Mobs Simulator: A Multi-theoretical Stochastic Agent-based Modeling Tool to Study Mobs Outcomes & Mobbers Behaviors

Owen McGrath, Luke Zacher, and Samer Al-Khateeb

Department of Computer Science, Design and Journalism (CSDJ)

Creighton UNIVERSITY

Center for Undergraduate Research and Scholarship

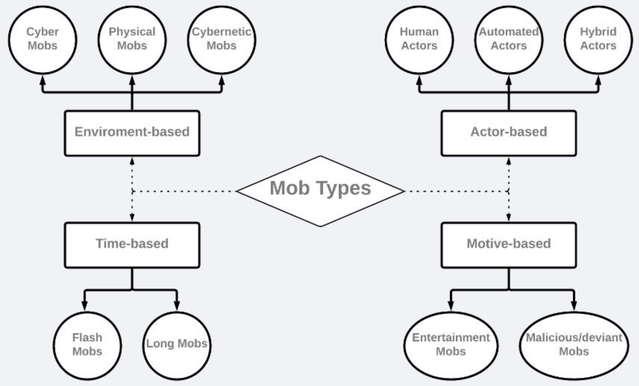
Abstract

A mob is an event organized via digital communication technologies where people assemble (online, offline, or both) to exert a collective force, ranging from malicious actions like coordinated cyber-attacks or street takeovers, to benign gatherings such as unplanned dance performances. While previous research has established theoretical frameworks and data-driven approaches to understand mob behavior, these models often remain inaccessible to practitioners and researchers. Building upon the collective action theory-based model developed by Al-khateeb et al. (2024) and the multi-theoretical framework by Murray et al. (2024), we implement a stochastic agent-based modeling (ABM) simulation tool mainly using Python to better understand mob phenomenon. Our model incorporates key behavioral scenarios driven by five social science theories where agents can: act (participate), withdraw, perform power exchange (to gain utility), or act against the mob. The simulation takes three primary inputs: the number of invited participants, the number of powerful agents (e.g., organizers), and a threshold for mob success. We randomly assign each participating agent eighteen traits/social science factors and then determine their decision/action based on multi-theoretical constraints. The model then calculates a participation rate to determine mob success or failure. All of this is then wrapped into a web-application to create an accessible, interactive tool for studying collective behavior, particularly valuable for understanding cyber-social group formation and potential societal impacts. Our work bridges the gap between complex theoretical models and practical applications, offering insights into related phenomena such as social movements, organized protests, the diffusion of innovation, and the spread of rumors.

Introduction

Mob Organization Process

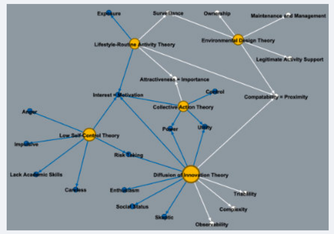
Mob Types

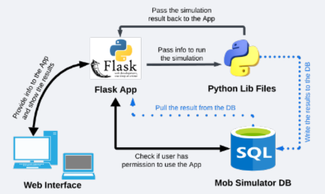


Mob Examples

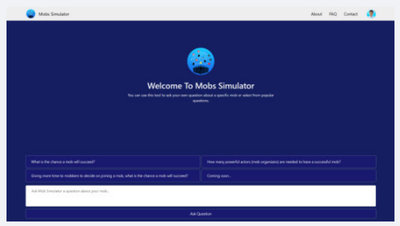
Social Science Theories

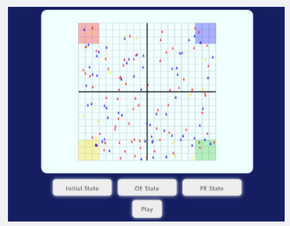
- **Collective Action (CA):** This theory aims to explain how rational individuals in groups do not always voluntarily act in a way that serves the common group interest (or goal). Instead, individuals choose their acts to serve their self-interest. An exception to this rule is when there is coercion forcing them to act, incentives to individuals other than those achieved by the group goal, or if the group size is very small.
- **Life-Routine Activities (L-RAT):** This victimization theory suggests that some individuals may be more likely to become victims because their lifestyle exposes them to more risk of victimization. It also suggests that the convergence in time and space of three elements (motivated offenders, suitable targets, and the absence of capable guardians) are necessary elements in the commission of crimes.
- **Diffusion of Innovation (DOI):** This theory aims to explain how an idea, product, or innovation diffuses through a population. The result of diffusion is the adoption or rejection of a new idea, product, or behavior.
- **Low Self-Control (LSC):** Individuals develop and maintain stable levels of self-control by the age of seven or eight, and those who develop lower levels of self-control are more prone to offending.
- **Environmental Design (ED):** This theory argues that manipulating the environment can create safer or more dangerous spaces.





Mob Simulator Web App





Currently our simulator can answer the following questions

1. What is the chance a mob will succeed?
2. How many powerful actors (mob organizers) are needed to have a successful mob?
3. Giving more time to mobbers to decide on joining a mob, what is the chance a mob will succeed?

References

1. Olson Jr, M (1971) The Logic of Collective Action. Harvard University Press , Cambridge, MA
2. Coleman JS (1973) The Mathematics of Collective Action. Aldine Publishing Company , Ann Arbor, MI
3. Hindelang MS, Gottfredson M, Garofalo J (1978) Victims of Personal Crime. Ballinger Pub Co, Cambridge, MA
4. Rogers EM (2003) Diffusion of Innovations, 5th edn. Simon & Schuster
5. Grasmick HG, Tittle CR, Bursik RJ, Arneklev BJ (1993) Testing the Core Empirical Implications of Gottfredson and Hirschi's General Theory of Crime. Journal of Research in Crime and Delinquency 30:5–29. https://doi.org/10.1177/0022427893030001002
6. Ellis J, Hertig CA (2010) The Professional Protection Officer. In: Davies SJ (ed) The Professional Protection Officer, 1st edn. Butterworth-Heinemann, Oxford, pp 1–8

Acknowledgement: This material is based upon work supported by the Office of the Under Secretary of Defense for Research and Engineering under award number FA9550-22-1-0332. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the U.S. Department of Defense.

Project Website: https://sameral-khateeb.github.io/MobsModeling/

Instructor Email: sameral-khateeb1@creighton.edu