

**A Cybernetics Approach to Solving Complex Problems
Improving Policy Making and Implementation**

**By
Richard N. Knowles, Ph.D.**

Abstract

The purpose of this paper is to help knowledge workers to

- communicate more clearly,
- improve the effectiveness of the policies they create, and
- develop better outcomes for all in our constantly changing, complex world.

How to improve workplace safety, which is a complex problem, is used as an example to illustrate the power of cybernetics, the science of communications and control theory, in helping to reduce the number of injuries and incidents. Tools are introduced that enable the people to see the whole, the parts and the interactions of the parts, to map the system and to take responsibility for their actions. The nature of problems and levels of learning to address these are discussed. This work has a solid, scientific foundation in Dynamical Organizations Theory (see end note).

New safety policies and procedures are co-created by the people in the system, together, so that the policies and procedures make sense and actually work in the field. As the people work to solve the complex safety problems new information and ideas emerge from using a focused, disciplined, bounded conversational process tool called Process Enneagram© to guide the dissipative conversational process. Their work is sustained using the co-created Process Enneagram Map, a dissipative structure that enables the organization to live far from equilibrium. The use of the Map guides and focuses ongoing conversations as the people and their environment continuously evolve. With the emergence of new information and energy, the people and their organization transform themselves, bridging the business and human sides of the enterprise, developing a highly effective, and more humane and sustainable workplace. Leading with this approach is called Partner-Centered Leadership.

Key words: cybernetics, dynamical organizations, organizational change, self-organizing criticality, process enneagram, dissipative process, dissipative structures, complex adaptive system, systematics. Partner-Centered Leadership.

The Safety Challenge

For the last 5-6 years in the USA about 4,700 people are killed at work, and about 2,000,000 people are so seriously injured that they lose time away from work. Each of these fatalities and injuries cause huge suffering for the individuals and their families. Each of these incidents cost businesses well over \$100,000 in medical expenses, counseling, legal fees, OSHA investigations, lost time away from work, retraining and replacement. This people and organizational waste is huge!

The challenges in improving safety performance are diverse and vary from industry to industry. Here are some examples.

- There are intense pressures to do the work quickly.
- There are also intense pressures to keep costs down and avoid unnecessary expenses.
- The impact of legal drugs in the workplace is serious.
- Many people are working alone.
- Workplace violence like bullying and sexual harassment are serious problems.
- Morale in many organizations is bad; almost 80% of the people in the USA report that they are unhappy with their bosses.
- Diverse cultures and languages must be accommodated.
- High turnover and training are serious, expensive problems.
- Providing a safe workplace environment free from physical and psychological hazards is vital.
- The technology like robots is changing rapidly and introducing new hazards.
- The workforce is aging.
- It is difficult to find qualified, new employees.
- Stress at home that comes into the workplace is difficult.
- Active shooters are becoming more frequent so extensive training is needed.
- Paper work and record keeping are consuming larger and larger portions of budgets.
- In many organizations safety is seen as an extra expense and is not supported adequately.
- Etc.

Many businesses, consultants, governmental agencies and organizations like OSHA, the American Society of Safety Engineers and the National Safety Council are working diligently to improve workplace safety. There is a vast array of safety regulations, procedures and equipment available and more is being introduced each year. Often large, multi-year, very expensive safety improvement programs are used to try to improve the safety culture and performance. Programs like behavior-based safety have been around for years. New thinking like Sydney Dekker's ideas of Just Cultures and Erik Hollnagel's Safety II are being introduced.

While all these efforts are helpful, progress is way too slow and often quite ineffective. About 80% of the efforts to change cultures do not live up to expectations.

Successes

At the DuPont, Belle, WV chemical plant there were about there were ~1,300 people engaged in working with and producing highly hazardous materials. Management was trying to reduce the awful injury rate of about 5.8 (~70 OSHA Recordable injuries/year), but with very slow progress. Knowles, the new plant manager, realized that a shift from treating the organization as if it was a machine and the people as interchangeable parts, subjected to management's demands, to engaging the organization and the people as if they were a living system and co-creating our future together would greatly reduce the injury rates. Working with the people together as a complex adaptive system (CAS) was the shift we needed to make.

- Within just two years the injury rate had fallen by about 95% to a rate of around 0.3. The people sustained this level of performance for 17 years.
- The shift to this way of working resulted in many other improvements like an increase in productivity of about 45%, a reduction in emissions of about 87% and an increase in earnings of about 300%.
- Another example of a large change occurred at the DuPont Belle Plant when 16 different conversions of chemical process control systems were made without building the control processes in parallel to be sure that the new processes would work before the old ones were shut down. Every one of the conversions worked, enabling the organization to cut the time and costs of these conversions by about 50%, saving months of time and millions of dollars of investment.
- Another large shift occurred in improving the productivity of the chemical operations. There were several products made in campaigns (one

production sequence run after another) where the same equipment was used. All the piping, valves and reaction vessels had to be meticulously cleaned so that there was no cross contamination between the products. The time for these changeovers was reduced from about 7 weeks to about one week as everyone worked more closely and interdependently.

After Knowles retirement he helped a large sugar mill in Ayr, Australia with about 350 employees to reduce their number of injuries from about 35/year to 0 after just three weeks of working with them.

Beyond the area of safety improvements Knowles was able to help the city of Niagara Falls, NY take about \$16,000,000 out of a \$62,000,000 budget in 4 years; services improved. One Department Head with 20 years of experience said that this was the most effective leadership team he had ever seen.

The Breakthrough

In order to achieve these successes, basic changes in how we understood the systems in which we worked were needed.

- We had to understand the nature of the problems we faced, recognize their differences and learn how to solve them.
- We had to open up the conversations and the flow of information so that everyone knew what was going on, and could see how important their specific roles were for our total success.
- We had to open up the virtual space so that everyone felt safe and was willing to open up and share ideas.
- We had to build trust and interdependence.
- We had to co-create our principles and standards of behavior so that trust and interdependence could build.
- We needed a way to see the whole of what we were doing as well as the parts and how everything interacted.
- We had to close the gap between the policy and procedures work which is work-as-imagined when the people doing this work do not talk with and listen to the people doing the actual work-as-done. Everyone has vital information that needs to be shared in order to have the best successes.
- We had to bring the business side of our work together with the people side, which would result in the release of enormous creativity and energy.
- We needed a way to hold the conversations so that we could accomplish all these

challenges. Knowles created the Process Enneagram that enables people to do all this.

All of these points are a sharp break from our management heritage. The roots of which go all the way back to Frederick Taylor's (1911), *Principles of Scientific Management*, and are further influenced by Max Weber, A. M. Henderson and Talcott Parsons (1947) in *The Theory of Social and Economic Organization* who refer to layers of hierarchy, rigid status and structure, rules, and the role of experts.

The Nature of Problems and Solutions

It is important to understand the kinds of problems we face and the best approach to solving them.

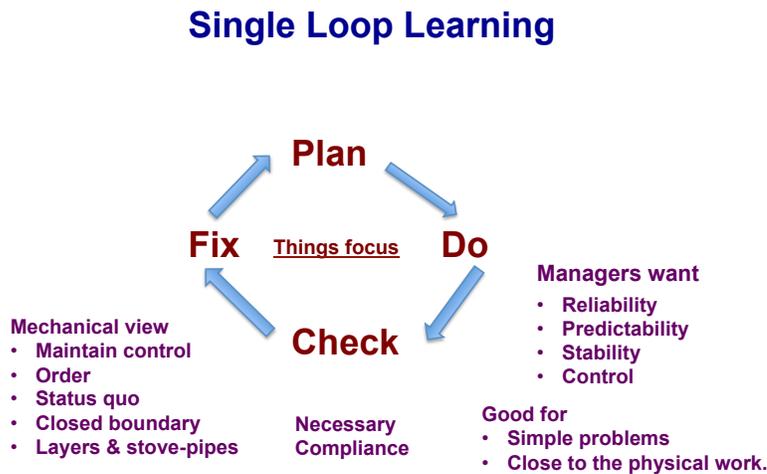
There are four general classes of problems.

- Simple problems are those that are routine and can be solved with little thinking and effort. A simple problem that I face every day is deciding what clothes I need to wear.
- Complicated problems are more of a challenge. These can have many steps like a production line or planning for a big project. These are linear in nature in that following the steps will get to the desired solution. Essentially all the current approaches to reducing fatalities and injuries are treated as complicated problems. If the training of the people is done right, if the machine is designed right, if people would do just as they are told things would be fine. But all the work on safety improvement is not getting the results that are needed. The work is being done at the wrong level of understanding. Virtually all of our safety policy work comes out of this level of thinking and talking.
- Complex problems are those where there are many people involved who are making their own decisions about the work, the environment is constantly changing, the work demands keep changing, new people come into the organization, experienced people leave, etc. This is the world we live in as we try to improve safety. It is not linear. It requires a new way of seeing, listening and building shared values together. It necessitates learning to live in ambiguity.
- The fourth class of problems is chaos where everything is out of control and going all over the place. Challenges like the Middle-East problems fall into this arena and are outside our consideration in this paper.

Each of these classes of problems has a general way to solve them.

Chris Argyris and Don Schön (1974 and 1978) developed the idea of intentional inquiry and introduced the concepts of single loop and double loop learning. This was based out of Gregory Bateson’s work.

Simple problems can be addressed using single loop learning as shown in Figure 1. This approach is suitable for the people who are close to the physical work like fixing a pump, moving some portable equipment or typing a letter. This is where a lot of safety effort is expended. It is okay for this level of work, but not for higher levels of work.



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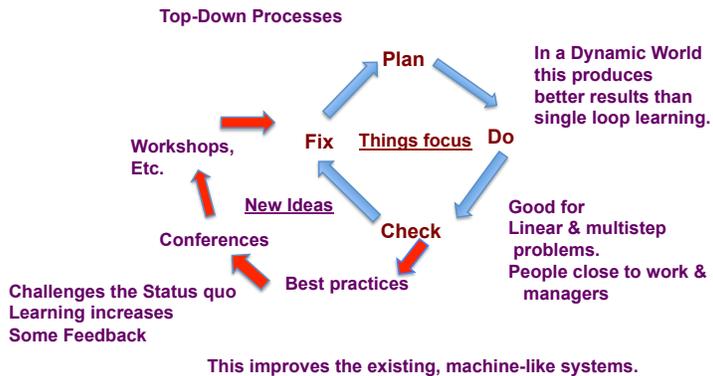
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Figure 1

Complicated problems can be addressed using double loop learning as shown in Figure 2. If the safety performance is poor the business will often bring in a consultant, like one who specializes in behavior –based safety, to help to solve the problem. This is treated like a linear problem and bringing in the expert may help a little.

Double Loop Learning



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Figure 2

This approach often results in some improvement, but it is an imposed, top-down process and is very hard to sustain without a lot of management effort and pushing. These top-down approaches often drive people away and create a lot of resistance to change.

Other consultants may drive at the generation and use of data, and the search for patterns. Finding patterns may help, but without a deeper understanding of what they mean, this is superficial and can lead to making the wrong decisions and doing the wrong work.

In this top-down approach many people sit in their offices, developing policies and procedures but not talking with and listening to the people who do the work; this is work-as-imagined. In our complex, dynamical environments the policies and procedures they develop are often way off base. This gulf between the work-as-imagined and the work-as-done causes big problems. This is a major barrier to making real improvements.

Breaking Through

To make the breakthrough Knowles realized that complex problems had to be addressed using a deeper level of learning. Romme and van Witteloostuijn (1999) and Gilpin and Murphy (2008) introduced triple loop learning as shown in Figure 3. These problems are not linear. There are many people interacting, each with a mind of their own. The environment and the business are constantly changing. Everything is quite dynamical; everything is moving all the time.

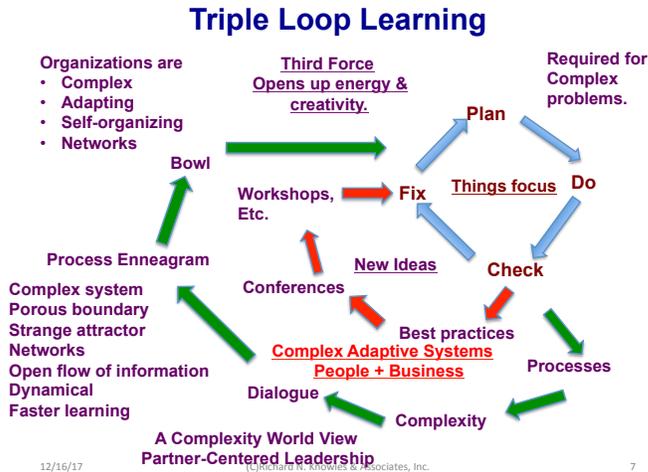


Figure 3

These problems arise when the level of agreement as to what should be done are low and the level of uncertainty of the outcome is also low. This is the arena where most of our policy problems occur. These are the kinds of problems that require Partner-Centered Leadership to develop sustainable solutions. This is shown in the Stacey diagram in Figure 4.

Where the Problems Fit

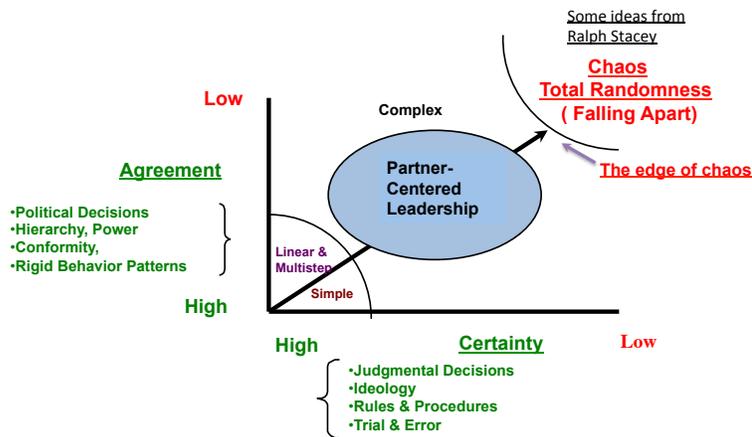


Figure 4

The complexity tool, Process Enneagram that Knowles created, works very well in the region of ambiguity where the levels of agreement and certainty are low. This is shown in Figure 5.

Living and Thriving

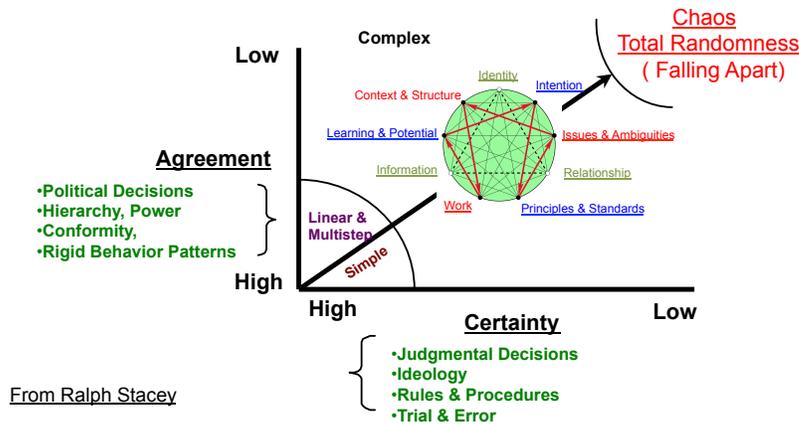


Figure 5

Change is co-created and emerges from focused, disciplined, bounded conversations using the Process Enneagram©, a tool to guide the dissipative conversational process, and is sustained using the co-created Process Enneagram Map, a dissipative structure, that enables the organization to live far from equilibrium, and to guide and focus ongoing conversations as the people and their environment continually evolve. Arising out of this openness and synthesis, emerges the capability and will for the people and their organization to transform themselves, joining the business and human sides of the enterprise, and the development of a highly effective, more humane and sustainable workplace.

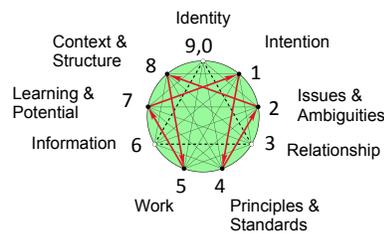
The energy that drives these processes is released in the purposeful, focused, disciplined, and sustained conversations about something that is vitally important to the people and for the success of the organization. Most people have a lot of energy to talk about things that are important to them. Self-organizing criticality explains the powerful role that the conversations play. The Process Enneagram is the tool to guide and map the conversations in this dissipative process. The completed Process Enneagram Map is the dissipative structure, the BOWL, the attractor, that holds the organization far from equilibrium near the edge of chaos.

The Process Enneagram©

The Process Enneagram (Figure 6) is a tool for dealing with complexity (Knowles 2002). An enneagram is a Greek word for a 9-term figure. They people from all levels

from across the organization co-create their living strategic plan. The inclusion of a diverse group of people helps to provide the requisite variety that Ashby (1956) emphasized. Beverly G. McCarter and Brian E. White (2013) in *Leadership in Chaordic Organizations* suggest that the Process Enneagram© provides the missing link between complexity theory and practical application.

The Process Enneagram©



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Figure 5

The Process Enneagram©, Figure 5, guides and informs the conversations that are needed to move towards excellence in all aspects of performance including safety. The dialogue process begins with a question that is important and compelling to the people like “How do we improve our safety performance?” This is followed by dialogue at each of the 9 points, writing onto the map the people’s ideas and comments as they emerge. This is an enlightening process of self-discovery for the people who realize that collectively they have a lot more knowledge than they realized, and together they learn from experience.

The Process Enneagram Map that the people co-create is their attractor and living strategic plan. It is then posted on the walls of their meeting rooms. It is constantly discussed each time they meet, asking each other about their experiences since their last meeting, making revisions as things change, and decisions are made.

The Process Enneagram has been successfully used for over 25 years in all sorts of organizations, on varieties of problems and in many countries.

Summary

Knowledge workers and policy makers become much more effective by shifting their thinking to embrace cybernetics, complexity and complex adaptive systems. Their use of the Process Enneagram tool is a proven way for them to accomplish this.

Notes

Dynamical Organizations Theory: Openness, Synthesis & Emergence enables organizational change in a way that is practical and proven in many organizations. It integrates the work of Ilia Prigogine on dissipative systems (1996) (open, free flow of information and energy into, out of and throughout the organization), and synthesizes Kevin J. Dooley's discussion of complex adaptive systems (1997), Jeffrey Goldstein's discussions of dissipative structures and self-transcending constructs (2011), Per Bak's self-organizing criticality (1996), John Bennett's Systematics (1966 & 1985) and uses Richard N. Knowles' Process Enneagram (2001a, 2002b, 2013), a disciplined, focused dialogue tool which leads to the emergence of new information and releases the creative energy of the people. The gulf between work-as-imagined and work-as-done is closed. The use of the Process Enneagram enables whole organizations to energetically move forward to resolve their complex problems and create a better future.

Ashby, W. R. (1956). *An introduction to cybernetics*. London, Chapman & Hall

Argyris, C. and Schön, D. (1974). *Theory in practice: Increasing professional effectiveness*, San Francisco: Jossey-Bass.

Argyris, C. and Schön, D. (1978). *Organizational learning*, Reading, Mass.: Addison-Wesley.

Bak, P., Tang, C., Wiesenfeld, K., (1987). *Self-organizing criticality, An explanation of 1/ f Noise*. Physical Review Letters, 59, 381.

Bak, P. (1996). *How nature works, The science of self-organized criticality*. Springer-Verlag, New York. ISBN 978-0-387-98738-5.

Bennett, John G., (1996 and 1985). *The Dramatic Universe, Vol. 3, Man and His Nature*. Coombe Springs and Claymont Communications. Charles Town, WV.

Byrne, David and Callaghan, Gill. (2014). *Complexity Theory and Social Sciences, The State of the Art*. Routledge, New York. ISBN 978-0-69368-4, p244.

Dooley, K. J. (1997). *A complex adaptive systems model of organizational change*. Nonlinear Dynamics, Psychology and Life Sciences, vol.1, 69-97.

Gilpin, Dawn R. and Murphy, Priscilla J. (2008). *Crisis Management in a Complex World*. New York. Oxford University Press. P 73-77.

Goldstein, J. (2011). *Emergence in complex systems*. In P. Allen, S. Maguire, and B. McKelvey (Eds.), *The sage handbook of complexity management* (pp. 65-78). Thousand Oaks, CA:Sage.

Knowles, Richard N., (2001). *Self-Organizing Leadership: A way of seeing what is happening in organizations and a pathway to coherence*. Emergence, V. 3, No. 4.

Knowles, Richard N., (2002a). *Self-Organizing Leadership: A way of seeing what is happening in organizations and a pathway to coherence*. Part II. Emergence, V. 4, No. 4.

Knowles, Richard N. (2002b). *The Leadership Dance, pathways to extraordinary organizational effectiveness*. Center for Self-Organizing Leadership, Niagara Falls, NY. pp. 173-175. ISBN 0-9721204-0-8.

Knowles, Richard N., (Ed.) (2013), *The process enneagram, essays of theory and practice*. Emergence: Complexity and Organization. Emergentpublications.com.

McCarter, Beverly G. and White, Brian E. (2013). *Leadership in chaordic organizations*. Boca Raton, FL. CRC Press. ISBN 978-1-4200-7417-8.

Prigogine, I., (1996). *The end of certainty*. New York: The Free Press, Simon & Schuster, Inc.

Romme, A. G. L. & van Witteloostuijn, A. (1999). *Circular Organizing and Triple Loop Learning*. Journal of Organizational Change Management, 12 (5) 439-53.

Taylor, Frederick W. (1911). *The principles of scientific management*. Harper and Brothers, New York.

Weber, Max, Henderson, A. M. and Parsons, Talcott. (1947). *The theory of social and economic organization*. Oxford University Press, New York. The first Paperback Edition, 1964. Simon and Schuster, New York. ISBN 0-684-83640-8.