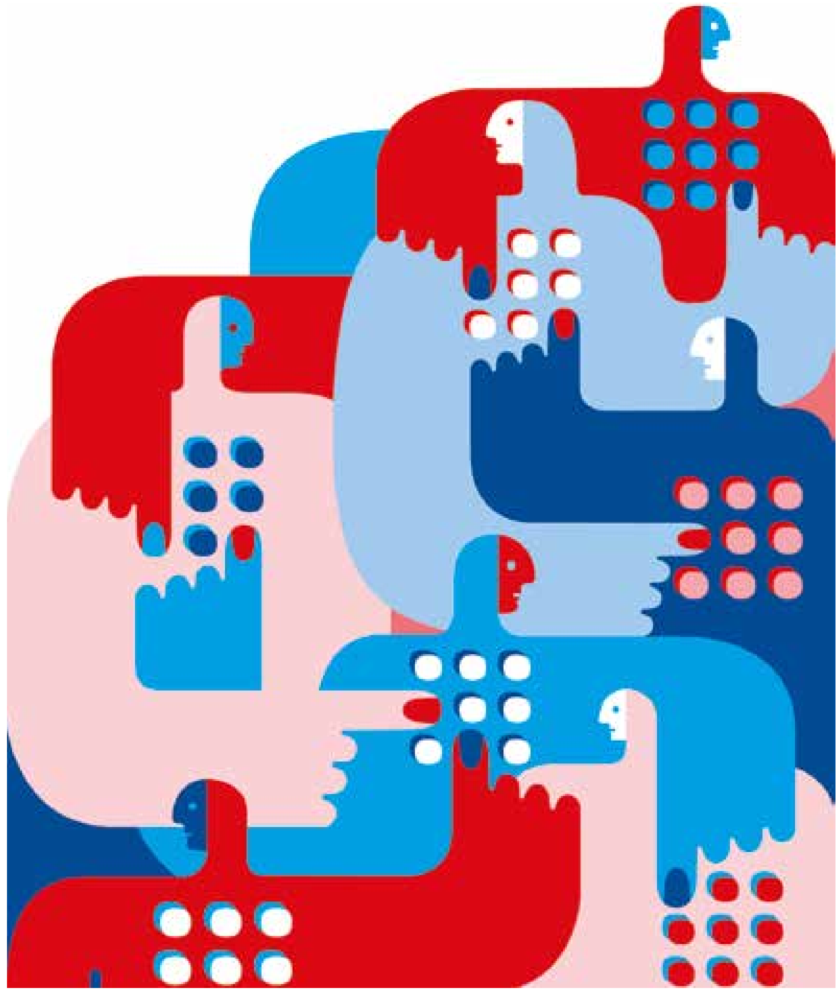

COMPLEXITY at WORK

Old approaches to strategy and organization can't help in uncertain times, says Brunswick's **RONALD SCHRANZ.**

THERE IS A SCIENTIFIC CULPRIT THAT GETS the blame for why in many cases it is hard or even impossible to make predictions. The bad guy is complexity.

In its fashionable usage, "complex" is a vague way to refer to anything complicated or difficult. But it has a more precise scientific definition. To a scientist, a system is complex if it is composed of numerous elements that are interconnected with feedback loops. Each element can influence the behavior of all other elements. Such systems show "complex" or "emergent" behavior that may include enormous dynamic contours with dramatic shifts.

The reason is the non-linear, circular causality. With neither outside influence nor a central controller (managers should take note), complex systems tend to organize themselves automatically and at times can act in strange and chaotic ways. Patterns are considered phases. Transitions between phases are particularly unstable and sensitive to even small changes. On the largest scale, hurricanes, networks of rivers and clusters of galaxies are all phases of complex systems.

Complexity science and chaos theory are close relatives. Logically, the emergent, complex behavior can be hard or impossible to predict, especially during a phase change. Take a stampede of cows, or a bank run: the high number of interconnected group members – cattle or bank clients – produce feedback loops of increasing panic to create a brainless dynamic. The same is true for coordinated movement within flocks and swarms: neighbor behaves like neighbor behaves like neighbor...

When you understand the basic concept, you see complex systems at work everywhere, in the trends of nature and human society. Complexity is a fundamental principle, an omnipresent phenomenon governing this universe, all life and every organic process. It is the force behind all development, change and disruption, becoming and decay. Human systems – from a couple and a family to a state, politics, the economy, the stock market or the internet – are complex by nature as our brains and minds are the most complex systems in this universe.

Disputes in society and politics, for instance, where populations are polarized and behave "irrationally," paradoxically and unpredictably, are actually acting according to a known phenomenon: groups competing for limited resources always divide into a crowd and an anti-crowd.

Of course, the unpredictability breeds uncertainty; decisions need to be made under increasingly unclear and unstable conditions. There is nothing we can do about this except deal with the consequences, accepting the limits. Prediction becomes problematic at best – at worst, pure guesswork.

For business however, the big stumbling blocks are not unpredictability and uncertainty themselves, but that we try to solve problems with traditional mindsets and methods: looking for full information where none is present; trying to solve com-

ILLUSTRATION: MELINDA BECK

plex problems with linear, hierarchical, directive approaches; merely scaling that old linear thinking into more "complicatedness" (more of the same). These make the problems and damages worse.

However, complexity itself can offer us a little help. Complex systems can assist us in analyzing complex situations and processes, toward developing a new, circular and holistic understanding. But even more importantly, we can use the power of complex systems to shape organizations and strategies. By embracing complexity, we can prepare for complex problems before they arrive.

Give a system sufficient autonomy, structure it with interconnections and feedback loops, and steer it by context – providing purpose, goals, rules and model behavior. Like magic, the system will act in an intelligent way, adapting to quickly changing, unpredictable circumstances, thriving while oscillating in an area between balance and chaos.

Strategy itself is often treated as something linear, step-by-step and separate from execution. In complex conditions, that approach becomes dysfunctional and dangerous. Instead, we need a flowing process with feedback loops from each activity to the previous ones, including experiences from executing the strategy. This creates a living strategy – constantly adapting, learning and hopefully improving its effectiveness.

For organizations, hierarchical or top-down models threaten to fail as size and complicatedness meet complexity. Taking advantage of complexity is the next stage of business evolution. While not invoking complexity directly, Brian Robertson's *Holacracy* or Frederic Laloux's *Reinventing Organizations* offer stepping stones in this direction, notably the inclusion of feedback and transparency and more horizontal alternatives to linear top-down management.

The new structure should feature wide-open communication channels and strong feedback loops that allow for autonomous decisions based on context. In addition, team composition should be highly flexible and management should see its role as a servant, setting up the conditions and facilitating the best solutions in each case. These changes can feel like a loss of control for old-fashioned managers, but they are the only promising path under current circumstances.

The principle of complex systems with interconnected elements working together to solve problems is the standard approach for emergency units, including first responders, medical intensive care and industrial incident units as well as corporate crisis management teams. These groups are empowered to self-manage in unpredictable situations within a range of predefined skills and roles. The potential of such complex organization becomes very visible when addressing dramatic situations, saving lives and controlling damage.

In unpredictable situations, complexity becomes the good guy. But it requires letting go of the idea of responses geared toward a static, mechanical, stable and predictable world, and replacing it with a dynamic-organic view. Complexity in the problem requires complexity in the solution.

Redefining leadership for our time means creating systems of good people and steering by context, letting a good future emerge. Much better than trying to predict the unpredictable. ◆

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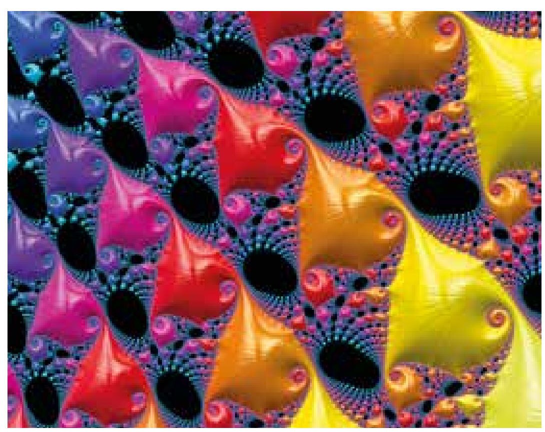
BEAUTY IN REPETITION



PHOTOGRAPH: TIM BIRD

IT MAY SEEM COUNTER-intuitive, but a wise application of chaos and self-organizing systems can produce wondrous feats of organization.

In 1975, frustrated that geometry couldn't describe natural forms like a coastline or a tree, French mathematician and IBM researcher Benoit Mandlebrot founded a new discipline, in which self-replication is used to model naturalistic shapes of elaborate beauty.

"Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth, nor does lightning travel in a straight line," Dr. Mandlebrot later wrote in *The Fractal Geometry of Nature*. He coined the term "fractal" to describe forms that unfolded in the fractions that lay in between the three dimensions of traditional lines, planes and cubes.

The concept of fractional dimensions may be abstruse, but fractals themselves are fundamentally simple: a repeating algorithm creates a complex form with many layers of scale. Such forms exhibit "self-similarity," where small details replicate the shape of the larger structure.

As an oak tree grows, for example, it divides into branches; the branches repeat the pattern, which is then echoed in the veins of the leaves. Each smaller part resembles the whole.

In the computer graphic at left, an algorithm creates seashell-like shapes that are replicated in smaller and smaller details. This process, called a cascade, creates fine, crystal-like edges around a pattern of large holes, places the algorithm never fills in.

Chaos theory, complexity and fractals are all closely related, as they all rely on repeating structures ("iteration") that inform and change the ongoing process ("feedback loops"). Clouds, crowds, snowflakes, forests, market movements and weather patterns are all examples of such systems.