

## *The Effect of Panic on Crowd Dynamics*

Gabriel Brown

University of Notre Dame

Poster Project

We read the headlines and shake our heads in disbelief. We see the images on the eleven o'clock news and cannot imagine how it happens. The aggregate damage caused by panicked individual action is many times astounding. In its most benign form, people leaving a venue in a hurry results in a sub-optimal amount of time it takes to evacuate everyone. However at its worst, the collective behavior of panicked people can have fatal consequences.

In light of the recent tragedies at nightclubs in Chicago and Rhode Island, we have studied the conditions under which singular actions and panic can create jamming in emergency situations. The study includes how aggregate behavior varies with changes in individual agents' parameters. The simulation is implemented using Swarm so as to control the characteristics of the agents, the environment in which they reside, and the statistical feedback given in varying trials.

The agents may vary from how panicked or how calm each person is, or what combinations of different type of people, will vary the outcome. Also investigated is how the density of people in a given space influences results. We notice how a group of calm agents leaving a room in an orderly fashion exit more quickly as compared to when a crowd rushes the door. We extend the notion of an emergency situation by simulating smoke in a room and correspondingly give agents a limited view of exits. We also add to the simulation problems akin to those reported in Chicago in which people ran to the door they entered, leaving other viable exit doors underused.

Additionally, we alter the structure from which these agents are attempting to escape. We show how different room sizes, shapes and configurations influence results. Even though each person's actions cannot be altered (their panic "unlearned") number, types, and sizes of exit doors can be changed to prevent future tragic consequences.