Review

Can We Agree on Panic?

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Review

Can We Agree on Panic?

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Abstract: This paper intends to review social science studies of emergency evacuations to discuss the difficulties in understanding them as panic and to point out the continued misunderstandings that occur in several computer and engineering science publications when panic is used to model them. The paper first presents five usages of panic in social science literature. It then shows how the conceptualization of one of these approaches on the panic flight, which assumes the prevalence of nonsocial and self-centered behaviors during crisis evacuations, has been transformed by recent studies of emergency evacuations from buildings to show that they are best understood as social behavior in which people exhibit means-end rationality and social solidarity, and as the behavior of collectivities of socialized individuals moving towards sources of actual or perceived safety. The conclusion suggests first that the continued usage of the irrationality formulation by a minority of engineers and computer scientists writing on the topic of emergency evacuation and their use of "herding," or the notion that during dangerous conditions, people follow the actions of others, leading to conformity, is not supported by a majority of findings in the social sciences, and second, that a likely solution to the disconnect between the two science communities is the increasing adoption of transdisciplinary collaborative research designs.

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1. Introduction

This essay calls attention to panic, hoping to encourage renewed scholarly interest in the subject matter it represents by students of disasters and rapid social change. It begins with a novel synthetic emergent definition of panic flight as **the movement of precipitated collectivities of people concentrated in time and space who engage in spontaneous and synchronized collective behaviors and enact new norms and or social relations as they respond to perceived or actual threats under time scarcity. These movements are impacted by the size of the collectivity and its average human density, the degree of social cohesion and shared emotions, and the prevailing extent of interdependence and uncertainty.** Panics also vary by their institutional context (essential to mass hysteria) and the presence of complex organizational actors, as is the case of moral panics and epidemics of deviance. They involve the emergent, collective behavior of moving multitudes and are more than individuals' behaviors; even in the case of a panic attack or psychiatric illness affecting a person, the individual's mental disorder links to a social context which is the partial source of the unresolved anxiety. Panics are the result of triggering incidents suffused with fear forcing the adoption of new collective definitions of what is going on and, in so doing, transforming the culturally-established understanding of the initial gathering. Quarantelli (2008) and other scholars have documented that panic flight behavior rarely occurs during disasters. However, the panic concept is used in contexts other than disasters, which requires examining the more prominent of these other conventions. The resulting typology is not intended to be exhaustive but rather an attempt to summarize the most frequent usages of the panic concept to contextualize its use in the disaster literature. The following pages examine five ways the concept of panic is used, followed by a review of the literature on panic in the social sciences. The third section then presents more recent studies of crisis evacuations as a situs to panic flight incidents to indicate how they have forced a rethinking of the classical model of panic. It is followed by a concluding section reviewing the continued use of irrationality and herding

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concepts in some computer science studies of crisis evacuation. It suggests that transdisciplinary collaboration offers a methodological solution to this misunderstanding.

2. Panic Models

One way to make sense of panic is by noting the precipitated gatherings' size and social complexity, from persons to groups, collectivities, organizations, communities, nations, and international-level aggregates. At one end of this continuum is the meaning of panic used in the medical literature that conceptualizes panic as a psychological illness or medical condition, defining a panic attack as a "(a) discrete period of intense fear or discomfort…which…reach a peak within 10 minutes: (with) palpitations; rapid heart rate; sweating; trembling or shaking; shortness of breath; the feeling of choking; chest pain or discomfort; (Panepinto, 2000, p. 12)." *Panic hysteria* in individuals is a recognized condition in psychiatry. The term originates in Freud and Breuer's "Studies of Hysteria" (1895), which led to catharsis in psychoanalysis in treating mental illness (Scheff, 1979, 26-45.) Approximately 1.7 percent of the U.S. population is estimated to suffer panic attacks during a given year. Women are more likely to experience them; young people less than 24 years old are also overrepresented. A second use is known as *mass hysteria*. It also uses medical criteria but refers not to individuals but to collectivities of persons claiming uncorroborated symptoms of physical illnesses. An example is the mass hysteria among young women that brought about the nefarious witch trials in Salem, Massachusetts, 1692-1693, in which twenty women were executed from the two hundred, mostly older women accused. Elsewhere, those impacted during the Tanganyika laughter epidemic of 1962 in Tanzania experienced uncontainable laughter, accompanied by fainting, respiratory problems, and crying; the hysteria spread from a group of schoolgirls to the entire school, neighboring schools, and entire villages. Other cases are the panic hysteria of "penis becoming smaller" common in Asia and Africa in 1967 and the 2012 episode of mass hysteria in Sri Lanka when one thousand nine hundred children from 15 different schools in the nation suddenly experienced coughing vertigo, and skin rashes. Another recent incident is the 2011-2012 Tourette syndrome mass hysteria in New York that involved students from LeRoy High School who started showing symptoms of Tourette syndrome (Bartholomew, 2001, Section 2; Wilkipedia gives an extensive list of these incidents from the middle ages until the 2000s.) An even more recent incident occurred among personnel working in the American Embassy in Havana and elsewhere who exhibited a mysterious, until now unexplained illness syndrome (still under scientific exploration by federal government agencies.) Mass hysteria incidents occur to categories of people densely distributed in well-defined and relatively circumscribed settings such as schools, religious institutions, embassies, offices, and factories and typically involve young people. Both panic attacks and mass hysteria are relatively straightforward usages of the panic concept. However, in cases of collective delusions described below, mass hysteria may involve hundreds if not thousands of people spread over broad areas.

Moving to a meso level of analysis, a third convention considers panic as flight behaviors of people's collectivities in closed or open spaces responding to what they perceive as a threatening force (Moss Haber 1980, 156). *Panic flight* in close quarters, such as during evacuations from building fires, the main topic of the subsequent sections of this report involves collectivities of people responding to either real or imagined dangers and impending risks. Still, whether the participant in massive flights is fleeing from the perceived hazard or, as affirmed among others in A. Mawson's affiliation hypothesis (2007: 233-252) is seeking safety by moving toward perceived sources of psychological support such as friends, spouses, and groups to which they belong is unresolved. Such seeking implies mean-to-end rationality, rendering the widespread assumption of irrational behavior misplaced (see below.) In open spaces, this type of panic is referred to by various names, from collective delusions (Bartholomew 2001, Section 4), such as in the European mad cow panic of 2000, to the generic label of groupthink (Bénabou. 2013.) One of the most representative examples of panic flight in open contexts is military panic, in which an army overtaken by fear or aggression either flees from the battlefield in what is known as military routs or charges headlong in what Collins' (2009) called forward panic as it happened in the First Battle of Manassas **(July 21, 1861)** of the American Civil War

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in which Southern troops attacked and brought about a momentary collapse of the Union troops, putting at risk Washington, D.C. Panic flight behavior is different from moral panics. The first occurs in collectivities that may not share lasting institutional memberships. In contrast, such membership is fundamental to moral panic (see next.)

The fourth usage of the panic concept refers to *moral panic and deviance epidemics* (Goode and Ben-Yehuda 1994; see also Thompson 1998). In both waves of moral panic and epidemics, a population segment clamors for protection from categories of people perceived as dangerous. They advocate---in what is often eventually perceived as inaccurate and counter-effective--- for state officials' adoption of protective responses. Their success brings about punitive actions against those who "threaten" them. Moral panics express the unorganized fears of communities. However, organizations and moral entrepreneurs often respond to or orchestrate epidemics. In these cases, these organizations amplify, if not create, community anxieties, transforming them into politically advantageous public opinion currents. Moral panics and deviance epidemics are like collective delusions but with the added components of culture and politics. A present-day example is a moral panic and epidemic against people seeking refuge in the U.S. through the country's southern border. Many organizations and moral entrepreneurs want to amplify, if not create, community anxieties, creating politically valuable public opinion against the would-be immigrants. The two forms commingle: moral panics often facilitate the emergence of organizations trying to bring about the desired change. Or the organizations create moral panic as part of their efforts to elicit public approval for their corporate goals and actions. Moral panics and epidemics are widespread. Importantly, each shows means-end rationality irrespective of their often-negative effects on society. A fifth and final use of the panic concept focuses on macro units such as societies and cultures. Its focal points are the environmental catastrophes and the uncontrollable hazards and disasters increasingly faced by societies in the post-industrial epoch of the world system (Giddens, 2002; see also Beck, 1992), which cause panic as a product of people's widespread ontological anxiety and insecurity (Tester 2013, 11, 92-93.) An example is the widespread contemporary concern in the U.S. with the activities of Satanic Cults and Devil worshipers, the extensive fear and aggression it causes against presumed perpetrators, and the doubt that scientists and government agencies are able or willing to do anything about them. In this instance, the epidemic reflects and amplifies the epistemic insecurity of communities searching for ways to make sense of their lives in what Giddens identified as a "runaway world."

As ideal types, the links among these various definitions and usages of the concept of panic, offered here for heuristic purposes, have received scant attention. There are few studies of how one type of panic coexists or is transformed by another; for example, the extent to which moral panic brings about the physical and psychological effects postulated by the medical model. Similarly, except for the first two types based on medical diagnoses, there is no consensus about the relative validity of critical constructs and how to develop standard metrics to measure them. Nor is there a sufficient number of rigorous comparative studies such as the United States Strategic Bombing Survey (1945, 16.) It concluded that despite the fact of considerable losses and disruptions, panic attacks, hysteria, and flight behaviors among German civilians were rare: the majority continued to participate and function as full members of their communities and workplaces amid the withering Allied bombing raids of their cities during 1944-1945.

Given these multidimensional aspects of the panic concept and the still many unanswered questions, rather than abandoning the study of panic flight (compared to Clarke 2002, 21), it seems preferable to carry out rigorous comparative studies of the relationships of panic flight with the other types of panic. The relation between these types of panic is worth pursuing. For example, the presence of moral panics may make possible mass hysterias, as was the case in the Salem witch-hunts, an instance of mass hysteria made possible by a moral panic and subsequent deviance epidemic among the Puritan sect occurring within the strictures of a religious organization; Puritans believed that women were prone to fall prey to the Devil--they saw the soul as feminine and women's bodies as weaker and more vulnerable to the Devil's designs (Reis, 1995, 13.) The same is the case for epidemics of deviance, in which a leader of an organization, such as a political party, leads a precipitated

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gathering of adherents to engage in various forms of collective behaviors such as demonstrations and marches. Additionally, mass hysterias and moral panics often bring about precipitated incidents, as shown, for example, in recent, recurrent economic fears in Argentina, Russia, and other countries during which throngs of people congregate in front of banks and other financial institutions trying to withdraw their capital suddenly perceived at risk, or when mass fears precipitate emergency evacuations. There is also a relationship between governmental and civil society organizations' current warnings about the ongoing destruction of the environment (which at times have justified a deviance epidemic) and fears about climate change's nefarious impact, a type of moral panic.

3. The Collective Behavior Tradition

In the social sciences, several studies examine panic flight as a form of collective behavior (C.B.) The most relevant early contributors include Gustave Le Bon, Robert E. Park, Ralph Turner, Lewis Killian, and E. L. Quarantelli. These influential authors made primary contributions to our understanding of panic. The sequence in which they are listed here traces the start of collective behavior in Europe, its introduction to sociology in the United States, and its more mature phase in the 1980s. Also mentioned below are other prominent writers such as Herbert Blumer, N. Smelser, John Lofland, Clark McPhail, and J. D. Sime. We now turn to two of the field's founding figures, a European and an American.

Gustave Le Bon (1841-1931) was a controversial European author reacting during the late 19th and the first decades of the 20th century against democracy and the labor movement. His law of the mental unity of the crowd, now superseded, emphasized the importance of the transformation of individual identity into a shared collective identity that he presumed came about by processes of suggestibility, contagion, and regression which incapacitated the individual from engaging in reasoned action. Le Bon conceptualized the crowd sui generis as an emergent collective behavior form. He never discussed the panic flight as such but subsumed all forms of C.B. into the crowd as the prototypical configuration in his well-known monograph entitled “The Crowd: A Study of the Popular Mind” (1895, free from gutenberg.org.) For Le Bon, the crowd's instantiation occurs as people converge to specific places and imitate others’ behaviors at these sites through contagion mechanisms, which diffuse into a shared and unitary mental state among the crowd’s members. Le Bon claimed that crowd members lost their cognitive abilities and individuality. Instead, people adopted a shared mental and emotional state that reflected their gender, race, and national character: people in crowds experienced high emotion, were highly suggestible to others' ideas, and did not act rationally. Other contemporary European intellectuals adhered to an extent to Le Bon’s dictum, among them, José Ortega y Gasset in his monograph “ La rebelión de las masas” (1929) and Sigmund Freud’s “Group Psychology and the Analysis of the Ego” (1922.) Notwithstanding his continued approval by the reading public, the specialty's subsequent writings have not been kind to these ideas. Critics point out that high emotion does not eclipse the ability to reason (Lofland, 1993.) Experiencing a great deal of emotion in specific cases is highly rational, for example, when a building fire threatens people’s survival. People's prior understandings and interests mediate the acceptance of suggestions: they do not act upon all suggestions. Furthermore, the findings of numerous empirical studies have supported neither his assumptions about the homogeneity of participants' experiences in instances of C.B. nor that crowd members regress to shared racial, gender, and national identities. Nowadays, these claims are racist, sexist, and ethnocentric.

Robert E. Park (1864–1944), a faculty member of the University of Chicago's sociology department and a leading figure and public intellectual, helped introduce the study of collective behavior in American sociology with his dissertation entitled “Crowd and Public: A Methodological and Sociological study” as well as a subsequent very influential 1924 monograph “Introduction to the Science of Sociology” co-authored with Ernest Burgess. He made the felicitous distinction between the crowd and the public, recognizing the importance of facts and reasoned discussion in the latter. His approach was based in part on a social psychological perspective, and employed multiple criteria to distinguish the nature of collective behavior: it marks the disruption of established routine,

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challenging tradition, and is the process of solving the persistent problems within the existing institutions; further, it is the means through which society evolves and gradually adjusts itself more effectively to the ever-emerging problems challenging it, leading to the creation of new institutions more capable of elucidating the issues that individuals face. This forming and reforming of society is a permanent process of conflict and resolution that is very different from a Lebonian exposition (Turner, 1967).

Nevertheless, traces of Le Bon's ideas are apparent in some of Park's writings. He accepts much of Le Bon's negative views of the participants in instances of C.B. even as he assigns collective behavior a beneficial effect in the evolution of modern societies. This ambivalence makes it unclear how he logically derives from a situation of social unrest marked by behavioral and psychological retrogression at the individual level a functional, positive effect of the same instance of social unrest at the societal level. Thus, one of his most controversial hypotheses is the notion that circular rather than symbolic interaction typifies collective behavior, in which sympathetic responses among the people involved "implies the existence in A of an attitude of receptivity and suggestibility toward the sentiments and attitude of B and C (Park and Burgess, 1924: 893)" which has the effect of removing the natural reserves that often exist between persons (p.789). An emotional collective sentiment emerges, which is social and the group's property. Contrary to this claim, however, is that circular interaction has not been found as a significant feature in most subsequent empirical studies of collective behavior.

Park coined the concept of unorganized crowds to refer to panic flights and stampedes. These were two borderline forms for which he showed great ambivalence, writing that since the person in a panic or a stampede does not cooperate with others but instead tries to protect herself even at the cost of others, panics are not instances of C.B. for they lack a common shared purpose (Park and Burgess, 1924, p. 876). In passing, Herbert Blumer, perhaps the best-known of Park's students, elaborated on Park's ideas about collective behavior and panic as a subtype of the acting crowd; people in panic have outside goals and are competitive, aggressive, and often self-destructive. In them people presumably share familiar feelings or moods, act out the impulses associated with this mood, and show varying degrees of loss of control of average community values and norms.

Two of Blumer's students, Ralph Turner (1919-2014) and Lewis M. Killian (1919-2010) authored an influential monograph entitled "Collective Behavior" (three editions published in 1957, 1972, and 1987) in which they introduced emergent norm theory (ENT) based in part on Herbert Blumer's symbolic interaction theory (see C. McPhail's summary and criticisms, 1991, Chapter 3.) ENT emphasizes the importance of norms and social relations and posits that C.B. emerges from a normative crisis brought about by a precipitating incident. Depending upon how the participants collectively perceive and interpret the events, it may destroy, neutralize, or not allow for the preexisting normative guidelines, division of labor, power enactment, and other social arrangements to be defined as appropriate guides for action. Instead, the precipitating incident creates a sense of uncertainty and urgency, requiring a new, emergent normative structure to guide their behavior and forcing people to act. Compelled by the crisis to abandon their previously established social relationships and normative guidelines regarding legitimate ways of acting, people engage in C.B. to solve their problems. First, they mill about and offer alternatives to the new situation. They propose cues for appropriate action to others, evaluate their relevant skills regarding the new demands of the situation, and try out alternate schemes before they agree on what to do, which these authors call a shared emergent norm. ENT assumes the presence of heterogeneous actors with different backgrounds, perceptual abilities, and motives. People also differ in what they think is going on, how to respond to the crisis, and who is responsible for doing various things. From the perspective of ENT, C.B. is produced by social interaction and is rational, normative behavior. ENT positions panic flight as a crowd subtype in which people enact parallel and competitive lines of action. This view of panic is heavily influenced by E. L. Quarantelli's earlier writing (1954), nowadays referred to as the classic model of panic (see below). They wrote that panic "arises when the members of a collectivity are each trying to obtain an objective whose obtainment is problematic for each (Turner and Killian, 1987, p. 81)," adding that panic flights

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are more likely to occur in situations with limited available exits. People lacking adequate information about their shared threat often feel trapped (such as a blocked or soon-to-be obstructed escape route), increasing their need to escape and the resulting competitive responses.

This viewpoint is quite similar to Quarantelli's (1954) earlier model of panic, which views it as "nonsocial behavior." According to this author, in a panic, "the "ordinary social relationships are disregarded, and pre-existent group action patterns fail to be applied" (269.) The hazards (270) are perceived as so severe that people ignore social conventions in their search for survival. Instructively, later on (1975), Quarantelli continued to stress that panic flight behavior is nonsocial and non-rational but not antisocial (9) and that the nonsocial dimension of panic behavior is rare and short-lived (14.) He also wrote that the "orientation of activity of the (panic) participant is highly self-centered, both temporally and psychologically (11)." Presumably, her flight continues until people believe they are away from the danger (12.) Quarantelli's emphasis on self-centered behavior is similar to Kurt Lang and Gladys E. Lang's view of panic as demoralized private behavior in the absence of the pursuit of group goals. However, Quarantelli's claim introduces a difficulty, for studies have shown that most collective behavior, including during precipitated encounters in emergency evacuations, is deeply concerned with others. The claim of self-centered behavior in instances of panic has not received substantial empirical support (see below.)

Another distinctive recent approach is Neil Smelser's (2011, xxiv; 1963) structure-functional valued-added theory of collective behavior, which emphasizes four structural components of social action, e.g., facilities, motivations, norms, and values. Smelser argues that collective behavior results from the misapplication and "short-circuiting" of the appropriate functioning among these four components brought about by the participants' faulty or magical generalized beliefs or modes of thinking. Panics are the simplest form of collective behavior, dominated by hysterical generalized beliefs about the presence of a shared deadly threat. They result from the flawed specifications of the facilities that are relevant to the rest of the components for social action, and are facilitated by the presence of hazards, shared anxiety, and the perception of closing exits. Hysterical generalized beliefs are a crucial feature of Smelser's understanding of panics, rendering it as irrational collective behavior.

4. Recent Studies of Crisis Evacuations

Some published studies confuse the nominal-realist levels of analysis so that individual-level descriptors are used to measure the aggregated dimensions of the crisis evacuation. This error is partly due to the analysts not making their choices explicit (but see Wenger, 1980, 215- 216.) Feinberg and Johnson (2001a: 270) acknowledge the problem: "…the definitions that refer to panic as a collective response, sometimes referring to "mass panic" or "group panic" ---are unclear as to whether the collective phenomenon is simply an aggregation of individual panic responses or is a property of a collectivity." Feinberg and Johnson complain that descriptions of panic "ordinarily employ individual (rather than collective) referents" and exemplify this problem in the theories of two highly regarded contributors to this field of studies. The first is E. L. Quarantelli's (1954) use of the individuals' perceptions and behaviors in his etiological model of panic. The other is J. D. Sime's (1983) stress on individuals' subjective experiences and affiliate behaviors that attribute panic in an anticipatory and rearward manner to the behavior of others rather than to the self. There are many difficulties generated by this confusion. Smith (1979, 3; see also Mawson, 2007, 235-245) mentions the need to keep these levels of analysis separate, while Moessinger (2000, 82) adds that "(t)here is little chance that coordinated activities and spontaneous organization could be explained by individual choices only." All told the findings of recent empirical studies of the aforementioned precipitated encounters do not entirely support the classic view on panic held by Le Bon, Park, Blumer, Turner, Killian, Smelser, and Quarantelli. Quarantellis' panic model is only partly supported, particularly its assertions of the prevalence of nonsocial and self-centered behaviors among the people involved in mass evacuations. Some of the characterizations of panic flight are at variance with the findings of empirical studies by Anthony R. Mawson, Jonathan Sime, John Drury, and Johnson and Feinberg, among others, who

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document that crisis evacuations show considerable social solidarity. The evacuees do not cease to act as socialized individuals; instead of moving away from danger, they move towards real or perceived sources of safety, thus exhibiting means-end rationality. The following section reviews the available empirical tests of these contrasting theoretical claims.

Social science studies of crisis evacuations from buildings. The study of of group-level processes during crisis evacuations from buildings is not as abundant as they should be. Neverthelesss, they are a few cases that should be mentioned. The chance presence of D. D. Smith (1979) at the Armor Room of the Tower of London during the terrorist explosion of July 17, 1974, allowed him to observe group-level behavior during the impact phase of the bombing as well as interview the survivors. At the time of the explosion, 80 persons and 21 groups (15 families and six friendship and acquaintance groups) were in the room. He reports that twenty individuals acted in panic and another 20 in a confused manner, and there was panic behavior in six groups in the Armor Room. There were also proselytizing interactions between the two groups, leading to panic behavior. Most of the group leaders were males, but the incident lacked one. Groups indicated to their members what type of response was appropriate, such as when they needed to stop dashing out of the room: Norms, both institutionalized and emergent, guided individuals' behaviors, leading Smith to conclude that the response showed a mix of both types of norms (Smith 1979, p. 13).

Sime (1983), studying behavioral response in fire emergencies, hypothesized that evacuations' human action conforms to an affiliative model. He tested it using information from the 1973 Summerland fire and showed that social attachments to other evacuees strongly influenced exit choice and that they tried to search for the familiar in the emergency and aligned themselves with those they had a prior social connection to try to magnify their safety. Sime concluded that egress behavior is "flight behavior…characterized by the movement toward rather than away from individuals with whom one has close psychological ties..(that) attachment takes precedence over escape behavior.. (and that in) …flight..individuals tend to move away as a group, thus maintaining proximity with attachment objects." (702). Similarly, John Drury and his collaborators contributed to the social identity tradition by studying processes of social identity change during precipitated encounters and its beneficial effects, rejecting the view that people panic. One of their studies (Drury et al., 2008) used information from 90 survivors and 56 witnesses of the July 2005 London bombings to examine the emergent group formed in the aftermath of this tragedy. Their study showed their respondents had a sense of unity among themselves due to their shared experience during the bombings; helped each other in part because of this feeling of unity; took risks to help other members of the group, including strangers; and felt that after the explosions they continued to be in danger. These authors proposed "a novel explanation for this evidence of 'collective resilience,' based on self-categorization theory, according to which a shared common fate entails a redefinition of self (from ‘me’ to ‘us’) and hence (an) enhanced concern for others in the crowd." Turner et al. (1987) and Mawson (2007) are also exponents of similar theoretical approaches to understanding people's behavior in these precipitated gatherings, by and large at odds with the earlier collective behavior writings on panic.

Mawson reviewed the mass panic literature and many instances of crisis evacuation. He offers a theory of mind, hypothesizing that people have cognitive maps (internal sensorial representations of their interpersonal and physical environments) and that when an external stressor deviates from this cognitive map, it alarms them. People evacuating do not run away from the hazard but instead run towards individuals or places they perceive as sources of psychological support and feelings of safety and wellness; during evacuations, people try to locate other significant people and join them (p. 245). In situations of panic flight, according to this author, the evacuees are escaping from a dangerous situation and moving toward other places providing them with a sense of safety (234.) Mawson interprets this seeking behavior as an attempt to restore congruity to evacuees' cognitive maps as they seek what they perceive are familiar and safe places and people. This propensity to self-organization is also evident in Connell’s (2001) detailed content analysis of first-person newspaper accounts of the survivors of the WTC 9/11 evacuations. Connell documented how leaders, victims' social locations, and increased risk perception impacted the decision to evacuate. Emergent norms operated in

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the stairways, such as guiding helping behavior, moving in a single file, no talking, not cutting in line, with evacuees serving as a moving human chain conveyor passing information and supplies up and down the stairways.

Feinberg and Johnson, 2001b) used information about the emergency egress of 1215 patrons from the Cabaret Room in the supper club in which one hundred sixty-four patrons died. In this incident, there was an emerging threat (fire); a warning to evacuate was given, and people trying to escape encountered a blocking of exits and a dwindling of escape routes as the situation worsened. In a counter-flow produced by locked doors, people engaged in aggressive behaviors such as pushing, jumping over tables and yelling, as predicted by an earlier set of theoretical assumptions, but most evacuees were orderly. Helping behavior was more typical, for social norms, values, and affiliations prevented aggressive actions. Feinberg and Johnson (2001a) documented group-level processes in this fire, writing that "social organization-specifically roles and status relations endure even during the flight from calamitous fires" (293.) They showed that roles and status relations continued during the evacuation from the building. In a finding duplicated by Aguirre (see below), some patrons put themselves in great danger while assisting others in their kinship groups, returning to the burning building to search for their significant others. Similarly, the restaurant staff performed heroic, selfless acts to help their clients. Even if the evacuation was norm-oriented, it did not mean less deadly. Feinberg and Johnson (2001a) found that the greater the size of groups, the higher the probability of dying among the group members (R square=.791). It is a statistical correlation reproduced by other studies without a present-day conclusive explanation. For example, Cornwell (2003) also concluded that the extent of social links among members of the groups in the Beverly Hills Supper Club fire increased their chances of dying and that in bigger groups, members spent more time looking for other group members and in so doing exposed themselves to more significant dangers. Aguirre et al. (1998; see also Sorensen, 1991) also showed that group dynamics impacted people's decision to evacuate the World Trade Center during the first terrorist attack in February 1993. Normative considerations impacted the start of the workgroups' evacuation, and members who knew and cared for others took the longest to start evacuating. Another hypothesis advanced by Benjamin Cornwell (unpublished manuscript) is that it is not the size of the group but its internal segmentation that determines their differential morbidity. Aguirre et al. (2011) studied the Station nightclub fire's evacuation of 465 people in West Warwick, Rhode Island, in 2003. Most females waiting for the show's start were in front of the dance area. Opposite them in the bar were many male members of their groups. When the fire started, they moved in opposite directions, trying to find each other in a place that quickly became full of deadly smoke. Due to this spatial dispersion, group members in the various locations were closest to different exits from the building that went unused. The building had four exit doors and two windows in the greenhouse and bar areas facing the front. These were broken and used as exits as the fire progressed. Significant crowding occurred in these exit paths. Other confined spaces also had high human density. Increases in the proportion of intimate relations among the 212 groups present in this fire increased their chances of dying. Groups of people with friends, dates, and kin had the highest percentage of deceased members. Further, the greater the average distance between group members at the start of the fire, the higher the proportion of group members who had not visited the nightclub before the incident, and the higher the average length of the groups' evacuation routes, the higher the proportions were of dead group members. Here again, the group size and average distance among group members were positively correlated (Pearson R .85), as are the size of groups and chances of dying (R=.86.). Many survivors claimed that they did not panic but that people around them did. However, despite the presence of conditions previously identified in the literature for panic to occur, there was no consistent sign of irrational panic flight in this fire: according to the Rhode Island chief medical officer at the fire (personal correspondence), the deceased' bodies did not show signs of blunt force blows or other violence that are often assumed to occur during a panic when people struggle with each other trying to escape. This finding challenges the claim of widespread aggressive competitive behaviors among those trying to exit the building.

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Accounts of population evacuations fleeing volcanic eruptions, earthquakes, and other hazards typically show people in a hurry trying to distance themselves from the dangers that threaten them—a rational pattern of behaviors that most often does not support the stereotypes associated with panic flight. A case in point is the study of an open space evacuation that examined the departure of hundreds of thousands of people across the New York Harbor on September 11, 2001, after the Twin Towers' destruction (Kendra and Wachtendorf (2016.) The ferries, tugboats, and other crafts that typically operated in the New York harbor formed an emergent operational group that responded to this incident. This emergent system helped people cross the bay and return to their homes in New Jersey and elsewhere. Their study document how this previously unplanned group response took place. Preexisting institutional arrangements adjusted to the new situation, such as the Coast Guard accommodating these new collective activities by temporarily relaxing regulations regarding the appropriate number of passengers per craft. Their study showed the importance of previous social ties among the personnel that worked in the harbor and the adaptations to their work patterns, which made possible an unrehearsed and unplanned but highly effective waterborne evacuation. Despite the potential competition among tens of thousands of would-be WTC evacuees trying to get into crafts to navigate the N.Y. bay, this study also indicates no competitive flight panic behavior among them. Yet another open space evacuation occurred during the September 19, 2017, Mexico City earthquake. This summary comes from an incomplete, preliminary analysis conducted by this author with Dr. Jesus Manuel M. Medrano from the Centro de Investigaciones y Estudios Superiores en Antropología Social (CIESAS) in Mexico D.F. of the hundreds of videos of this disaster available on Youtube. These videos show people running away from the buildings they justifiably feared would collapse. However, acts of violence and aggression are absent, showing that behavior dominated by high emotion is not necessarily irrational or violent. Indeed, very few of the hundreds of people in these films showed signs of being overcome with screaming and uncontrollable crying. In these films, it is also possible to observe traditional gender role differences and social solidarity among the evacuees. Men act out the protective role, appearing calm. They tell women near them that the worst of the shaking has passed and there is no cause to worry, while women are more prone to pray, cry and show fear. The expressions of cooperation and social solidarity are plentiful: for example, people spontaneously volunteering to get pre-teen school children out of a school bus that the falling debris from a collapsed building had damaged and immobilized; small groups of people linking arms and kneeling, perhaps in prayer; people embracing, or taking their turn and helping each other as they moved in the halls and stairs; and the thousands of people standing near high rise buildings, many of them waiting to find out the whereabouts of their relatives and friends who resided in them, even at the risk of being killed if the buildings collapsed.

In sum, these more recent studies stem from an earlier tradition of scholarship but abandon irrationality and self-centeredness as valuable ways of understanding the collective behavior of people involved in crisis evacuation. They indicate that irrational flight behavior is rare and that most evacuees behave rationally and empathetically toward others (Fahy and Proulx, 2009; Aguirre et al., 2011 and literature cited in these studies.) They emphasize the simultaneous presence of both emergent and established norms and the relevance of the expectations and goals embedded in the statuses and the sets of roles played with others in these instances of social life. Many do not use the word crowd as an organizing concept because of its cultural baggage, substituting for it Erving Goffman's (1966) dramatist concepts of the gathering and the precipitated encounter, which re-structure the topics or culturally-given meanings of the occasions and bring about the emergent collective behavior; in them, the participants' involvement in their roles become all-absorbing, everything is upfront, and people's behaviors reveal intimate aspects of themselves (summary in Brown and Goldin, 1973, pp. 150-163). An example is McPhail's (1991: 61-102) symbolic interactional-behavioral conceptualization, which emphasizes people's behavior in gatherings engaged in symbolization and the variety of distinct collective forms that result. He uses vocalization, gesturing, and other synchronized movements among the participants, the direction most people face, and the activities

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they are engaged in to identify close to fifty of what he terms "elementary forms" of collective action. These forms are, to varying extents, emergent types of associations.

The paper's first section presented five usages of panic in social science literature. It then reviewed how one of these approaches, focused on panic flight, has been understood in the collective behavior (C.B.) scholarly tradition. It concluded that the more recent studies do not support the classic view of panic. The next and final section examines the engineering and computer science literature on evacuations from buildings to indicate that probably less than 20 percent of these studies continue to assume that panic behavior is irrational and to challenge the notion that herding is appropriate, nd its assumption individuals in conditions of danger give control over their actions to others leading to conformity.

5. Panic and Herding in Computer Science Studies of Evacuation

Currently, writings on panics and herding during evacuations usually ignore (but see Harding et al. 2008) the potential formation of "knots" or immobilizing aggregates of people amid collectivities evacuating in buildings and other close environments. These "knots" are not the result of individual and group-level volition but instead represent short-lasting, emergent collective assembles. People acting nonrational (panic), copying what other people do (herding), and high human density is not sufficient to create these knots; there are many instances of dense but well-regulated and organized gatherings. The likelihood of these "knots" occurrence probably increases in rapidly changing contexts, such as when evacuees become frustrated by blocked exits and unexpected movements occur, for example, when they inadvertently push others who fall to the ground and then block others or stumble in front of people behind them. They are also due to people racing in different directions when their paths intersect. Contra-flows in which two or more segments of a collectivity move in opposite directions in constraining environments may also bring about the occurrence of these "knots", but only if such flows lose their prior coherence (as happened briefly in the evacuation of the Alfred P. Murrah Federal Building in downtown Oklahoma City in the aftermath of the terrorist explosion on April 19, 1995.) The victims' location at the fire's start is probably the most potent predictor of experiencing the blocking effect (or supra force) produced by these knots. Hypothetically, those in the middle of the space where the evacuation is taking place are the most likely to experience it, while the people at the periphery of the evacuating collectivity are least liable to suffer its effects. However, they help create the conditions for it to form. By implication, such knotty subareas with many interactions involve only a fraction of the evacuees and a fraction of the space, pointing to the heterogeneity of victims' experiences. The literature often misconstrues these knots' effects unknowingly when it folds them into terms such as human avalanches, stampedes, and crowd exuberance, miscomprehending their effects. The resulting attributions of evacuees' irrational behaviors ignore alternative explanations based on poor visibility or insufficient information. They do not help us understand these knots' effects and the dynamics of these precipitated encounters.

Despite the consistent finding that instances of panic flight seldom impact crisis evacuations, some authors in the engineering and computer science literature examining evacuations from buildings on fire assume that panic behavior-- showing irrationality and herding, another analogous concept in which people follow the movement of others disregarding their understanding of what is going on, is a common occurrence. Herding is another analogy to irrationality that presumes people disregard their understanding of what is going on and instead adopt the direction and speed of movement of others near them. Recently, Haghani et al. (2019b) examined the use of the panic concept in the social and physical sciences and the need for agreement on defining panic and irrationality among these science communities. Instead, anticipating the present argument, they point out that panic flight and herding continue to be popular concepts some scholars use in the physical science disciplines. It is possible to make a very rough indicator of the extent of the use of this term in the physical sciences from a search in SCOPUS. The search in this electronic reference tool used (as of 3.14.2021) the terms (TITLE-ABS-KEY (*building* AND *evacuation* AND panic AND *computer* AND *simulation.) It found* 1580 documents, 401 (or a quarter) of which *included panic*. However, even within this smaller percentage,

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the use of panic as nonsocial behavior cannot always be assumed. For example, Wirth and Szabó (2018, 78) use a mathematical formula to define panic, which seems utterly devoid of any discussion or awareness of irrationality and the social science background to this concept.

Helbing et al.'s (2007) prominent social force model of simulated pedestrian and evacuation flows represents humans using the analogy of gasses, fluids, and granular flows. They write (p.14), in a close paraphrasing of Gustave Le Bon's long-discredited crowd transformation hypothesis, that individuals in certain conditions of danger "transfer control over their actions to others, leading to conformity. This herding behavior is, in some sense, irrational, as it often leads to overall bad results." Their description of the transition to crowd turbulence in the main overlooks its socio-psychological dimensions. Wang (2020) tries to rescue the Helbing et al. social force model by identifying several socio-psychological dimensions embedded in the model's equations, reinterpreting the original meanings with mixed results. Wang accurately points out that contrary to what was initially stated by Helbing and colleagues, the equations in their model do not "imply any irrational behavior aroused by fear, but (instead) describe a kind of rational mechanics that govern an individual's motion." Wang adds that "the general use of panic is not essential to the social-force model (4.)." This author reasonably proposes that "stress, produced by an individual's interaction with an environment, is a more accurate conceptualization of the social-force model than panic." Wang adds that stress is related to the time pressure that is an intrinsic part of any emergency. It results from the discrepancies between the person's psychological needs and the environment as impacted by the hazard's demands. These stress outcomes are the fight or flight response and the emergence of conflict or cooperation among the people involved. Less satisfactory is Wang's treatment of herding, which states (2020, 10) that emergencies bring about time pressures that "weakens the ability of logical thinking and reasoning (making people) more inclined to follow others (such as neighbors) rather than make decisions by themselves." This assumption is doubtful, for as mentioned earlier in the appraisal of the Le Bonian approach, a good deal of information disproves that people "lose their minds" during emergencies or that emotion is opposite to mean-to-end rational thinking.

In some cases, the use of the concept of herding continues *even when the results of the very study refute the common-sense meaning of the term*. Thus, in an otherwise methodologically ingenious and worthwhile study, Mehdi et al.'s (2016) findings show that pedestrians have a higher tendency to follow "their neighbors when stress was high, simply because the *neighboring individuals were more numerous due to the increased density level."* They add that "(h)erding, therefore, resulted from the crowdedness and not from a change in the individual tendency to imitate neighbors." The statement is probably correct, but the question remains: if it is human density and not imitation, why insist on using the latter? Why continue to assume an irrational response in which people ignore their evaluation of what is best for them? Or, in the best of cases, why use this loaded term if the intent is merely to indicate that people move in the same general direction in situations of high density?Helbing et al.'s social model (2000) posits that the more people move towards a specific goal, the more influence their collective decision will have on a prospective evacuee's behavior and the more likely she will join them. Nevertheless, the most recent and thorough empirical study that we are aware of, based on a controlled experimental design by Haghani and Sarvi (2019a), finds that the opposite is the case, for people evacuating prefer to use the exits that attract fewer people. Haghani and Sarvi find that humans do not tend to imitate the majority's direction choices. On the contrary, they tend to avoid the majority's direction: the greater the size of the majority is, the less likely they will follow it. These authors also find that their high-urgency treatment, associated with higher degrees of stress, did not increase or decrease this avoid-the-majority tendency. They write that the number of people in the person's vicinity amplified the avoid-the-crowd tendency in specific scenarios. When uncertainty about what is happening, people are more likely to evacuate away from the majority. Of course, environments that permit only one or a few directions of movement, when high human density renders difficult multiple directional choices, or when high social cohesion makes people feel that they should move in the same direction as their groups limit choices and make it appear as if people are engaging in irrational herding. A good example is when the very dense numbers of attendees to the Hajj in

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Saudi Arabia are said to behave in a herd-like fashion even if they have no option other than to follow the throng of people surrounding them as they try to complete their religious pilgrimage or survive during the recurrent mass fatality incidents that have taken place in this annual gathering. However, these restrictions on the direction of movement are logically irrelevant to evaluating the irrationality argument.

The Emphasis on Transdisciplinary Collaboration. The continued use of the panic flight and herding concepts in some computer and physical science publications, despite the results of social science studies showing their rarity, is probably due to the traditional divide between the two science traditions. Current social science research efforts often use a multi-methodological design combining qualitative methods, such as content analysis of documents, observations, life histories, in-depth interviewing, and key informants, with quantitative methods, such as surveys, random sampling, and statistical methods. They do it to take advantage of the relative strengths of the various approaches while controlling for their difficulties and the reactive nature of human responses. However, some scholars distrust qualitative methods, for the physical sciences typically depend on experimental designs and quantitative methodologies. The continued use of the panic and herding perspective may reflect a lack of understanding and trust in the current methodologies used in the social sciences and their incredulity about this body of social science studies' findings. However, the traditional understanding of science based on disciplinary silos has not proven optimal in responding to the urgent need to find solutions to the tremendous increases in the costs of the damage produced by disasters worldwide, as documented among others by Munich Rex. In the United States alone, the cost of natural disasters during 2020 was $2.215 trillion, according to the National Center for Education Statistics. The near-geometric increase in costs during the last few years is one of the reasons that research efforts in the field of hazards and disasters are moving, particularly in China, Japan, and India, towards novel methodological approaches to the study of disaster, hazards, and accidents based on transdisciplinary collaboration (Aguirre and El-Tawil 2020) and methodological integration among the disciplines interested in their study. New transdisciplinary university curricula, science groups, and research funding agencies actively encourage multidisciplinary research into common interest problems to increase the likelihood of finding practical solutions. These changes in scientific practice mark a new phase for disaster-oriented science disciplines. Relatedly, in a broader acknowledgment of the need for this type of integration, recent writings in the philosophy of science challenge the traditional definition of science and offer a new, broader understanding. Hoyningen-Huene's (2013) recent contribution contests the traditional understanding of the scientific enterprise. This author abandons the effort to identify what constitutes science and instead considers a broad spectrum of human efforts to make sense of nature and society by examining the extent to which the activity in question is *systematic;* instead of defining what science is, Hoyningen-Huene offers ten dimensions of "systematicity" to compare humanistic, social, and physical science disciplines that have dissimilar epistemologies. For example, he compares the extent to which biblical studies and other religious disciplines are systematic vis avis the social and biological subject areas. Math and physics score very high in his approach, while the social sciences are highly systematic in some of the dimensions. Hoyningen-Huene's is a new approach to science that may help clarify the strengths and weaknesses of different science groups interested in studying disasters and crisis evacuations. It will hopefully encourage more fruitful collaboration across disciplines as it becomes the norm.

6. Conclusions

This essay illustrated the value of rescuing "abandoned" concepts such as panic. It argued for the continued relevance of panic as a form of collective behavior for scholars interested in studying disasters, hazards, and emergencies. It advanced a new definition of panic to the effect that it is the collective behavior and people with emergent characteristics revolving around new norms and social relations, such as their average human density, cohesion, uncertainty, shared emotions, synchronized behaviors, and size responding to perceived or actual threats. It then described the five main ways scholars understand panic: psychological, mass hysteria, moral panic, deviance epidemics, and

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ontological insecurity. It showed the evolution of the understanding of panic behavior among social scientists and their consensus that during emergency evacuations, people continue to exhibit means-end rationality and social solidarity and act as socialized individuals moving towards sources of actual or perceived safety. The paper documented the continued use of the irrational panic flight model by some computer and physical science publications despite the results of social science studies showing their rarity, conjecturing that this disconnect might be due to a misunderstanding of the rigorous multimethodological designs used in the social disciplines. It advocated for using a "systematicity" understanding of science, which would facilitate transdisciplinary studies of emergency evacuations, crises, and emergencies and the greater integration of research groups representing the social and physical sciences.

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