

DIMESim: an agent-based model of the psychological dynamics of collective action

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Abstract: We present DIMESim, an agent-based model that models the response of protesters to an authority that engages or suppresses the movement. A key innovation is that the response includes both the internal psychological dynamics, as well as choices on tactics and dis/engagement. The model is grounded in the DIME (Disidentification, Innovation, Moralisation, Energisation) model of collective action, and parametrised using empirical data. An overview is provided of the model dynamics, and exemplar simulations showcase both the formation of conventional protest movements and the emergence of latent radicalism within the DIMESim framework.

Keywords: Social psychology, protest movement, latent radicalism

1 INTRODUCTION

From the Arab Spring Revolutions to pro-democracy movements in Chile, Thailand, and Hong Kong, protests play a critical role in shaping society and influencing the course of nations. We are living in an age of protest, and there is significant interest in understanding how movements shift from a smattering of individuals to collective action by thousands, and how tactics evolve over time (Cantoni et al., 2024). Agent-based models are one approach to develop this understanding, given their ability to link individual-level dynamics and network interactions, with emergent population-level phenomena. Existing models have explored many factors that cause people to protest, including economic injustice, social influence, and the presence of an authority that suppresses protesters (Siegel, 2011). To date, there has been limited focus on modelling the psychological dynamics of protesters. This abstract presents DIMESim, an agent-based model that was developed from the DIME theoretical model (Louis et al., 2020), with model parameters obtained from empirical data (Louis et al., 2022). We showcase simulation examples that illustrate the emergence of conventional mass protest or latent radicalism.

2 MODEL AND RESULTS

Model. We briefly describe our model, with a schematic in Fig. 1a, and refer the reader to our pre-print (Thomas et al., 2025) for the full mathematical model and results. At discrete time steps $t = 0, 1, 2, \dots$, an authority sends a failure signal with probability $p \in [0, 1]$ to a population of n agents (protesters) connected in a network. This signal represents the authority engaging with the movement (success) or suppressing it (failure). Agents can contest this signal, reframing failure to success. First, individual reframing can occur following a probabilistic mechanism. Then, an agent can reframe failure to success if enough of their network neighbours believe the protest was successful, in a process termed collective reframing. Next, an agent updates four psychological variables (Disidentification, Innovation, Moralisation, Energisation) depending on whether they perceive the movement as succeeding or failing (note that this perception can differ between agents due to reframing). Based on the updated variables, each agent determines whether i) at the next time step they will be active or latent (i.e. engage or disengage with the protest movement) and ii) to continue their current tactic, or change tactics (a choice between conventional vs. radical tactics). Up to six types of agents are possible, classified by two qualities: i) active or latent, and ii) adopting conventional, radical or innovative (simultaneously conventional and radical) tactics.

Results. Fig. 1b shows the time series for two exemplar simulations of $n = 1000$ agents, in which the ability to reframe (individual or collective) is absent. The top panels show the fraction of population for each of the six types of agents, while the bottom panels show the DIME psychological variables averaged across the population.

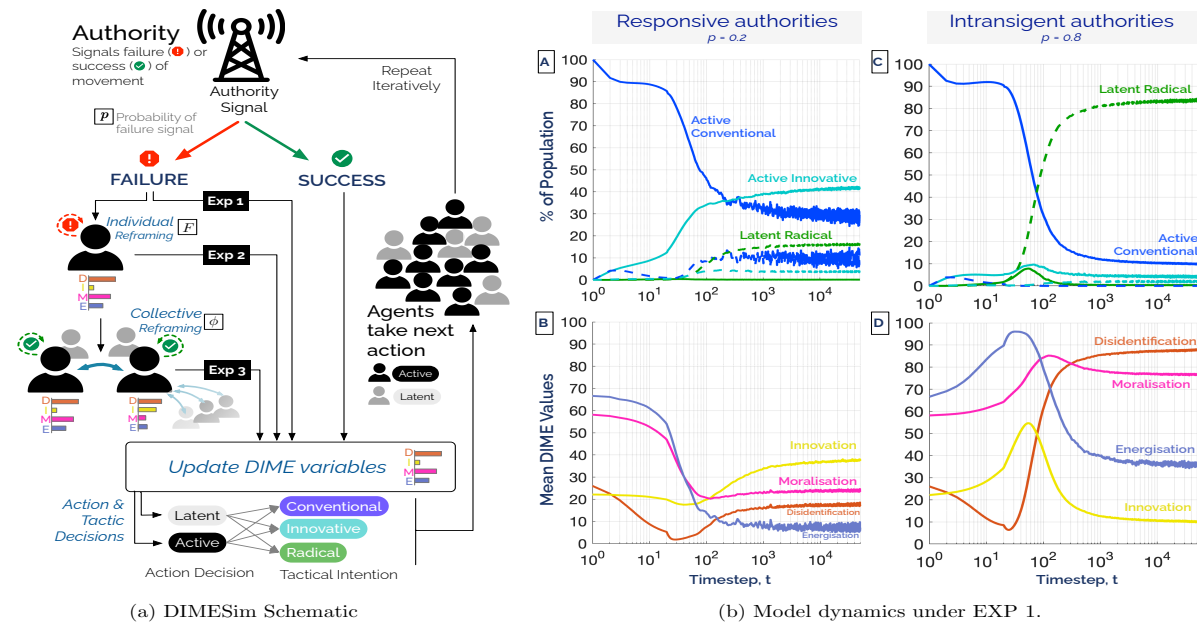


Figure 1. (a) A schematic of DIMESim. (b) Time series from example simulations, under a responsive and intransigent authority. The left column corresponds to a “conventional protest” phenomenon, while the right column corresponds to a “latent radicalism” phenomenon.

The left panels correspond to an authority that is largely responsive and engaging ($p = 0.2$). The right panels correspond to an authority that repeatedly and regularly suppresses the protesters ($p = 0.8$). At $p = 0.2$, we see a moderate movement forming, made up primarily of active protesters that adopt either innovative or conventional tactics. There are few radicalised agents, and those are almost all inactive (disengaged). At $p = 0.8$, the persistent suppression leads to more than 80% of protesters becoming latent and disengaged (inactive). However, psychologically, they are geared towards radical tactics (radicalised). This state of widespread latent radicalism is a potential precursor to violent revolution and uprising; a simple spark or tipping point could mobilise all the latent and fully radicalised agents. Thomas *et al.* (2025) employs a large Monte Carlo simulation campaign to explore how three key features of the model can shape the emergent phenomena: i) responsiveness of authorities, ii) the ability for agents to individually reframe, and iii) the ability for agents to collectively reframe. Both conventional protest and latent radicalism phenomena can emerge under a range of scenarios, with the transition often being a sharp phase transition. Repressive, intransigent authorities drive the emergence of latent radicalism, but the ability to reframe (individually or collectively) can prevent latent radicalism from emerging up to moderate levels of repression.

3 CONCLUSIONS

DIMESim is an agent-based model of protest and collective action, grounded in psychological theory and parametrised using empirical data. Initial work showcases the ability for DIMESim to predict real-world emergent protest movements, with plausible explanations based on authority responsiveness and the psychological dynamics of the protesters. One future direction is to model an authority who changes their response based on the evolving protest movement, perhaps aiming to minimise latent radicalism. Another direction is to explore how opinion leaders in the network could increase protester engagement. We hope the findings will be relevant both for researchers of collective action, and for advice to policymakers on how to engage constructively with protest movements.

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