

Probability and Possibility

March 11 is the third anniversary of the Great Eastern Japan Earthquake and Tsunami. As a resident of Japan, the grief and shock which I felt that day has a half-life of its own.

But Japan is not the only country in Asia which experiences earthquakes and tsunamis, not to mention volcanoes and typhoons. It seems that in Asia we have more than our share of extreme natural disasters, with both the strength and cost of them seemingly unpredictable making emergency response a Sisyphean task..

Why is this the case? What can we do about it?

Fat Tails

Suppose the tallest person in the room is 2 meters. What is the likelihood that a person taller than 2 meters will walk in and be more than twice as tall, say 4 meters? Surely that likelihood is extremely small.

Prior to 2005, the most costly hurricane in the US was Hurricane Andrew (1992) at \$41.5 billion in 2011 dollars. Hurricane Katrina was the next record hurricane, weighing in at \$91 in 2011 dollars.

People's height is a "thin tailed" distribution, like a bell curve, where the extreme values of measurement act nicely and tend to extremely low likelihoods in the "tail" of the distribution. Bigger is less bigger.

Hurricane damage is "fat tailed": Extreme values never act nicely and never approach low likelihoods. The way we should reason from historical data and the way we should think about the future are very different depending on whether we are dealing with thin or fat tailed events. And it seems from investigations and analyses that other types of natural disasters follow suit. Worsen is more worsen.

Of course fat tails are the infamous black swans made popular in Nassim Taleb's book, "The Black Swan", which proposed a new way of thinking that took the public, the experts, and the statisticians, by surprise.

The answer to why this is the case was put forth by the mathematician Benoit Mandelbrot in 1963: The geometry of Nature is fractal, not Euclidean. Clouds are not spheres; mountains are not cones; rivers do not travel in straight lines.

Extreme natural disasters are different because the geometry of Nature is also different.

Coastlines are fractal and can only be approximated by broken lines which depend on the jaggedness of the coast. The fractal geometry of fault movement is central to the magnitude of earthquakes. On March 11, 2011,

people from Japan, like the people from Sri Lanka to Thailand on December 26, 2004, tragically experienced the implications of fractal geometry.

Resilience

Usually we live in constant, relatively safe world. But then something unexpected happens and the world changes with a monstrous typhoon. We have never been there before, we have no idea where we are, we have no idea which path to follow, we have no idea who can help.

Resilience, that current management cliché, does have a meaning: When the world falls apart, and there seems to be no sense to the situation, resilience is the art of rebuilding some sense of what is happening and putting the pieces back together into a world.

Resilience is rebuilding the world. But it will not be the same world as before. Expect the accident. Expect to change.

What are keys to resilient response? Let me list some which I believe are necessary:

1. Having Experience;
2. Questioning Experience;
3. Intuition;
4. Improvisation and Bricolage;
5. Speaking and Listening;
6. Examining Preconceptions;
7. Ignorance + Knowledge = Wisdom;
8. Taking Advantage of Luck.

When disaster strikes, we need an A-team of resilient responders to work with traditional emergency crews. Individuals or groups that show the above traits are much different than individuals or groups who work following strict protocols, procedures, and rules. In critical situations there are sometimes clashes of these two different cultures. Resilience in an individual meets with no internal resistance, however in a group, those that follow a rule, and those who improvise a tune, can find themselves at odds.

Can these two cultures coexist during recovery from extreme events? I do not know the answer at all. But I do know, that without them both, we will not be able to serve the people when disaster strikes.