (.02)	.74 (.06)

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Table 2: Average percentage of democratic states in the last 10% of iterations. Standard deviations across simulations in parentheses. Based on 3600 simulations.

## Notes

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1 Although in this model it is assumed that only authoritarian regimes limit the information supply to their citizens, it should be noted that it is not entirely absent in modern, Western democracies either. In various European countries, the distribution of Hitler's *Mein Kampf* is illegal and the pressure to limit the free speech of radical Muslims is increasing.

2 See Le Gallo (2000) and Gleditsch (2002) for the calculation of Moran's  $I$  and its variance, and Griffith & Arlinghaus (1995, p. 27) for the calculation of the expected value.

<sup>3</sup> This is not to suggest that simulation studies are equivalent to experimental studies. Whereas the latter are empirical studies in causal relationships, the former are theoretical studies into the internal consistency and logical implications of a set of theoretical assumptions.

4 See Mok, Wellman, & Basu (2007) for an extensive overview of the literature on this assumption.

5 The source code is available from <http://jaeweb.cantr.net/research>.

6 There are strong arguments for using a randomly sampled set of parameter settings instead of a fixed parameter sweep (see also Laver & Sergenti, 2007; Plümper & Martin, 2006), but a parameter sweep is easier to present and interpret. Extensive analyses have been performed using randomly set parameters that confirm the results presented here.

7 Throughout this article,  $N_{[a,b]}(c,d)$  is a draw from a normal distribution, with mean  $c$ , standard deviation  $d$  and truncated to the interval  $[a,b]$ .

8  $\tau$  is divided by four because there are four neighbors in the Von Neumann neighborhood. The division by 100 is because  $\varphi$  is scaled from 0 to 100.