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Preparing for Global Pandemics: Lessons from Marshmallows, Boiled Frogs, and Bathtubs

Bill Gates has made a public call for a Global Epidemic Response System. Here, we look at a few of the systemic factors that make this Response System necessary, as well as those that stand in the way of the systems' development.

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We have all heard the boiled frog story. A frog placed in super hot water will jump out, while a frog placed in cold water will sit calmly while the water temperature is increased until the boiling point. Are we like frogs? Perhaps we are. But, the good news is, this parable of the boiled frog is a myth.[1] A frog will actually jump out when the water gets uncomfortable. If a frog can sense an increasing threat in its environment, and take appropriate action, perhaps so can we.

Bill Gates, Silicon Valley giant and leader of the Bill and Melinda Gates Foundation, recently wrote a set of articles written in response to the Ebola outbreak of 2014 about the need to prepare globally for the next pandemic.[2,3,4] His ideas address the question, "What are the systemic factors we must address to prepare for the future?"

We Need a Global Warning and Response System for Epidemics

In his New York Times and New England Journal of Medicine articles, Gates highlights the key insights he gleaned from the 2014 Ebola epidemic in Guinea, Sierra Leone, and Liberia.[2,3] Ebola had everyone's attention because of the scary fatality rate, but it did not spread as fast as many other infectious threats for two reasons: one, the time period between being contagious and showing symptoms was not long; and two, it is not an airborne pathogen, and instead requires physical contact for transmission.

Many infectious agents spread much more easily through air, and also are asymptomatic while contagious, thereby increasing the number of people exposed to the infection. While Ebola failed to have the disastrous fatalities expected, the next, as yet undetermined epidemic, could easily affect ten times the number of people. Gates cites an epidemic likely to kill 10 million people is substantially high.[3] He says, in short, that we need a global warning and response system not just for Ebola, but for all epidemics.

The lack of a functioning global surveillance system for epidemics has a staggering impact. Basic health care infrastructure is lacking in many areas, particularly within Africa where a lot of the new diseases originate. However, a coordinated body of health care professionals who are trained for epidemics and ready for emergency response, and an infrastructure to deploy large numbers healthcare

equipment and personnel could create significant improvements. Better, cheaper diagnostics and drugs for treatment and prevention are needed.

There Will Be a Delay—a Long One—for Setting up This System

Everything takes time. Gathering capable people takes time, assembling funding takes time, communicating takes time, deciding what to do takes time, training people takes time, gathering supplies takes time, and building infrastructure takes time.

Building these systems takes a lot of time. And we usually drastically underestimate the amount of time necessary.

Dana Meadows wrote in *Thinking in Systems* that Jay Forrester would tell his protégés when building simulation models for project dynamics to ask everybody involved in the work for their estimate of the time necessary to complete the project.[5] He would then take those estimates and multiply by three. He had observed that everyone underestimates delays and he attributed this, in part, to a lack of understanding of stocks and flows.

Stocks, like bathtubs, are a delaying mechanism. They fill up slowly depending on the inflows, where there is also a delay. Consider the frequency and amount of adding to a savings account. Even a disciplined savings approach takes years before the account begins to look significant. These stock and flow structures, which mimic real world physics, compound delays further (Fig. 1).

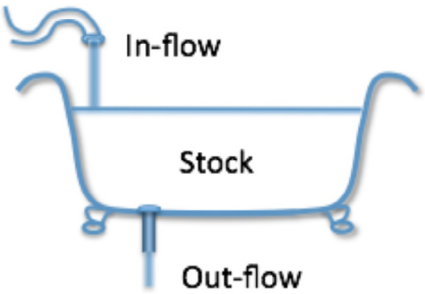

Figure 1. The bathtub model helps visualize the in-flow and out-flow of a particular stock. When the tap is turned on the whole way, the stock begins to increase from zero, but there is a delay for the water to accumulate in the tub. A similar delay occurs when the drain is pulled; all the water doesn't rush out at once. Source: Leverage Networks

Understanding and internalizing the implications of delays are a key marker of astute and systemic thinking. As we consider a global warning and response system for epidemics, we need to think about the ways delays will affect it—both in its creation and set-up, and also as it functions. How can information be transmitted in a timely fashion? How can we compensate for the delays that will inherently be a part of the solution?

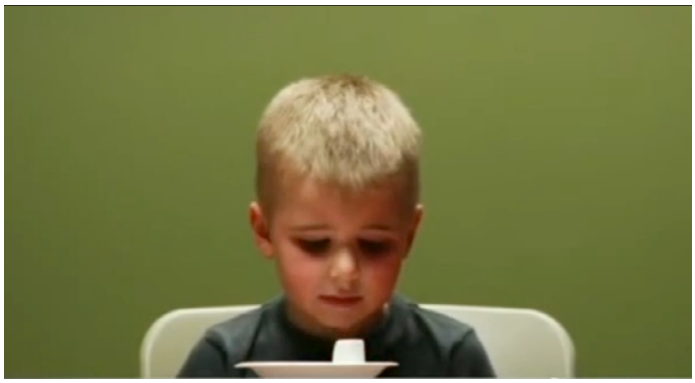

Figure 2. The Stanford Marshmallow experiment underway. A four- to six-year-old child is told if he can wait 15 minutes without eating the single marshmallow, he will be rewarded with two. The implications of the results are still being discussed. Source: PSPConnections, 2013.6

The Delayed Gratification of This System Will Cause Further Challenges

We could say that the famous Stanford marshmallow experiment is being done with all of us.[6,7] For those who have more than enough money for basic needs, how much we plan and save for our retirement is an example of delayed gratification; or perhaps how much we set aside for large inevitable expenses, like replacing a roof or a vehicle (although the anticipated availability of low interest loans and higher return markets play a role here, resources still need to be set aside for investment).

There may have been a number of factors affecting whether the children stuffed the single marshmallow

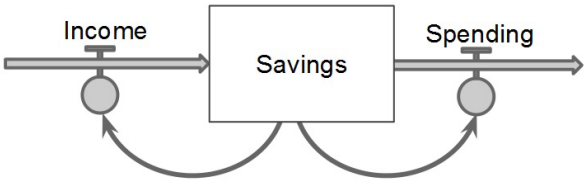

Figure 3. Factors that impacted children in the Stanford marshmallow experiment can also impact adults as they plan for retirement. Source: Leverage Networks.

into their mouth when the adult left the room, or waited patiently for the authority figure to return and reward them with two marshmallows. These include: their trust in authority, their previous exposure to stable or unstable environments, their individual interest in sweets, their level of maturity, hunger, or a more recent idea— willpower "fatigue." Some of these factors also play a role in our decision and follow-through for retirement saving, as they may with other sorts of planning and preparation for the future. As Systems Thinkers, we can use stock and flow diagrams, like Figure 3, to see where gratification will come from—as well as why it is delayed.

As mature, high-performing adults, we must set aside short-term desires that take our attention and short-term demands on our resources, in order to prepare for our retirement, say, or to exercise to stay healthy. This does not take away the fact that the temptation to spend resources (or time) on something more immediately gratifying is tremendous.

Here is an extension of the delayed gratification logic: as mature, high-performing organizations and societies, we must save for a major capital expense, or to prepare for the next global epidemic. Gates suggests that building a health response system is similar to building a military. Globally, can we show the same amount of national willpower to prepare for upcoming epidemics? How can we ensure we don't fall back on our child-like tendencies to stuff the marshmallow in our mouth at once, instead of keeping our eye on the goal of global security?

We Need to Shift Away from The "Fire Fighting" Mentality

A commonly occurring dynamic in many organizations—an archetypical dynamic, even—is that instead of preparing and preventing catastrophic breakdowns in our systems, we tend to cultivate people and organizations who can react quickly to squelch the major breakdowns. These reactive systems create heroes that we can admire, and suck resources away from activities that would enable planned and measured responses.[8] Our biology, common to all animals, is wired to react and respond to things that are happening in our immediate environment.

These ideas are actually the point of the hackneyed boiled frog fable. Things that are moving quickly or making loud noises tend to capture our attention before things that are moving slowly or seem less of an immediate threat. This is how our species survived and evolved. But many of the serious problems we face, in organizations and in our world, are larger and move very slowly.

Surely if an amphibian can respond in ways that reduce its risk of survival, organizations and societies can respond to subtle but important changes in their environment. But because of the likely significant delays, we must act ahead of time.

In the case of 2014 Ebola outbreak, there was a lot of scrambling. The response was a major fire fighting

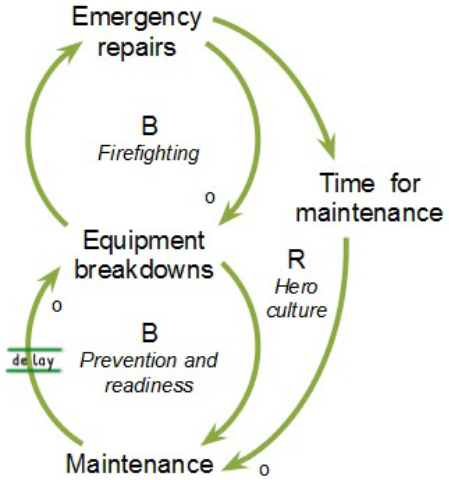

Figure 4. The Firefighting archetype describes a response to a situation where the fire can sometimes be prevented due to preparation and maintenance. Source: Leverage Networks

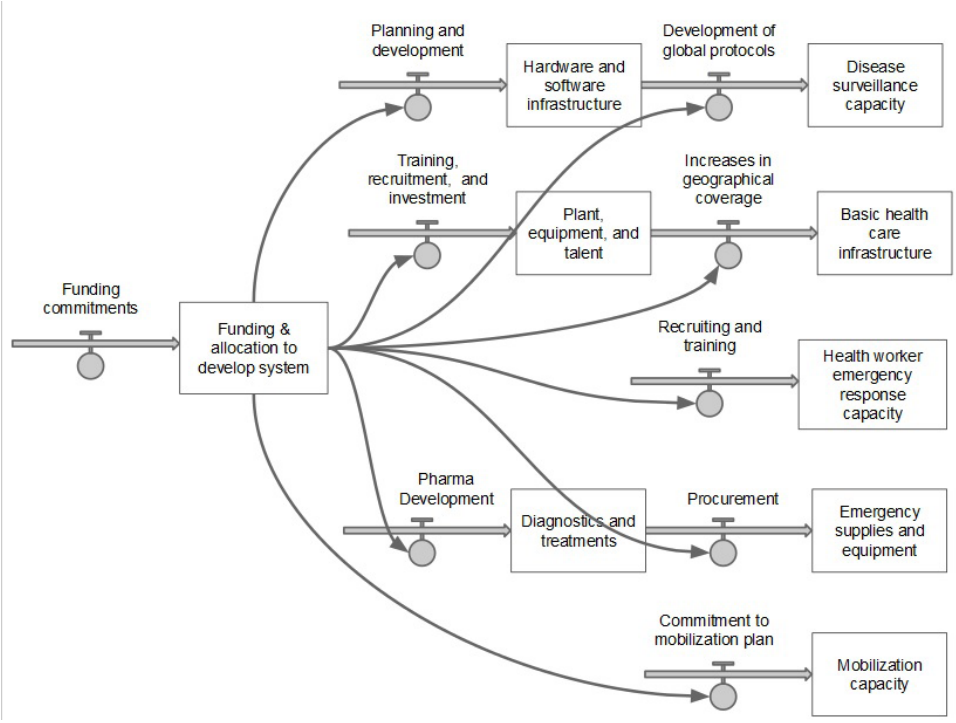

Figure 5. A draft depiction of the structural delays that developing a global pandemic response system will entail. Source: Leverage Networks

effort. Doctors Without Borders was, in large part, the hero of the day. And many other organizations also contributed. The World Health Organization (WHO) put to work its severely underfunded Global Outbreak Alert and Response Network. The US and UK governments had their militaries provide critical transport of people. They also provided supplies including, tents, power generators, medical supplies, and manpower.[2,9]

> ***"The problem isn't so much that the system didn't work well enough. The problem is that we hardly have a system at all."***
>
> ***- Bill Gates [2]***

Facing Probability and Uncertainty in Planning for a Pandemic

Cases in which the perceived probability of an event occurring is low, people often choose not to prepare for it. In cases in which the event probability is high, such as retirement, most of us will take action to the extent we are able. There are situations in which the likelihood of something happening is more uncertain. Some people are more likely to do nothing in situations where the uncertainty is high, but others consider multiple scenarios, and at least think through their plan for each.

Classic scenario planning has been done by more advanced organizations for decades.[10] At it's simplest, it involves identifying the key uncertainties, varying them to describe multiple possible futures, and then projecting how each scenario would play out for the organization. The projections are simulations either performed mentally, or for organizations who take their strategic planning seriously, using computer simulations.[11] Rough strategic plans are decided upon prior to the events occurring.

So, how uncertain is a pandemic? In the last 10 years we have seen the rise of SARS (Severe Acute Respiratory Syndrome), MERS (Middle East Respiratory Syndrome), H5N1 avian flu, and the H7N9 avian flu, among others. Every year influenza kills 500,000 people, and in 1918 the flu pandemic killed between 50 and 100 million people.[3] Although, the field of evolutionary biology has been focusing on viruses, bacteria, and other organisms that can spread disease, it is playing catch up with the mutating organisms themselves.

While we wait for the world's scientific communities to amass evidence and strategies to increase prevention, the likelihood of serious infectious threats continues to be high, even though there is uncertainty about when and what form it will take. Preparation for these serious infectious threats is a wise strategy.

The Bottom Line: Will We Build a Global Response System?

The WHO estimates it will take approximately US$3T to make a global warning and response system for epidemics a reality. And still, this leaves the question of how long it will take to build unanswered.

The good news is that 39 nations have come together to make commitments and begin this difficult, important work. Specific actionable goals have been laid out in the Global Health Security Agenda Action Plan.[12, 13] Each of these goals has a high-level timeline of 5 years, costing an estimated average of $600B per year. Using Forrester's rule of thumb, this project will take 15 years, at least. Hopefully, the nations of the world have the sustained willpower to follow through.

Disciplined preparation for the future is a critical success factor. Successful people and societies prepare. Here is to putting the marshmallows in the drawer, and keeping our eyes on the future.

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