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Vulnerability and all that jazz: Addressing vulnerability in New Orleans after Hurricane Katrina

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Abstract

This essay reviews the concept of vulnerability, paying special attention to the vulnerability of New Orleans exposed by Hurricane Katrina, and the need for interdisciplinary approaches to reducing vulnerability. Vulnerability is defined as a function of exposure, sensitivity, and adaptive capacity. Physical vulnerability results from exposure, and social vulnerability emanates from social factors that place people in highly exposed areas, affect the sensitivity of people to that exposure, and influence their capacity to respond and adapt. The paper describes how the city's physical exposure has caused extreme vulnerability. Its large population of poor blacks is even more exposed than others, has high sensitivity, and possesses limited capacity to adapt. The paper argues that to understand vulnerability requires an interdisciplinary approach, one that physical scientists, engineers, social scientists, and humanists should work on collaboratively in order to reduce vulnerability in New Orleans.

Keywords: Vulnerability; Interdisciplinarity; New Orleans; Hurricane Katrina; Jazz

1. The intro

This essay explores issues of vulnerability in New Orleans in the aftermath of Katrina. It uses the basic structure of the great musical invention of New Orleans, jazz, to arrange the essay, including introduction (The Intro), exposition of the theme (The Head), development of that theme (The Solo), recapitulation of the theme (The Head Out), and ending (The Coda) [1]. The Head presents an overview of the concepts associated with vulnerability; The Solo situates those concepts in the context of New Orleans vis-à-vis Hurricane Katrina; The Head Out shows how interdisciplinarity can help address issues of vulnerability; and the Coda sums up and draws conclusions. Like jazz, each section works with the theme, in this case vulnerability, each section attacks the problem in its own way, and each has its own feel, but it all comes together by the end.

After Hurricane Katrina's rampage along the Gulf Coast, many questions arose about the future of New Orleans. Important among these questions are: what will happen to the city's most vulnerable inhabitants—the poor, weak, sick, old, unemployed, and friendless? Will the recovery process treat them fairly, providing

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them equitable access to resources? Or will the least vulnerable—the rich, powerful, healthy, well-positioned, and well-connected—take advantage of whatever resources are available, leaving the more vulnerable to fend for themselves?

2. The head: vulnerability

The concept of vulnerability means many things to many people, but most agree that it includes the likelihood of harm to people and to the places or things they value, often stemming from a hazardous event such as a hurricane or the floods spawned by a hurricane [2,3]. Although agreement breaks down after that point, experts accept some representations of vulnerability more than others. This essay will use one commonly accepted description of vulnerability as a function of three components: exposure, sensitivity, and adaptive capacity [4].

Exposure is the degree to which people and the places or things they value are open to a potentially harmful event. The expression *places or things they value* refers not only to economic value and wealth but also to cultural, spiritual, and personal values. In addition, this expression refers to critical physical and social infrastructure, including such physical infrastructure as police, emergency, and health services; communication and transportation networks; public utilities; schools and daycare centers; and such social infrastructure as extended families, neighborhood watch groups, and fraternal organizations. The expression even refers to such factors as level of urbanization, economic growth rates, and economic vitality. People value some places and things for intrinsic reasons, and some because they need them to function successfully in our society.

Sensitivity is the degree to which people and the places or things they value can be harmed by exposure. As will be discussed below, some individuals, communities, and things are more sensitive than others when exposed to the same event. That sensitivity can be inherent. Infants are intrinsically sensitive, whereas healthy adults are inherently much less sensitive than infants to most hazardous events. Sensitivity can also change over time. All other factors being equal, an established community with aged physical infrastructure will be more sensitive to a harmful event than a new community with state-of-the-art infrastructure; in a century, the newer community will be considerably more sensitive to a hazardous event than it is today because of the deterioration of that infrastructure.

Adaptive capacity is the least explored and most controversial of the components. The understanding of adaptive capacity favored by the global change research community is the degree to which people can mitigate the potential for harm by taking action to reduce exposure or sensitivity both before and after the event. The physical, social, economic, spiritual, and other resources they possess, including such resources as educational level and access to information or technology, determines the capacity to adapt. Another slightly different view favored by the hazards and disasters research community is that adaptive capacity consists of two subcomponents: coping capacity and resilience. Coping capacity is the ability of people and places to endure the harm, and resilience is the ability to bounce back after exposure to the harmful event, even if the people and places suffer considerable harm. In both cases, individuals and communities can take measures to increase their abilities to cope and bounce back, again depending on the physical, social, economic, spiritual, and other resources they have or have access to.

Some people and the places or things they value can be highly vulnerable to low-impact events because of high sensitivity or low adaptive capacity, while others can have little vulnerability to even high-impact events because of insensitivity or high adaptive capacity. One hazardous event may result in patchwork patterns of harm because of tremendous variations in vulnerability over short distances [5]. Such a spatial "crazy quilt" means that authorities need to identify the most vulnerable areas so they know where to concentrate evacuation efforts before the event and which places are likely to need the most help afterward.

Some groups of people are inherently more vulnerable to hazardous events than others because they have greater exposure (they have more difficulty getting out of harm's way), are more sensitive, or have limited adaptive capacity. The very old and very young, the sick, and the physically or mentally challenged are exceedingly vulnerable [6]. Some disadvantaged groups, such as the poorly educated or non-English speakers, tend to be more vulnerable because they do not understand written or oral emergency procedures as well [7]. Women, who typically spend more time and effort on care-giving than do men, are often more vulnerable because caregiving exposes them longer as they struggle to get their aged parents, children, and sick relatives

out of harm's way [8]. Especially vulnerable groups combine one or more of these categories, such as the poor—who in a single individual could be old, non-native speaking, and female [9]. Another example of a particularly vulnerable group is the single-mother household, which could, for example, be headed by a poor woman who is responsible not only for caregiving, but also for providing the family's income. Some groups, such as minorities, tend to exhibit greater vulnerability not because of their physical attributes (e.g., skin color), but because they more often possess socioeconomic characteristics that make them vulnerable (e.g., poor English language skills or poverty).

3. The solo: vulnerability in New Orleans

Hurricane Katrina's impacts on New Orleans revealed a complex picture of vulnerability. In principle, everyone who lived in the city before Katrina struck was in some way vulnerable to a big hurricane through simple physical exposure. In his 2001 article in *Scientific American*, Mark Frischetti proclaimed, "New Orleans is a disaster waiting to happen" [10]. Before the storm, the Gulf Coast around the mouth of the Mississippi River was prone to hurricanes and large hurricane storm surges. Levees surrounded the city to keep the Mississippi River and Lake Pontchartrain out during a big storm or flood, but because the city had been sinking for years, it was below sea level, essentially turning New Orleans into a bowl. Once water got in, it could not get out without a major pumping effort. To make matters worse, land loss in the delta region had eliminated a considerable portion of the natural buffer against hurricane storm surge provided by wetlands. Ironically, New Orleans needed levees that were both stronger and higher to protect it against the threat of hurricane-induced flooding. Before Hurricane Katrina, the federal government put its appropriation priorities in other places and chose not to fund sufficiently the levee alterations and repairs needed to protect the city from hurricanes. Thus, the potential for harmful hurricane exposure made all residents of New Orleans vulnerable to "the big one."

Since Hurricane Katrina, the residents of New Orleans are still vulnerable to hurricane exposure, with the same problems continuing into the future. The odds of New Orleans getting hit by another "big one" are still high—the levees are still not high enough or strong enough; the city continues to sink; the wetlands continue to erode.

Because Hurricane Katrina was only a category 3 storm and gave New Orleans a glancing blow instead of a direct hit, it was not "the big one." Nevertheless, it produced an unusually powerful storm surge that crashed into the levees, cracked their defenses, poured water into the city through the levee breaches, and destroyed houses, cars, trees, and anything else in the path of the water gushing through those breaks. And once water entered the bowl of New Orleans, and pumps failed, the water could not get out. Many feet of water sat for days and weeks, soaking tens of thousands of homes in a festering soup of chemicals, waste, and whatever else lay around the city. After the waters receded (or more correctly, were eventually pumped out), mold destroyed what the waters did not.

One important lesson from Hurricane Katrina was the dramatic variations in vulnerability—from person to person, from family to family, and from neighborhood to neighborhood. It is true that some people were more vulnerable because their exposure—some experts would say their *physical vulnerability*—was greater than that of other people [11]. Anybody who lived near one of the levee breaks was extremely vulnerable to total loss of property and, if they had not evacuated the vicinity when the breaks occurred, loss of life. The levee breaks paid no attention to socioeconomic status: the white middle- to upper-middle-class neighborhood surrounding the 17th Street Canal breach was as devastated as the poor black lower Ninth Ward. Similarly, those who lived in the lowest-lying areas of the city were most vulnerable to flooding compared to those living on the highest ground, no matter what their income.

Even more striking than the differences in physical vulnerability were the disparities in *social vulnerability*. The social factors that place people in highly exposed areas, affect people's sensitivity to harm, and influence their capacity to respond and adapt, were uncovered by Hurricane Katrina, and for those people who were largely unaware that New Orleans is a city of great socioeconomic disparities, it was a gut-wrenching learning experience [12,13]. Far and away the most vulnerable portions of New Orleans were those areas populated primarily by poor blacks. It is instructive to look at three commonly recognized stages of a

disaster—preparedness, response, and recovery—to see how New Orleans' poor black population fared [14]. Examples of vulnerability are legion.

Preparedness involves taking measures in advance of a hazard to ensure effective response to its impacts. It includes issuing timely and effective early warnings and temporarily evacuating people and possessions from threatened locations. The authorities, as well as most residents of New Orleans, were ill-prepared for Hurricane Katrina, and socioeconomic differences highlighted the vulnerabilities resulting from this lack of preparation. The socioeconomic position of the city's poorest residents meant they had far less access to transportation during the onset of the disaster than did their richer white or black counterparts. The communication and evacuation planning by local and regional authorities was inadequate for the number of poor blacks in the city. For some of these residents, by the time they heard about the coming storm, cheap or subsidized ways out of the city had dwindled. Most wanted to leave, but they did not have enough money for gas or hotels and food if they did so. Some did not want to leave their homes, afraid that looters might take their hard-won possessions. For these and other reasons, tens of thousands of poor blacks stayed in the city, huddling in their homes or crowding into the Louisiana Superdome as the storm passed and then water flooded the city. The oldest, sickest, and often the poorest—the most vulnerable—watched helplessly and drowned as their shotgun houses[1] filled with water [16]. In contrast, the relatively wealthy white population, as well as wealthier blacks, heard about the approaching storm early and had fewer limitations to prevent them from evacuating. They did not have to rely on the government and other sources of aid in order to leave. There were relatively few white faces at the Superdome.

Response is the emergency assistance that takes place during or immediately after a disaster. Its purpose is to save lives and meet the most fundamental needs—water, food, and shelter—of the people affected by the event. Many people watched Hurricane Katrina's relatively brief assault on the Gulf Coast and New Orleans on the Weather Channel; many more watched the protracted response efforts in New Orleans on the evening television news. For days, the national and international news was filled with positive images of treetop and rooftop helicopter rescues, of efforts to get water and food to survivors, and of other prosocial stories. Negative images of stifling heat and humidity, of looting, of violent squabbles among survivors, and other antisocial behaviors also gripped the nation's attention.[2] No matter whether they were seen in a positive or negative light, these images showed that the victims of Hurricane Katrina were overwhelmingly black. Some were black and old; some were black and young; some were black and sick; most were black and poor. The recovery effort might have been racially blind, but it was racially specific because essentially one racial group was so socially vulnerable that a large number were left behind to suffer the horrors of the hurricane's aftereffects.

Recovery involves "putting things right again." In the short run, this phase of emergency management means restoring important infrastructure and services, like sewage, electricity, transportation, and communications. In the long run, it means rehabilitating and rebuilding physical structures. Ideally, recovery should not only restore pre-disaster living conditions by rebuilding the physical setting, but also should better those conditions by improving the social setting. It should provide opportunities to make physical and social changes that reduce the risk of, and vulnerabilities to, future disasters.

In the early stages of recovery, when blacks were the largest number of inhabitants who remained in the city, blacks had the best access they have ever had to public utilities, to police, emergency, and health services, and to schools and daycare centers. As the recovery wears on, however, poor blacks, such as those in temporary housing, have decreasing access to utilities, services, and education. They have less access to the levers of government that can speed the recovery and reconstruction efforts, especially if they are still forced to live far from New Orleans. There is less political will to focus on black problems because that is not where the money—and hence the political clout—is. For instance, an important issue during recovery has been the

[1] The standard shotgun house is a narrow, rectangular, one-story residence that consists of three to five rooms in a row with no hallways. Most shotgun houses are usually no more than 12 feet wide, with doors at each end of the dwelling. The style was developed in New Orleans and is the most prevalent house type there [15].

[2] A recent analysis [17] found that prosocial behavior dominated the response to Katrina and that looting, violence, and other crimes were not that bad and were exaggerated by the media. Discussions I have had with New Orleans residents suggested that post-Katrina crime was a significant problem that touched everyone who remained in the city. This problem has continued into the recovery phase of the disaster. During summer 2006, crime increased as population returned and security became less adequate in many parts of the city.

question of rebuilding in the city's most flood-prone areas. Although they are low-lying and especially likely to flood again, there is little doubt that white districts like middle-class Gentilly and wealthy Lakeview will be rebuilt and reoccupied. What is less certain is whether the flood-prone but historically, culturally, and architecturally rich lower Ninth Ward—an overwhelmingly black part of the city—will rebuild. Clearly, race and class frame the debate to rebuild [18].

In the end, it is likely that the most vulnerable people of New Orleans will be the last to recover, will have the least capacity to adapt and to reduce their future exposure and sensitivity, and therefore will continue to be the most vulnerable. Those people are mostly black and almost all poor. Is it enough to "put right again" an inequitable system that maintains classic differences in vulnerability, or are there ways we can use recovery to improve both the physical and human systems to reduce vulnerability overall and, in particular, in the most vulnerable parts of the system?

4. The head out: vulnerability and interdisciplinarity

Reducing vulnerability requires an interdisciplinary approach. From the above, it is clear that vulnerability includes not only physical systems but also human systems. Thus, understanding vulnerability requires contributions not only from the physical sciences and engineering but also from the social sciences and humanities. Most important, understanding vulnerability requires that these disciplines work together to grasp the interactions among systems, and the possible tradeoffs that policymakers will have to make to reduce vulnerability in any specific place.

Physical scientists and engineers need to know how systems work to see how people and things they value might be exposed to hazards. Everyone concerned also needs to appreciate how humans interact with nature in order to enhance or diminish that exposure. In the case of New Orleans, those physical scientists and engineers studying the problems need to comprehend the ways that human activities reduce wetlands that buffer hurricane storm surge, for instance. They also need to know how much wetland is required to buffer the city against another Katrina-like storm and what human actions might be considered to rebuild wetlands to that size.

While engineering is in some ways the application of physical sciences to human problems, engineers and social scientists are often not used to working with one another. Within the academy, the wall between the School of Engineering and the School of Liberal Arts is often particularly thick. Engineers typically have little formal training in the social sciences beyond elementary financial calculations and cost accounting, and social scientists rarely have any introductory coursework in engineering. All too frequently, they come from different intellectual cultures and paradigms, and neither speaks the other's language nor frames problems the same way. In many cases, engineers fail to take into account the non-economic needs of people, while social scientists remain unaware of the physical realities imposed by our engineered environment.

These barriers extend into the political arena, with policy makers sometimes perceiving engineers as infallible and social scientists as unrealistic do-gooders. In the case of New Orleans, the perception that engineering is dependable contributed to mistakes in building the levee system that both protects and threatens the city from the water that surrounds it. In post-Katrina New Orleans, it is important that engineers and social scientists work together with policy makers to assess not only where the levee system needs strengthening and how high the levees need to be, but also where people should and should not live behind those levees or, for example, where public spaces might be a socially acceptable substitute for houses.

Equity and justice are not absolutes, and what seems equitable and just to a social scientist might be quite different than equity and justice from the perspective of an engineer or a policy maker. Thus, the potential role for humanists in reducing vulnerability is crucial. They can serve as educators, helping others to see the ethical issues inherent in questions of vulnerability. They can also help as brokers, enabling all sides to stake their philosophical ground, yet see the common ground. In the case of Hurricane Katrina and New Orleans, knowing where a storm surge can strike a levee is a physical science issue; understanding how high and strong a levee to build to keep out that storm surge is an engineering issue; identifying who is vulnerable and what social, psychological, or economic incentives to apply to get them to move from critical points in the levee system are social science issues; and appreciating what an equitable and just vulnerability reduction policy might look like is a humanistic issue. Scholars from each of these traditions could work independently on their

parts of the vulnerability problem and present their findings to policy makers as individual papers in a set of observations on the problem. Using this approach, it would be up to policy makers to synthesize the results and learn what is useful for policy decisions from various perspectives and languages.

Alternatively, the scholars could work together, presenting a single report with a shared vision, common language, and mutual set of policy considerations. This method would require considerable leadership and effort to integrate the work of the group members, but working together in this manner could have a powerful effect on the policy makers and might stand a better chance of reducing vulnerability.

5. The Coda: conclusions

Understanding vulnerability makes it possible to ask tough questions about the equity and justice of the recovery and reconstruction of New Orleans. Answers to these questions are difficult to resolve. For example, to reduce the physical vulnerability of the poorest homeowners, if they can afford to rebuild, should they be allowed to do so in low-lying areas that are sure to be flooded again sometime in the future? If they are allowed to rebuild in these areas, should the rebuilding efforts take into account the physical realities of New Orleans and require them to elevate their houses? If they rebuild, but disaster-resistant building materials and techniques drive the cost of rebuilding beyond the means of poorer homeowners, should society pick up the additional costs of building stronger, safer homes?

Equally difficult questions surround social vulnerability. Since the key to reducing vulnerability in New Orleans is to raise the socioeconomic standard of vulnerable people, how much more should society invest in job creation, better schools, public transport, and affordable housing? For equity and justice, to what extent should the most vulnerable neighborhoods receive the most financial assistance?

On the one hand, not accounting for vulnerability during recovery and reconstruction of New Orleans will lead to neighborhoods that are as vulnerable or even more vulnerable to flooding in the future. It will perpetuate environmental injustice and festering inequities in the socioeconomic structure of the city. It will also mean that when the next Katrina blows through New Orleans, society will face similar financial costs, social questions, and ethical dilemmas. On the other hand, reducing vulnerability entails enormous financial burdens to the city, the state, and the nation, with no way of knowing how well vulnerability reduction will work until the next major hurricane hits New Orleans. Nonetheless, reducing social inequalities in vulnerability is the ethically right thing to do. Perhaps more practically important, reducing vulnerability also reduces existing socioeconomic problems that we should want to solve anyway. Besides, if we fail to reduce current vulnerability, it will result in large future costs that will be borne sooner or later not only by the vulnerable, but also by the rest of society.

Because it requires contributions from experts from across the academy, reducing vulnerability is inherently an interdisciplinary problem. As in any jazz band, at the very least it requires that physical scientists and engineers take the lead on physical vulnerability issues (with backup from social scientists and humanists), while social scientists and humanists blaze the way on issues of social vulnerability and its ethical dimensions (with strong support of social scientists and engineers). Ideally, like the finest jazz musicians, they should work together interactively, treating vulnerability as a holistic, complex, and nonlinear phenomenon and creating a beautiful arrangement from individual contributions. Although this team approach is at variance with their university training and, especially, their acculturation as Americans to be soloists, being part of a band may be the best way to play against vulnerability in New Orleans.

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