

# Complexity and chaos

Much is known today, from a theoretical standpoint, about the dynamics of chaotic and complex events. Yet there is little practical application of such modern science in the field of Institutional Emergency Management, say **Michel Nesterenko** and **Patrick Lagadec**

**W**HEN YOU MAKE one – or a couple – of deadly mistakes, you fix the problem; this is tactical common sense. When you discover a series of repetitive flaws, you can change the rules; this is doctrine. When confronted by a constant flow of fiascos, the fundamental concepts at the core of visions, goals and practices must be reinvented. Five years after 9/11 and one year after Katrina, we have reached this point.

The issue is not that gaps persist in the security net, but that our understanding of the very purpose of the net is now outdated. Courageous new creative vision and daring leadership are what we need.

Five years after the destruction of the World Trade Center by foreign terrorists, the US Federal Government is still trying to fix the intelligence and emergency management failures identified

by the 9/11 Commission. Congressional audits indicate that intelligence is still substantially segregated in silos and, by and large, not accessible to the first responder who could make use of it. Interoperability of communication is still some distance in the future. Borders are not yet 'fully' under surveillance. The freight industry is following the principles of declaratory security, with few true physical audits.

## Chasing rainbows

Elsewhere, at airports, the London episode (August, 2006) with liquid borne explosives indicates that addressing the current threats is like chasing rainbows: we are stuck with an outdated threat typology where liquid threats are not identified.

In 2005, the destructive violence of Hurricanes Katrina and Rita, coupled with the limitations

of the New Orleans levees, dealt a blow to the credibility of the US Federal Government's claim that everything was 'under control'.

Such a clear failure of the US institutional emergency management system four years after 9/11, and billions of dollars of investment, forces the question: "Are we tackling the right institutional problem?"

Furthermore, after the failure of emergency management during Katrina, we are now faced with the failure of reconstruction. Because of the magnitude and the complexity of the economic destruction, the Federal Government rightly focused on marshalling the huge budgets necessary for reconstruction. Yet *one year* later, little has been done on site, the promised budgets are stuck in bureaucratic red tape and it will be decades before normal life is truly restored. In the meantime, the citizens are waiting



**Chaos describes complex dynamical systems where behaviour is unpredictable, yet patterns can be observed. Chaos theory is not a far-fetched scientific discipline to be cloistered in a high-tech research institute, but has down to earth applications in biology, economics, political science and – according to the authors – in dealing with the increasing number of ‘Class-5’ events**

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and suffering.

All this is happening in and to the richest democracy on earth, which has the best minds to hand, which continually analyses problems and disseminates lessons learned; a country with no shortage of ideas and money and whose government is highly qualified and has the necessary budgets.

The problem is not confined to America – no country is immune. Europe is suffering from the same institutional dysfunction: France and its 2003 heat wave fiasco; Spain and the

*Prestige* tanker oil spill or the Madrid commuter train attacks; the UK and the BSE crisis. This is a global challenge, and first and foremost a transatlantic democracy issue.

Since 2001, our institutions appear to be acting collectively like a person in quicksand, frenetically trying to reach ‘normality’ and solid ground, thrown into crises which defy the imagination, coming from all quarters. Governments try any and all of the easy solutions: finger-pointing, scape-goating, demanding more staff and increased budgets, calling for more scripts, more models, more plans, more communication, more drills, more insurance, more of any conceivable ready-made tools. Still, nothing seems to work quite right. Even when all the means are at hand, effective implementation is nowhere to be found.

If we do not reshape the whole we are bound to be defeated in every battle, as Sun Tse said some thousands of years ago. It’s time to search for new concepts and new roadmaps.

## Class-5 events

We must develop the basic understanding to deal with the increasing reality of Class-5 events. First, comes the ‘conceptual stage’, followed by the ‘doctrinal stage’ and finally the ‘tactical stage’. No tactical reinforcement can solve a doctrinal gap. No doctrinal hardening can compensate for a conceptual breakdown.

The most difficult is to get out of basic ruts. Many leaders with packed appointment books insist: ‘We are here to bring answers, not to raise questions’. But blindness cannot chase away reality. When you don’t know the direction, fiasco lurks around the corner.

Two conceptual potholes must be avoided:

■ **The labelling trap:** When faced with a Class-5 hurricane we must avoid labelling it ‘a hurricane’. In truth it is much more than that, and we do not yet know how much more. Decision-makers and leaders must throw away all the labels and start from the image of reality piped in from the front lines. However, leaders can be emotionally attached to labels which symbolise normality, safety and knowledge.

■ **‘Everything’s under control’ trap:** Leaders must stop claiming that they have all the answers. The crisis and events move too fast and are much too erratic, chaotic and complex for this. The way out of the trap lies in humility, to start trusting fellow citizens and first responders and position the supply chain to help them.

To truly change the paradigm, not just patch it up, we must change the scientific substrate. It is clear that that Euclidian and Newtonian linear scientific principles are not the most appropriate tools to explain the phenomenon

typically encountered during major crises and emergencies. Over 20 years ago (1984) the Santa Fe Institute was created by a number of Nobel Prize scientists to apply quantum, chaos, complexity and fractals theories beyond the realm of physics and mathematics to the fields of biology, social sciences and economics, among many. In 1996, the New England Complex Systems Institute started applying the same chaos and complexity theories to explain the dynamics of networks. Much is known today, from a theoretical standpoint, about the dynamics of chaotic and complex events. Yet, there is little practical application of such modern science in the field of institutional emergency management.

Chaos theory is not a far-fetched scientific discipline to be cloistered in a high-tech research institute, but has down to earth applications in biology, economics and political science. The answers are not necessarily black and white ‘predictions’, but as Ilya Prigogine said: “The laws of Chaos have to be formulated at the statistical level,” and more: “Probability is no longer a state of mind due to our ignorance, but the result of the laws of nature.”

James Gleick has reported that Leon Glass, of McGill University in Montreal and a team of research cardiologists, used: “The tools of chaos to discover that traditional cardiology was making the wrong generalisations about irregular heartbeats, inadvertently using superficial classifications to obscure deep causes. They discovered the dynamic heart.” Complexity theory has proven an invaluable tool to explain the inherent dynamic instabilities of complex electronic based networks like the electrical distribution web among others.

Eric Bienhocker, tells us that chaos and complexity are applicable to social and economic systems: “A chaotic system has three important characteristics. First, although it might look random, it is actually deterministic... Second, unlike a periodic system, you can run the formula forever and it will never exactly repeat itself... And third, the system is bounded. Even though the system’s trajectory is all over the place, there are some places it won’t go.” Such characteristics indicate that it may be utopian to try to manage a Class-5 event in a military hierarchical fashion.

## Fractal analysis

According to Benoît Mandelbrot: “In fractal analysis, time is flexible. The multifractal model describes markets as deforming time – expanding it there, contracting it there. Time does not run in a straight line.”

This elasticity of time is a well known phenomenon in every major crisis, when there

▶ never seems to be enough time to respond as planned and practised. Stuart Kauffman and Ludwig Boltzmann say: "The consequence of the second law (of thermodynamics) is that in equilibrium systems, order ... tends to disappear ... it follows that the maintenance of order requires that some form of work be done on the system ... Hence we come to our current sense that the incoherent collapse of order is the natural state of things." And: "Any small change in a chaotic system can, and typically does, have large and amplifying effects ... Note again that failure to predict does not mean failure to understand or to explain."

But there is hope, for within the chaos the solutions can be found: "We will find an ordered regime where poor compromises for the entire organisation are found, a chaotic regime where no solution is ever agreed on, and a phase transition between order and chaos where excellent solutions are found rapidly".

The few quotes here do not give proper credit to the richness and applicability of chaos theory. Our goal was merely to show that a true paradigm shift is possible if only emergency management leaders are prepared to look at crises from a holistic point of view instead of a fragmented deterministic one.

The tool used to manage a democracy is bureaucracy. Bureaucracy as we know it today has evolved from the beginning of the industrial era in the form of specialised silos acting according to Newtonian scientific principles. In the early days of the 21st century, we are at the dawn of the information and network era. Globalised networks have aggravated and amplified the frequency and the quality of crises which can propagate through the whole system via largely unchecked instabilities. So we must ask two questions. First, should bureaucracy continue to use Newtonian science (in an environment where it does not apply, because Newtonian science is linear and the crisis is non-linear) or should the focus be on the new (non linear) science of Chaos, Complexity, Fractals and Quantum Theory? Second, is the hierarchical silo type organisation of bureaucracy adequate to manage the chaotic crises of the networks?

If we, as a democracy, do not debate and choose not to answer the conceptual questions, and keep on doing 'as before', but with ever increasing budgets, we are doomed to experience more failures. The turning point against this attitude will come from the citizens at the polls and with the courts compensating citizens for the loss of property and loved ones because a government did not do enough, fast enough.

As previously discussed in the pages of *Crisis Response Journal*, we are all focused on rapid

action forces. Along with the more 'tactical' crisis teams, focused entirely on immediate operational responses, plans and logistics, we need teams familiar with the 'inconceivable'. Their mission is to undertake four broad lines of questioning:

- What is the essence of the problem? The intelligence front involves a constant battle to anticipate, detect and clarify surprises, domino effects, escalation dynamics, and the across the board mutations that can be triggered;
- What are the major pitfalls? When the pressure of events becomes extreme, when bearings are lost, a very normal tendency is to become mired in the most counterproductive ruts;
- What new networks are to be considered? New issues affect new players and have to be handled with new players; and
- What creative initiatives can we launch? The most important thing is to discern one or a few critical initiatives that could help us to escape our crisis-induced mental ruts and launch virtuous circles.

Moving from command and control to shared trust and power means getting leaders involved, empowering citizens and developing creative partnerships.

## Never assume

When bearings are lost and the customary field of action disintegrates, nothing can be achieved without exemplary leadership from the pinnacle of the organisation. An especially striking example here is that of Rudolph Giuliani, the Mayor of New York City at the time of the September 11 events. His convictions and his personal commitment on the front line were the cornerstone of the city's resilience. His advice is unambiguous: "Have beliefs and communicate them. See things for yourself. Set an example. Prepare relentlessly. Underpromise and overdeliver. Don't assume a damn thing."

But citizens must be empowered as well. Often, we live with the assumption that 'the government will look after me, everything is under control, I don't need to do anything'. This assumption needs to be radically overhauled. We must take on board the requirements of a collective effort in a chaotic world – an environment that now demands dynamic linkages, fluidity and speed, shared information, and collective confidence. The official 9/11 report says: "One clear lesson of September 11 is that individual civilians need to take responsibility for maximising the probability that they will survive, should a disaster strike".

Creative partnerships are also essential. The logic of 'The government dictates the plans, operators comply' can no longer prevail. The principle of partnership is so obvious that it has become a cliché, and something that everyone

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pays lip service to. But do we have the cultural underpinnings to weave these partnerships, which demand sharing, trust and the willingness to explore together?

For the time being, we still have a long way to go, regardless of which country we live in. Very shortly now the private sector will also be adopting National Response Plans to avoid being held hostage to ideas they judge outdated. And critical infrastructure operators are not the only ones involved. Major TV news networks are creating their own 'situation rooms' for live coverage of major crises. Similarly, the myriad of players – NGOs, international institutions, local associations, web surfers – will soon be organising, in ways that will surprise us, their own modes of response to grave situations. They could even forget the public sector if the latter prove to be too mired in dead concepts.

Either our big organisations will learn to live with these upheavals and reinvent their position, or they will be swept away. The time has come to be decisive.

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