



From Earthquake Engineering to Nuclear Holocaust, via The Blessings of Disaster: The Lessons That Catastrophes Teach Us and Why Our Future Depends on It

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ABSTRACT

Are we doomed? As individuals, certainly, eventually, inevitably. But as a species? As a civilization? Perhaps not. The Blessings of Disaster draws on knowledge from multiple disciplines to illustrate how our civilization's future successes and failures in dealing with societal threats—be they pandemics, climate change, overpopulation, monetary collapse, and nuclear holocaust—can be predicted by observing how we currently cope with and react to natural and technological disasters. Maybe most importantly, this entertaining and often counter-intuitive book shows how we can think in better ways about disasters, to strengthen and extend our existence as both individuals and as a species. When it comes to rare extreme events, such as earthquakes, hurricanes, floods, tornados, volcanic eruptions, technological accidents, terrorist attacks, pandemics, and even existential threats, it is in our nature to set ourselves up for disasters because the gamble may be worth it. But only maybe....

Keywords: Disasters, Earthquake Engineering, Lessons, Nonfiction, General Public.

INTRODUCTION

Earthquake Engineering is a fascinating journey that can bring its “practitioners” deep into many aspects of human nature.

Somehow, beyond the fascination with the extreme power of earthquakes, everybody wants to be reassured that our infrastructure will not collapse and that we will not suffer or die following a big one — as if for once we could be protected from the inescapable flaws of human nature. An earthquake engineer is tasked to design infrastructure to survive earthquakes. Such efforts often require engineers, architects, social scientists, public policy experts, political scientists and even the public — all with clashing priorities — to agree on a common objective when a consensus often does not even exist within a single one of these groups. Trying to make this happen is moving on a path that inevitably connects with the multiple facets of human nature — from the captivating ones to the crazy ones.

This struggle is not unique to earthquakes. Similar challenges arise with every hazard, with every action beyond the beaten path when attempting to enhance disaster resilience, and now, with every existential threat (some more “in the news” than others, such as climate change for example, which seems to be in the news every minute of the day).

What is proposed by “The Blessings of Disaster” is that the way we currently deal (successfully or not) with various hazards and the disasters they create, can maybe predict how we will tackle our existential challenges. In other words, what we learn (or not) from past disasters may foretell our future survival as a species, as a civilization.

This paper describes the purpose of the book and its target readership, provides an overview of its scope, highlights some noteworthy aspects about the choice of cover page, and includes the first chapter of “The Blessings of Disaster” as an excerpt to provide a flavor of content and style.

WHY NOW?

Now, more than ever, if the goal is to achieve a resilient society, then *everybody* should be aware of the complex factors that make it so difficult for society to prepare against disasters, and of the patterns of human nature and technology that will ensure

that these disasters will (or will not) repeat themselves. It is important now because it is these same factors and patterns that will dictate how the world will face its multiple existential threats. Attempting to do this, “The Blessings of Disaster” takes a unique, overarching approach from the angle of disasters and existential threats, and makes it a journey to explore multiple facets of human nature and society in a manner that is informative and entertaining for a *general audience*. In other words, the book is not just for earthquake engineers, but also for their parents, their grandparents, their kids and grandkids — and the whole neighborhood for that matter — irrespective of their professions and education levels. Most importantly, this includes the current generation of students who are “on deck” to tackle our existential threats to create a better future.

The goal was not to write a preachy, dead-serious book that would have been unpleasant to read. The goal was to provide a truthful but effective journey through the world of disasters, and to make it enjoyable. It is entertaining on purpose, to appeal to individuals from all backgrounds and disciplines. That is why along the journey, the reader will discover connections between natural disasters, crooks, cows, hijackers, the Three Little Pigs, nuclear holocaust, movie reviews, viruses, scapegoats, trading stamps, real estate agents, Chinese hockey sticks, airport proctologists, and many more (weaved into a coherent narrative). If there is a pill in there, for sure it has more than one layer of sugar-coating.

At the same time, the book has enough thought-provoking and debate-igniting ideas for engineers, scientists and other experts from many disciplines to also have a blast reading it (including, of course, earthquake engineers). Disasters are nothing but the end-product of human nature, and the book provides a thorough overview of the global and multidimensional aspects of the problem from that perspective.

In short, “The Blessings of Disaster” is the very real story of our relationship with disasters and how it could provide insights on our future as a civilization — with enough arguments to tickle both optimists and pessimists alike. It brings together and connects knowledge from many disciplines to paint a global picture, it provides facts to assess the significance of it all, and it does so in bright colors to keep the reader’s mind focused.

The good news is that reviews have been positive so far. Publishers Weekly ((known as “the bible of the book business”) called it an “engrossing study of human complacency, myopia, and faulty risk perception on a grand scale.” From a professional perspective, many experts in the field of disaster resilience (including members of the Canadian Academy of Engineering) have likewise given the book an enthusiastic endorsement. The following webpage attempts to collect all written reviews that the book has received (<http://michelbruneau.com/TheBlessingsOfDisaster.htm>). However, much remains to be done to reach the broadest possible public, which is seen as an important step to help achieve a resilient society (as mentioned earlier). Members of the earthquake engineering community can play an important role in this regard, by bringing “The Blessings of Disaster” to the attention of those beyond this community.

In fairness (and in a way that may seem contradictory to what is mentioned above), this book does not promise to change or improve anybody. In fact, if anything, it is the book’s exact thesis that human nature cannot be changed easily — barring disasters. However, it shows that things eventually come out right, and sometimes better, for the lucky ones who survive.

SCOPE/STRUCTURE OF THE BOOK

To appreciate the challenges and complexities at play, the book is structured in three parts: “Meet the Hazards,” “Meet the Little Pigs,” and “Meet the Future.” Figure 1 outlines the content of the book, and a brief summary of each part follows.

Meet (Some of) the Hazards

The first part of the book focuses on hazards that have created past disasters—and that will continue to do so for the foreseeable future. Not only to understand the physics at play in each case, but also to witness how mundane it can be to live on a volcano, to work in a building behind a levee, to retire in hurricane country, to trust technology that is certain to fail, and more—until a disaster happens, of course. This is important because coexistence with disaster-prone conditions is universal. To put it plainly, there are no disasters without humans. Disasters “R” Us. When it comes to the simple matter of preparing, not preparing, and coping with various hazards, human behaviors range from baffling to amazing.

For example, did you know that as a result of federal laws, the number of buildings constructed in flood zones has actually increased over the years? Or that 90% of the Oklahoma homeowners will not spend money for a shelter where they can hide and bite their nails when a tornado blows away the rest of their house? Or that in Naples, which is right next to Pompeii, the city destroyed by the Vesuvius eruption in 79AD, there is actually a plan in place to evacuate 600,000 citizens of Naples in a week to escape an eruption of the Vesuvius, relying on 500 buses and 220 trains – and obviously a truly optimistic outlook on Italian punctuality? Also, major infrastructures that have failed, have pretty much always failed because of human errors and never because of a sudden glitch in the laws of the universe; and yet, many critical industries have carte blanche to write their own safety codes.

Meet the Little Pigs

The second part of the book seeks to explain why John and Jane bought a bungalow straddling the San Andreas Fault, Jim and Janet retired to a beach villa that will fly away in the next hurricane, Julio and Juliet reside on the slope of Mount Vesuvius, and Jack and Jill went down the hill and built their dream home there, in a flood zone. It may not make sense, but at the same time, it makes perfect sense. Confusing predictions and statistics, imperfect building codes, disinterested politicians that are simply mirrors, more pressing priorities, and the brain's biases in interpreting reality and beliefs, all play a part—with potentially deadly consequences.

For example:

- First, our brain is amazingly hard-wired in ways that are challenging when trying to deal with things that can create disasters. We are hard-wired for denial, for procrastination, for binging on French fries (fully aware that veggies are healthier), for blaming Yoko Ono for everything – and things like that.
- Then, we have a propensity for reacting – patching rips and plugging holes – instead of being pro-active. We all say “an ounce of prevention is worth a pound of cure”, but we live by “we’ll cross the bridge when we get there”, or “if it is not broken, don’t fix it”.
- Then, we get stuck with a “what are the odds?” mindset because we get entangled in statistics and probabilities that are not intuitive and far less simple than calculating batting averages.
- Then, there are folks who attempt to paint catastrophes as Black Swan events because – well – that is a convenient way to say nobody could see it coming, sweeping under the carpet the fact that actually tons of people saw it coming and said so loud and clear.
- Then, there are those who have blind faith in building codes, or in politicians,
- And so many more factors.

Meet the Future

The last part of the book is an extrapolation of the previous observations that makes it possible to address the issues of monetary collapse, climate change, overpopulation, nuclear holocaust, and other similarly joyous topics. In other words, it seeks to answer the question: “Are we doomed?”

Hazards Addressed

Examples of disasters in the current context include destruction caused by earthquakes, hurricanes, tsunamis, tornadoes, volcanoes, floods, technological failures, terrorist attacks, and other similar large-scale events (having a bad day at the office, no matter how “disastrous,” does not count here). Keep in mind that most hazards will not create disasters — if we are not there. This is sort of like the metaphysical question, “If a tree falls in a forest and no one is around to hear it, does it make a sound?” — but with disasters instead. It is in fact the very infrastructure that we built to protect us from the environment that collapses and kills us during earthquakes, tornadoes, and so on.

Examples provided throughout the book span over a range of disasters. If it seems that points are made by referring to earthquakes more often than for other disasters, it is because in a world with fifty shades of disasters, earthquakes provide the

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Figure 1: The three parts of “The Blessings of Disaster”

perfect black-and-white contrast needed in case studies: they are sudden and devastating, but their threat is rapidly and conveniently forgotten during their long periods of quiescence.

SIGNIFICANCE OF COVER PAGE

Much work went into designing a cover page for “The Blessings of Disaster” that both grabs the eye and (subliminally) tells a mini-story consistent with the book’s thesis. Different people will interpret the image differently, but key elements of the cover image that can be identified are: (1) destruction from a hazard (buildings destroyed by an earthquake in this case), and; (2) a person walking towards the damage, head-on. Much can also be interpreted from the fact that the person shown in the picture appears to be a regular citizen going to work (with a briefcase). It is the end of one story, and the start another one.

EXCERPT

To provide a flavor of “The Blessings of Disaster”, the book content and its style, the first chapter is presented here.

CHAPTER 1: WHICH LITTLE PIG ARE YOU?

A Matter of Relativity

In response to a moderate earthquake that had struck a foreign country and damaged a significant number of engineered bridges and buildings, the government had dispatched a team of experts to perform earthquake reconnaissance activities. The team’s mandate was to travel across the affected region, to document the extent of the damage, to determine to the extent possible what caused the extensive damage suffered by the infrastructure, and, most importantly, to report on whether such a disaster could happen at home.

Sad but true, there is always much to learn from disasters that kill and injure thousands of people and produce billions of dollars in damage and losses. Teams of engineers have conducted earthquake reconnaissance visits after damaging earthquakes all over the globe in the past decades, so this was by itself not an unusual thing to do. However, this time, it was different. Not only had this earthquake caused \$40 billion in damage, but it did so by striking a country that considered itself a leader in the development and implementation of modern seismic design codes and standards; a nation that was part of that elite club of players whose members represent more than 60 percent of the world’s net wealth; and, most significantly, a friendly nation with whom the government had long-standing close ties. On that account, there was potentially much more to learn than usual from the earthquake damage, and the findings from the earthquake reconnaissance mission were sure to be valuable.

So, the government got its report.

What happens once a technical report is printed and submitted very much depends on the political forces at play. Countless reports “rest in peace” on library shelves; less fortunate others are “filed” in bankers boxes buried in archives. Yet, when the stars align and the timely words fall in receptive ears, lucky reports serve their purpose and can lead to changes in building codes, enhance design specifications, or fulfill some other noble purposes mostly invisible to the public. In some rare instances, parts of these reports that have had an impact are quoted by politicians.¹ For whatever the reason may have been, in one such moment, an elected government official² deemed it appropriate to reassure the public and commented on the many bridges that collapsed during the earthquake in that other country. He emphasized that the way bridges were designed there was different than at home and that, contrary to what had been observed in that other country, the nation’s bridges were safe. “Safe!”

That elected official was a representative of the Japanese government commenting on the damage from the January 17, 1994, magnitude 6.7 Northridge earthquake that struck at 4:30 a.m. near Los Angeles and during which many bridge spans and overpasses either fell off their support or collapsed due to column failures. Most significantly, one of those collapsed spans occurred along the busiest freeway in the U.S. (Interstate 10), which, as a result, was closed

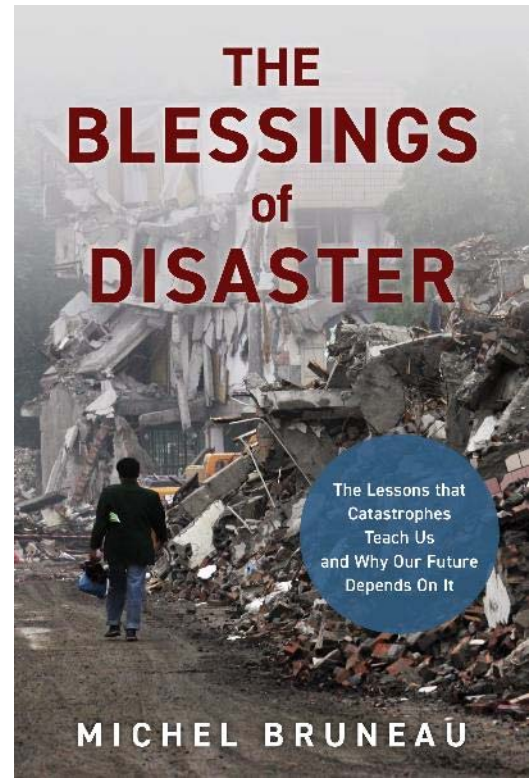


Figure 2: Book cover page

to traffic for almost three months.³ These collapses could have been of dramatic consequence had the earthquake not happened so early that day, but instead during rush hour with cars zooming by at more than seventy miles per hour.

The Japanese official's confident statement undoubtedly reassured the population at the time. Most unfortunately, he was wrong.

Exactly one year to the day after the Northridge earthquake, the Great Hanshin earthquake struck near Kobe at 5:46 a.m. on January 17, 1995. Beyond demonstrating that, statistically speaking, large earthquakes have a propensity to strike on a January 17 before business hours (one can really make statistics say anything), this magnitude 6.9 earthquake destroyed many bridges across the region,⁴ including large segments of the elevated railway for Japan's iconic bullet train—which could have been of dramatic consequence had the earthquake not happened so early that day, but instead during rush hour with trains zooming by at more than two hundred miles per hour. Also noteworthy, the elevated Hanshin Expressway that ran through Kobe suffered massive damage over nearly its entire length, and a segment of it collapsed in such a spectacular manner that photos of it made the front page of magazines and newspapers worldwide—and, not to forget, provided sensational opening footage for the television evening news. Beyond bridges, the earthquake also damaged more than one hundred thousand buildings,⁵ triggered about three hundred fires that burned for days, and debilitated Kobe's entire infrastructure. And Kobe's port, one of the world's busiest at the time of the earthquake, was ravaged by the earthquake and never recovered its stature.

So much for “safe.”

However, that was not the worst of it. This earthquake was also embarrassing for the Japanese government for a number of other reasons.

First in the list of embarrassments⁶ is the fact that the prime minister learned that the Kobe earthquake had occurred, not from government agencies, but rather from broadcast news. Unlike some other countries, where the president wants to be (or already is) the most powerful man/woman on earth, in Japan, the prime minister only aspires to be a good leader for his nation—sometimes acting as a manager of timid transformational forces, most often plenty happy to tend to the day-to-day business of presiding over the government. Nonetheless, it remains that the prime minister is the top decision maker in the country.⁷ It is the prime minister's office where the proverbial “buck” is supposed to stop, so from the head-of-state perspective, being the last one to know amounted to losing face—a particularly painful thing in many parts of Asia. Comparing the prime minister to a father (or mother, but Japan has not yet elected a woman to that position), it would be like having dad watch television in the den upstairs and learn on the news that a few hours earlier, somebody broke into the kids' bedroom in the basement, thrashed the place and set the curtains on fire, while the kids huddled in their closet. In 1995, the World Wide Web did not exist, but emails, telephones, CB radios, telegraphs, and smoke signals all existed; the fact that the prime minister's office did not receive an official notification of the earthquake and of its severity before news crews could be dispatched illustrates how local authorities were taken by surprise and the extent of their disarray following the earthquake. Part of this confusion can be explained by the fact that, in spite of evidence to the contrary, the general belief was that future large earthquakes were certain to strike soon in the Kanto area of Japan, close to the more than thirty million people that lived in and around Tokyo, but certainly not so in the Kansai area, close to the more than twenty million people that lived in the contiguous towns of Kobe, Osaka, and Kyoto (see end of chapter).

Second subject of embarrassment: the post-earthquake response was aggravatingly slow. For example, it took nine hours before the military was ordered to assist, and, thereafter, army vehicles spent hours stuck in massive traffic jams created as the population either tried to leave or to return to Kobe, winding around town to circumvent the collapsed bridges. In many instances, when firefighters finally reached burning homes (and sometimes entire burning neighborhoods), it was often to no avail as waterlines had been ruptured. To top it off, as a matter of national pride, the government reflex was to decline international assistance until shamed to do otherwise. The US offer of a nearby aircraft carrier that could have provided a floating two-thousand-bed medical facility was declined, and Swiss dogs specially trained in post-earthquake search-and-rescue operations were held for days in quarantine at the Kansai airport.⁸ In fact, the government's response was so poor that the Yakuza (which is the Japanese mafia) reportedly took it upon itself to provide food and water to residents in some neighborhoods (which is, after all, not totally surprising given that a large part of organized crime's activities are about providing services that the government does not). Part of the problem was attributed to the fact that there was not an equivalent to the US Federal Emergency Management Agency (FEMA) in Japan at the time—although FEMA has had its problems with disasters too, as will be addressed later.

Third embarrassing matter: recovery was uneven. On the positive side, repair of bridges progressed at an impressively brisk pace; in fact, train service throughout Kobe was completely restored in four months, which is impressive considering that Kobe's three separate train lines (JR, Hanshin, and Hankyu), in addition to the Shinkansen (bullet

train), each suffered damage over more than 20 miles of elevated tracks. However, the number of gas lines failures was so large that it took approximately three months to fully restore service to all customers. Three months can be an untenable delay for those who depend on gas for heat and cooking; contrary to transportation, where there are alternate roads and/or means of transportation that can be taken, there is only one line supplying gas per residence, and no alternative. Furthermore, because of earthquake damage or fires, a lot of people became homeless overnight. In rural settings, people can literally camp in their backyards, but in one of the most densely populated countries in the world, life is far from pastoral, and a lot of people were displaced. As a gauge of the problem, seventy thousand people spent two months or more living in temporary shelters, and some temporary housing units provided by the government remained needed for over five years. Of course, some optimistic spirits have professed that the post-earthquake recovery went smoothly considering the circumstances, but had this truly been the case, maybe Kobe's deputy mayor in charge of reconstruction would not have doused himself in kerosene and set himself on fire fourteen months after the earthquake,⁹ becoming in the process one of the many victims of post-disaster stress—although not all those so afflicted have set themselves ablaze.

Now, at this point, it is important to emphasize that the Japanese were not ignorant of their exposure to damaging earthquakes. Quite on the contrary, and this is best explained by a department store analogy.

In Japan's crowded urban environment, department stores are typically multistory buildings often located at major train stations (not coincidentally, since some of the stores were originally owned by railway companies). Although the practice has tended to disappear in recent years, some of the bigger stores still employ young "elevator girls," dressed in the company uniform, whose purpose is to cheerfully greet customers entering the elevator, graciously thank them as they leave, and in-between call out the services provided on the floors at every stop. Going up, they would announce:

- Basement: Food department—the quintessential Japanese grocery store, providing everything one may desire, from blemish-free perfectly shaped fruits (a national obsession) to live octopus.
- Ground level: Cosmetics and beauty products—yes, that, by itself can fill an entire floor.
- First floor: Women's fashion.
- Second floor: More women's fashion—yes, that, by itself can fill more than an entire floor.
- Third floor: Men's fashion.
- Fourth floor: Sporting goods.
- Fifth floor: Home furnishing—from water purifiers to waterbeds.
- Sixth floor: Kids clothes, stationery, and toy department—the only place in the world where one can buy an Ultraman figurine (not your typical superhero—readers will have to Google it to appreciate).
- Top level: Restaurants of all kinds, which display, next to their entrance, plastic replicas of their main menu items—most convenient for the locals or international visitors who cannot quite decipher the Kanji, Katakana, and Hiragana symbols that combine to create the Japanese written language.

So, Japan, in a nutshell (and arguably in its collective subconscious), is a department store of disasters, where one would find:

- Ground floor: Floods—for example, thousands died in the summer of 1953 when dikes along rivers failed due to heavy rain.
- First floor: Landslides—another consequence of downpours, and a widespread problem given that 73 percent of Japan is covered by mountains.
- Second floor: Earthquakes.
- Third floor: Earthquakes—yes, that by itself can fill more than an entire floor.
- Fourth floor: Fires and conflagrations—for example, 143,000 people died in Tokyo in 1923, when the fire caused by the earthquake caused more destruction and death than the earthquake itself. Note that, given the predominance of timber in Japanese residential construction, other cities there burned down on their own without the triggering effect of an earthquake, such as Hakodate, Hokkaido, in 1934.
- Fifth floor: Tsunamis, which are massive waves triggered by offshore earthquakes. It is reported that 21,959 people died during the 1828 Sanriku earthquake and tsunami that struck Tohoku, the largest to hit Japan until the 2011 Tohoku earthquake and tsunami during which fewer people died (15,896), but which is considered to be the costliest natural disaster in recorded history (some estimates reach \$360 billion),¹⁰ and that created a meltdown at the Fukushima Daiichi Nuclear Power Plant complex.
- Sixth floor: Typhoons and storm surges, which go hand-in-hand—more than 19,000 people died in the 1828 typhoon that made landfall on Kyushu with 180-miles-per-hour winds.
- Seventh floor: Volcanoes—the Japanese islands are dotted with 110 active volcanoes, and while Mount Fuji near Tokyo has been dormant since 1707, a 2018 government study¹¹ indicates that a repeat of that event would paralyze the economic capital of Japan indefinitely.

- Eighth floor: Nuclear Bombs—Hiroshima and Nagasaki are the only two cities ever leveled by nuclear weapons. On August 6, 1945, 70% of Hiroshima's buildings were destroyed, and over 100,000 people died instantly or in the subsequent months from the effects of radiation.
- Top floor: Godzilla—this is actually where the collective subconscious part comes into the picture. As world record holder for the longest continuously running movie franchise, with thirty-one Japanese full-length features since 1954, a bad actor in a latex Godzilla suit, scaled as needed to always be taller than Japan's tallest building of the day, has trampled and destroyed countless scale models of Japanese cities, as the embodiment of the subconscious conviction that the country is perpetually on the brink of being annihilated by forces beyond its control. In short, Godzilla means: "If you live in Japan, beware that some disaster is always lurking around the corner."

No one spending time browsing through the Japanese department store of disasters can miss the fact that disasters—including earthquakes—have consistently occurred throughout Japan's history. Hence, prior to the 1995 Kobe earthquake, everybody in Japan knew that they lived in earthquake country. How they acted in the years prior to that earthquake very much depended on their perception of the risk of it happening soon, in their very own backyard, and of the possible consequences of that event. For each organization and each individual, the level of preparedness very much depended on the complex juggling of relative priorities that takes place in the human psyche. And that is not unique to Japan, but rather universal.

Which brings up the Three Little Pigs.

There have been many versions of this classic nursery rhyme, from 1853's England to today's YouTube (with Disney's Silly Symphony adaptation about halfway), so everybody is presumably familiar with the story. In a nutshell, a first Little Pig builds a straw hut and the second one a house of sticks. This is expeditious and leaves plenty of time for frivolous play and to ridicule the third Little Pig who labors to build a brick home. Then, out of the blue, as if nobody saw it coming, a "Big Bad Wolf" shows up and blows away the first two huts. Depending on the age of the audience, the first two pigs either find refuge in the fortress of the compassionate third Little Pig or end up in a delicious pulled-pork sandwich. The moral of the story is that hard work pays off and—evidently, here—that the third Little Pig is a better engineer: It pays to build a more resilient structure.¹²

Indeed, the Three Little Pigs story is most relevant here, when dealing with extreme events and circumstances, because not all houses are created equal and some will suffer more damage than others during any disaster. However, one of the most important points of the story, but one that is not stated even though it is at the root of countless decisions, is that if no wolf ever came, the first two Little Pigs would have won, so to speak, with more free time to enjoy life and dollars to spare—which is essentially counter to the lesson underscored by the nursery rhyme. Likewise, when it comes to earthquakes, investments in earthquake protection measures may never actually provide any return on investment in the lifetime of the investor if no damaging earthquake occurs. The same is true for all other extreme hazards or life-impacting conditions. Therein lies the dilemma. One can invest resources and energy in hope of maybe reaping a benefit in some distant future. However, even when fully aware of the risk, betting on the probability that no disaster will occur, to spend time and money instead on things providing immediate rewards, is always an option. And a most attractive one at that.

As such, at any point in time, depending on circumstances and timing, everybody can be any one of the three Little Pigs, which makes preventing disasters an uphill battle.

This is what is explored at length in this book.

REFERENCES

Bruneau, M., 2022. "The Blessings of Disaster: The Lessons That Catastrophes Teach Us and Why Our Future Depends on It", Globe Pequot, Prometheus, 474p.

Note: The book contains 84 pages of notes and references. Those for Chapter 1 are included are endnotes here.

NOTES

¹ Reasons vary on why this happens, and some may speculate that this could include a showboating desire to demonstrate a deep understanding of key issues of some social or technical problem, or that it might occur impulsively, in panic, to respond

to an unexpected question on national television (neuroanatomy might someday demonstrate striking similitudes between the brains of politicians and those of professional jugglers).

² Sharon Begley, “Lessons of the Kobe Earthquake,” *Newsweek*, January 29, 1995, <http://www.newsweek.com/lessons-kobe-earthquake-182190>.

³ Nora Zamichow and Virginia Ellis, “Santa Monica Freeway to Reopen on Tuesday; Recovery: The Contractor Will Get a \$14.5-Million Bonus for Finishing Earthquake Repairs 74 Days Early,” *Los Angeles Times*, April 6, 1994, <https://www.latimes.com/archives/la-xpm-1994-04-06-mn-42778-story.html>

⁴ M. Bruneau, J. W. Wilson, and R. Tremblay, “Performance of Steel Bridges during the 1995 Hyogo-ken Nanbu (Kobe, Japan) Earthquake,” *Canadian Journal of Civil Engineering* 23, no. 3 (1996): 678–713.

⁵ Louise Comfort, *Self Organization in Disaster Response: The Great Hanshin Earthquake of January 17, 1995* (Pittsburg, PA: Graduate School of Public and International Affairs, 1995), 12, <http://cidbimena.desastres.hn/pdf/eng/doc8691/doc8691.htm>.

⁶ “Kobe Earthquake of 1995,” Facts and Details, <http://factsanddetails.com/japan/cat26/sub160/item863.html>.

⁷ There is also an emperor in Japan, but while this monarch was once considered a deity and referred to as the “heavenly sovereign,” his role post–World War II has been limited to the less godly duties of serving as a figurehead—albeit a figure whose head is never shown on bank notes or postage stamps anymore, contrary to the highly popular “Hello Kitty” cartoon character, who is featured on special-issue stamps almost every year. The emperor is empowered to perform important ceremonial functions, such as officially appointing the prime minister who has been democratically elected by the Japanese legislature (known as the Diet), but not much more, so it is OK if the emperor gets his news from the television.

⁸ Eric Johnston, “Lessons Learned in Kobe Aid Relief Effort,” *Japan Times*, March 15, 2011, <https://www.japantimes.co.jp/news/2011/03/15/national/lessons-learned-in-kobe-aid-relief-effort/#.W29jGLgnZ9A>.

⁹ “Japan Deputy Mayor Commits Suicide,” UPI, March 15, 1996, <https://www.upi.com/Archives/1996/03/15/Japan-deputy-mayor-commits-suicide/4439826866000/>.

¹⁰ Elizabeth Ferris and Mireya Solís, “Earthquake, Tsunami, Meltdown: The Triple Disaster’s Impact on Japan, Impact on the World,” Brookings, March 11, 2013, <https://www.brookings.edu/blog/up-front/2013/03/11/earthquake-tsunami-meltdown-the-triple-disasters-impact-on-japan-impact-on-the-world/>.

¹¹ Julian Ryall, “Mount Fuji Eruption Fears Prompt Japan to Draw Up Disaster Plans,” *Telegraph*, July 31, 2018, <https://www.telegraph.co.uk/news/2018/07/31/mount-fuji-eruption-fears-prompt-japan-draw-disaster-plans/>; “Japanese Government Begins Discussion on Contingency Plans in Event of Mount Fuji Eruption,” *Japan Times*, September 11, 2018; “Mount Fuji Eruption Could Paralyse Tokyo: Report,” *France-Presse*, May 1, 2018, <https://www.ndtv.com/world-news/mount-fuji-eruption-could-paralyse-tokyo-report-1845251>.

¹² Parenthetically, engineers would advise the third Little Pig to at least use reinforced masonry (that is, masonry that includes steel reinforcing bars), instead of unreinforced masonry, to minimize the risk of damage in future earthquakes, but that goes beyond the scope of the nursery rhyme.