The Utility of a Panic Model on Simulating Crowd Disasters

Tingguang Ma, Michael D. Larrañaga
Department of Fire Protection and Safety Technology
Oklahoma State University
492 Cordell South,
Stillwater, OK 74078

Abstract

Panic is a commonly used concept for explaining the result of a crowd disaster, but still without a well-accepted definition. Here a weak and broad definition, disorganization due to fear, is used to define the individual panic, an early form of mass panic. By choosing a different definition, panic is found everywhere in major crowd disasters, and plays a vital role in leading to a disastrous result. Following Smelser's value-added theory, six elements are identified to explain the initiation, growth and decaying of panic, which is a catalyst for a crowd disaster, but not a direct contributor. A panic growth model is proposed to explain the process leading to mass panic. Several types of panic are discussed and analyzed to show the utility of panic on crowd management. All historical crowd disasters (about 300 in total) can be classified into three categories, escape, acquisitive and aggressive. Their panic growth patterns will facilitate the simulators to study a group of similar disasters and identify clues of disasters in any crowd scenario.

During the last 11 years, China has 46 campus stampedes, with 73 school children died and hundreds injured. A study of the disaster patterns shows that the force between agents plays a vital role on initiating a crowd disaster, which is already used in simulating the escape panic by Helbing et al (2000). By combining the features in environmental and seasonal features, population, common beliefs, and external crowd control, a panic development model will be helpful to predict a potential disaster or explain why a normal crowd-control strategy fails. This work has the potential to guide the future evacuation simulations when a crowd is loomed by stampede or any other crowd-related disasters.

Panic is a debatable concept, which is culture-related. Focusing on some measurable symptoms of panic, its utility in predicting disasters will be explored to guide the evacuation simulations under emergency. Without panic, the crowd disasters will be difficult to reproduce in simulations. Panic is the key to non-rational behavior under emergency.