



# An agent-based model for understanding the influence of the 11-M terrorist attacks on the 2004 Spanish elections



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## ABSTRACT

Government, politicians, and mass media generated a large quantity of information after the bombing attacks in Madrid on the 11th of March 2004. This information had two competing dimensions on the terrorist group responsible for the attacks: ETA and Al'Qaeda. The framing theory could explain how this information influenced the Spanish national elections on the 14th of March, three days after the attacks. We propose to analyze this political scenario using agent-based modeling to recreate the environment and framing effect of the three days prior to the elections. Using our model we define several experiments where we observe how media communications influence agent voters after calibrating the model with real data. These experiments are what-if scenarios where we analyze alternatives for mass media communication messages and word-of-mouth behaviors. Our results suggest that the framing effect affected the election results by influencing voters. These results also outline the aggregated impact of mass media channels and the different role of each party segment of voters during this period.

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## 1. Introduction

On the 11th of March 2004 (11-M), three days before the Spanish national elections on the 14th of March (14-M), a group of terrorists exploded various bombs on trains circulating to Atocha train station in Madrid. 193 people died and about 2000 were wounded. The attacks changed the electoral process: in the morning of the 11-M, the campaign was suspended; on the 12th of March, there were demonstration marches against terrorism in the main Spanish cities; and on the 13th of March, there was a demonstration in front of the headquarters of the People's Party (PP), the Spanish right-wing party who was in the government. Finally, voting surveys failed and the results of the 14-M elections revealed an unexpected change of government.

After the attacks took place, a large quantity of information was generated by government, politicians, and mass media. That huge amount of information pushed the 11-M candidates to position themselves in relation to this event. Voters incorporated this political position about the attacks into their voting decision pro-

cesses [33]. The communicative framework of this event had two political competing dimensions regarding the two terrorist groups which could be responsible for the attacks: ETA and Al'Qaeda. The first position was defended by PP's government, while the second was supported by the left-wing Spanish Socialist Workers' Party (PSOE), the main opposition party, and other opponents [55]. Two main reasons influenced public opinion on PP and PSOE's positions: the evaluation of the management of the government against ETA terrorism and the active participation of Spain in the invasion of Iraq, in March 2003. The majority of the Spanish population positively evaluated the action of the PP government in the fight against ETA. Therefore, President Aznar's bureau declared ETA responsible for the 11-M attacks as an election strategy [38]. On the contrary, the Spanish government's decision to participate in the invasion of Iraq was against the majority of public opinion and political parties.

The presence of terrorism has influenced pre-electoral environments in the past. In the US, the hostage crisis in Iran embassy was few weeks before the presidential elections of November 1980 [65]. In the Netherlands, the mayor of the city of Rotterdam was assassinated nine days before the local elections of 2002 [57]. However, none of the previous cases was comparable to the dimension of the 11-M attacks. As a consequence, the analysis of the turnout of the 14-M elections cannot be performed by comparing

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it with previous observations because there is not any similar electoral incident.

The post-election studies of the 14-M elections showed that the 11-M attacks influenced the decision of many voters, a thesis that has been corroborated by existing research studies on the 11-M and its impact on the elections [3,11,38,39,59,70]. The authors supporting this thesis tend to interpret the elections turnout as a punishment to the ruling party for their mismanagement of the attack, along with their foreign policies. However, no previous study was devoted to explain the framing effect that was generated right after the attack by recreating the main communicative framework. Chong and Druckman [16] defined the framing effect as the psychological process that allows people to develop an *ad hoc* conceptualization of an issue or event, and to readjust their opinion. For instance, an important study showed that 11% of voters changed their minds and decided to go to vote after the attack [10]. This percentage rises to 15.5% in the survey conducted by the Regional Political Observatory [53] but it decreases to 6% in the opinion poll by TNS / Demoscopia [38].

Given the socio-economical and political importance of these facts in the recent Spanish history, the main goal of the current contribution is to analyze the framing effect generated after the 11-M attacks and how it influenced the decision of those who would vote for PP, PSOE, or abstain after the attacks. These two parties and abstention were the three electoral options with the highest support in the 14-M elections. PP and PSOE obtained 81% of votes cast, and 24.83% of the voters abstained, meaning that these three options covered the 84% of the overall voting population. We believe that focusing on the major parties benefits this study since the rest of the votes cast are either received by local parties or achieved an insignificant parliamentary representation. This is because the Spanish electoral system which follows the d'Hondt system [24]. In fact, PP and PSOE obtained 312 of the 350 members of the parliament (i.e., an 89%) with the 81% of total votes.

Our analysis involves studying the influence of mass media treatment of the attack's responsibility into voters and how this influence was spread by individual voters. We propose to model this political scenario using an agent-based model (ABM) methodology [7,23,45]. ABM has been broadly applied for social simulation [27,37,46,61] and for modeling political scenarios [40,43,51]. The ABM methodology relies on a population of autonomous entities called agents which behave according to simple rules and by interacting with other agents. The aggregation of these simple rules and interactions allow the representation of complex and emerging dynamics as well as defining what-if scenarios and forecasting hypothetical scenarios [34].

By using this ABM framework we simulate the 72 h next to the attacks and study how this period of time affects the Spanish population when voting for the 14-M elections. The simulated population is segmented using real pre-electoral data to replicate the main political options: PP, PSOE, and abstention. Our ABM simulation framework also reproduces mass media information from real tracking data and the word-of-mouth (WOM) mechanisms [14,42,60] by using artificial social networks [4,72]. Specifically, WOM is modeled by spreading voters' perceptions [5,20] through a scale-free network [4]. We include mass media information by gathering and modeling the main broadcast media involved in the event (i.e., television, radio, and press) for this period within the simulation.

Using real pre-electoral data as our input, we validate our designed model to fit its behavior to the actual 14-M election results, calibrating some of its parameters using the election's turnout as the target data. Although the values of some model parameters are directly set using reliable real data sources, some other parameters are more difficult to estimate. These parameters involve WOM volume and media influences, among others, and must be estimated

through automatic calibration. The automatic calibration process tunes these parameters and it is a crucial phase in model validation [14,54,58,62]. More specifically, we have implemented our calibration process using metaheuristics [69]. The selected metaheuristic is a memetic algorithm [50] based on a genetic algorithm [2,28] and a local search procedure which adjusts the main WOM and media parameters to replicate the reality.

We define several experiments where we observe how media communications influenced voters through their corresponding agents for the ABM-based calibrated simulation model. These experiments are what-if scenarios where we analyze alternatives for mass media communication messages and WOM behaviors. Alternatives for mass media involve different communication strategies, such as altering media messages to favor one of the identified framings. In the case of WOM, these alternative behaviors involve modifying how segmented voters react to WOM. Additionally, the proposed set of what-if scenarios is used for studying the impact of both media treatment and WOM in the 14-M election results. This study is carried out by monitoring the elections turnout for the different scenarios.

The structure of this paper is as follows. Section 2 discusses related work and motivation for analyzing the framing effect in our study. Then we introduce the description of the model and its structure in Section 3. Section 4 presents the model validation with real data. In Section 5, we run the what-if scenarios where we study how the designed model behaves under different communication strategies. Finally, in Section 6, conclusions and final remarks are discussed.

## 2. Related work and motivation

### 2.1. ABM for simulating political scenarios and mass-media influence

ABM techniques have been extensively applied in the field of political sciences for dealing with political party competition [35,36,40]. These approaches consider both parties and electors as moving entities that make decisions continuously. That is, electors react to politicians behavior and politicians reconsider their strategy regarding electors decisions. In [51], authors extended this approach by including mass media influence. This new role for mass media is focused on campaign organization, where political parties use media for enhancing their image regarding their voters. The latter studies show how mass media can be useful to add realism to the model and better explain the political scenario. We will explain how we incorporate mass media to our model in Section 3.4.

In [29], mass media influence is studied by distinguishing two possible behaviors: global and local. The essential differences between these behaviors are focused on how they behave regarding time and space. Mass media effect and the role of mass media during campaigns regarding voters mobilizations is also analyzed in [26]. This approach is interesting because it analyses the abstention factor, instead of focusing on individual voting preferences. Authors of [47] considered the polarization effect of mass media in opinion dynamics to examine how mass media affects individuals. In this model, mass media messages are propagated via social interactions, showing dynamic changes over different scenarios where strongly polarized messages influence the agent population.

In [43], the authors examined how mass media influence the opinion formation through opinion leaders (i.e., influentials) [41]. Using an ABM simulation, the authors highlight the importance of the communication networks used by opinion leaders to influence the public. Another approach to the cascade of influence and its relationship with social networks can be found in [71]. Some contributions like [68] incorporate topology restrictions for struc-

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