



Avoid major disasters by welcoming minor change

Scientists can educate policymakers on how to deal with the European refugee crisis — it's all about alleviating the pressure, says Len Fisher.

What can a 70-year-old book on how to play bridge tell us about addressing the ongoing refugee crisis in Europe? And what does it have to do with *King Lear*?

In Shakespeare's play, the Duke of Albany warns that "striving to better, oft we mar what's well". In the search for a solution, in other words, we can let the perfect become the enemy of the good. In his 1945 book *Why You Lose at Bridge*, S. J. Simon called it the half-loaf strategy: the most successful players aim for the best possible result, rather than the best result possible.

In human and political crises, the best possible result is often one of damage limitation — an outcome that avoids or delays the chance of a large-scale and catastrophic change. So, the question then becomes: how can we achieve such an outcome?

In a recent editorial (see *Nature* 525, 157; 2015), *Nature* suggests that nations should "keep a welcome" for refugees. I agree. This pressure-releasing approach could serve as an effective paradigm for policy development, being used to handle emergent crises of many types. It makes sense: not just from a humanitarian perspective but also from what we now understand about the underlying behaviour of our interconnected global socio-economic-ecological system. For example, convincing connections have been drawn among the European refugee crisis, global warming and future food supplies, so a solution to one problem is likely to bear on the others.

Such complex systems can undergo sudden change at any time. These changes (known technically as 'regime shifts', 'critical transitions' or 'catastrophic bifurcations') occur at all scales, happen with little warning and often have no apparent cause. They frequently seem to be out of our control. Examples include cascading failure in power grids, communication networks, financial systems, food webs and social organizations; epidemics, not just of disease but also of social unrest and innovation; and sudden shifts in the balance of power, be they in international relationships or small groups.

Policy development to deal with such sudden change is often based on searching for (or blaming) specific causes. But, to quote H. G. Wells, "History is a race between education and catastrophe." Scientists must show policymakers that sudden change is inevitable in any complex system, and the first step towards avoiding or minimizing catastrophe is to recognize this.

The second step is to understand the nature of these transitions. Scientists have modelled them as, for example, sudden slippages in a sand pile when extra grains are progressively added, or as evolving interactions of multiple positive and negative feedback loops in a system. An important common

feature of these models is that they predict that smaller changes are more frequent than larger ones.

Scientists have also suggested a number of different ways to develop policies to deal with the potential for sudden change. When it comes to protecting against terrorist attacks, some suggest that we must concentrate resources to protect critical nodes in a network. On the stability of banking systems, researchers argue for structural changes in networks so that damage in one part cannot easily propagate to others. A third idea, which to some extent complements the first two, is to build more resilience into our societies and institutions.

These ideas have their merits, but the 'keep a welcome' strategy for the refugee crisis suggests a different approach — one that can more easily be adapted to take account of the important (and sometimes overwhelming) human dimension in many crises.

This approach, which my colleague Jim Gimzewski and I have been examining, involves reducing the chances of sudden, large-scale, damaging change by altering the shape of the statistical distribution of event sizes. We should promote smaller, less-damaging transitions to reduce the chance of larger ones occurring. In metaphorical terms, the aim should be to reduce pressures before they can build to dangerous levels.

This is not a new principle. It underpins, for instance, the practice of triggering small snow avalanches to reduce the probability and impact of a major one, and it also has parallels with the philosopher Karl Popper's idea of 'piecemeal social engineering'. A simple social example is the reduction of traffic congestion by breaking

the traffic into manageable blocks that are separated and accompanied by slow-moving police cars. Progress is still slow, but on average it is much faster than if large traffic jams were allowed to develop.

Most social problems, of course, are not quite this simple. But we must be wary of the 'nirvana effect' — the belief that perfect solutions are out there somewhere. A half-loaf of bread is always better than none at all. Thus, for example, in the case of the Greek debt crisis, our approach suggests paying to create jobs, rather than imposing austerity. The cost of the former would be far less than the social and economic costs that may result from the latter.

The current refugee crisis falls into a similar category. Countries willing to bear the (financial and political) cost of welcoming more refugees with fewer restrictions would promote small-scale changes that release the build-up of devastating social pressures. In this way, scientific and humanitarian values can work hand in hand. ■

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