Do not cite. Published article is available through SienceDirect.
Journal of Safety Research, *Volume 42, Issue 4*, *August 2011*, *Pages 293-300*

Complexity and Safety

Rosa Antonia Carrillo, MSOD

Published in the NSC Journal of Safety Research With commentary from Edgar Schein, Professor Emeritus MIT

Aug. 2011

Introduction by Edgar Schein, Professor Emeritus MIT

Efforts to make the nuclear industry safer are more important than ever in the wake of the Japanese disaster. An enormous amount has been written about how to "create a safety culture," and it usually ends up with a long list of attributes of a culture and very little insight into the fundamental issues that underlie safety in all high hazard industries. I have observed the great energy and effort that goes into this process in my role as a part-time consultant and member of the Advisory Council of INPO.

Carrillo's paper is an important addition to this difficult dialogue in highlighting that we may be using the wrong models of how to think about safety in the first place. Her emphasis on complexity theory, sense making and polarity theory focus us on the two most fundamental problems of safety--1) We will never be able to predict all the things that can go wrong, that nature will throw at us, that human beings will, in their efforts to do things better, actually make things more complex and, therefore, maybe worse; 2) We will never be able to avoid the polarity between absolute safety (at any cost) and competing economic and psychological values. In our own daily behavior, we can see how the need to "accomplish things, get to places, do things in a timely and satisfying way, and have fun" tempts us into "risky" behavior, seen most clearly in the way we drive. But we try to avoid what some might call "reckless" behavior, as defined by consensus of others doing the same thing. In high hazard industries recklessness is totally unacceptable but our goal would be to find ways of avoiding even risky behavior so that the public and the employees are kept safe.

Effective management in high hazard industries therefore must focus on not only avoiding recklessness but also prepare employees for the unexpected, what has usefully been labeled the "unknowable unknown." If surprises have to be dealt with, we hope that employee innovation will minimize risk and we hope that management can create the conditions and incentives to enable employees to balance or even integrate the polarities implied by safety vs. productivity. We should have learned by now that better design or more detailed procedures is only a partial answer. In fact, the more we try to design fail-safe systems and the more we write procedures for how to do things, the greater the complexity and the potential for surprises of all sorts that we hope the operators in our plants have the ingenuity to deal with. Without their ability to make sense out of surprises and innovate to get the job done we would be much worse off. If we take complexity and polarity theory seriously it will point the way out of these dilemmas--we have to keep learning. We have to learn to think in terms of new models and develop some new skills

Becoming skilled learners and sense makers will be the keys to a safer future. In that regard learning how to be more helpful to each other will be the key because learning and sense making is a joint effort that hinges on mutual trust and mutual help. From working in the safety industry, I learned from employees that the biggest obstacle to improving safety performance is failed communication and lack of trust. Employees feel management doesn't listen. Management feels employees don't understand the bigger picture and suffer from entitlement. We can only fix that problem by creating a climate where employees feel they can tell their boss the truth. Bosses need to communicate that they really need employees' help. Managers need to know what is going on. However, employees won't speak up unless they trust management. The trust is developed as they see management respond to the information. Better information leads to better decisions. In my experience, this happens when managers are able to ask for help and employees feel their help is needed and valued.

How we can construct the relationships and communication structures that create successful and safe organizations? How do you develop trust? What if I want to trust more and I don't know how? What if I trusted someone and they betrayed me? Helping is the basis of trust. Trust is the basis of communication. Communication is the basis of organizational effectiveness. We have to pay more attention to mutual helping to create both safety and effectiveness. I have reached the conclusion that helping skills at all levels of an organization will be the necessary ingredients to a more effective and safe nuclear industry.

(Schein, E. H. Helping: How to offer, give and receive help, Berrett/Kohler, 2009)."

Edgar H. Schein
Professor Emeritus
MIT Sloan School of Management

Complexity and Safety

Rosa Antonia Carrillo, MSOD
April 9, 2011

Abstract:

The purpose of this article is to explore how ***complexity theory*** *provides further insight into why change efforts in safety fail, and how it can be used to create new approaches that produce sustainable results. This article will name some of the fundamental reasons change efforts fail and what leaders can do to achieve success. In other words, how can managers and safety professionals influence employees to embrace the need for change and to see the benefits of adopting new behaviors, processes or procedures? The proposed conceptual frameworks related to complexity focus on* ***relationship psychology*** *(human actions are dictated by relationships),* ***sensemaking*** *(how we determine what is true when the truth is not obvious or there is disagreement),* ***practical drift*** *(the tendency for people to use their experience to "adjust" established procedures), and* ***managing polarity*** *(identifying and reconciling competing priorities*

1. Introduction

This article addresses the challenges of changing the way people make decisions about safety related actions in a way that leads to fewer injuries and incidents. Violations of standard procedures occur routinely and sometimes result in injury. People walk by hazards that later result in incidents. The question arises, "Why didn't this person follow procedure?" Safety experts have long searched for the answer to this question at the level of the individual or even organizational systems with limited success. A deeper truth and the potential solutions to this conundrum may lie in the theories of *complexity management* and *sensemaking,* which attempt to help us understand the **invisible** dynamics that drive organizational behavior.

Changing basic assumptions about what is safe or not safe is not an easy mission to take on. It is well documented that change efforts fail over 70 percent of the time. (Strebel 1996, Beer and Nohria, 2000; Kotter, 1996) Why? Kotter and Schlesinger (2008) explain that four common reasons account for resistance to change. These include: a desire not to lose something of value, a misunderstanding of the change and its implications, a belief that the change does not make sense for the organization, and a low level of tolerance (p.42). In addition, the extent to which the change negatively impacts feelings of self-worth or self-importance also increases resistance to change. (Washington and Hacker, 2005, p.403). Managing this complex web of emotions, motivations, and feelings tied to self-identity is at the heart of complexity management and its related field, relationship psychology (Stacey 2007).

The inherent challenge in presenting these ideas is the current view that it is a manager's job to control and predict outcomes. Organizations tend to be viewed as machines that can be fixed through re-engineering or re-design. Complexity theory points to a very different paradigm, one of trust, unpredictability, and self-organization. These are radical ideas but the difficulty of changing mindsets and the promising research in these fields provide the incentive to investigate their practical application. The recommendations offered come from successful experiences with complexity theory in health care (Anderson, 2005a; Griffiths, 2007; Jordan et al., 2009; Matlow,Wright, Zimmerman, Thomson, & Valente, 2006; Plsek &Wilson, 2001), as well as other industries (Weick 2005, Sardone and Wong 2010). They also come from the author's perspective based on 20 years of documented research, dialogues, interviews, and work with teams to implement culture change (Simon 1995, 1996, Carrillo 1996, 1998, 2002, 2004, 2005, 2010a).

Three basic assumptions underlie this article. First, the most fertile area for improving safety performance lies in leadership's ability to question its assumptions about the nature of the problem and how to solve it. To do this, leadership must rely on the second assumption, that there is a vast wisdom available in the workforce. Third, the application of complexity theory recognizes that organizations get things done not because of rules and procedures, but through relationships between individuals (Anderson et al., 2005b; Stacey, Griffin, & Shaw, 2002). Based on these assumptions, this article examines how to apply three theories that show promise for managing change: *complexity, relationship psychology,* and *sensemaking*.

2. Complexity Management Theory

Complexity management theory is an area of organizational research that offers new ways to understand what shapes safety performance and how we might influence it. It draws analogies from complexity science, which looks at complex systems and their environments in much the same way as chaos theory (Waldrop, 1992). According to Fritjof Capra (2007), a physicist now focused on organizational change theory, our natural environment demonstrates continuous change, adaptation, and creativity, yet our business organizations seem to lack the same ability. Thus, complexity's underlying principles offer new insights for understanding why change efforts fail and how to design change strategies that are more successful because they are more in line with the way people feel, think, and act.

Complexity management models pose the possibility of order emerging from disorder through processes of spontaneous self-organization in absence of direction. (Stacey et al 2002) Ralph Stacey, who spent many years exploring how the complexity sciences might provide a new way of understanding stability and change in organizations, introduced a radical shift from systems thinking to what he calls "relationship psychology." Succinctly stated his research indicates that the root cause of what takes place in organizations stems from the interaction and communication between individuals and within groups (2007). One of the examples of this phenomenon is research that correlates the quality of relationships among staff members with the quality of health care they deliver (Andersen et al, 2005b, Gittell, J.H. 2009, Godwyn & Gittell 2011).

Table 1, "Comparison of Traditional Management to Complexity Management Principles," provides a quick overview of the paradigm-shift taking place in the way scientists view organizations. (McMillan: 212) Classical science principles led to the currently dominant management practices. Complexity science is moving management practices in the direction of empowerment, flatter organizations, diversity, and adaptability.

Table 1. Comparison of Traditional Management to Complexity Management Principles

Classical Science Principles	**Traditional Management Principles**	**Complexity Principles**
Linear	Rational planning	Non-linear
Hierarchical	Hierarchy	Non-hierarchical
Reductionist	Specialization	Holistic
Controlling	Controlling	Self-organizing
Inflexible	Rules & procedures	Flexible
Uniform	Maintenance of order & stability	Diverse
Centralized	Centralized control	Networked
Closed	Compartmentalized	Connected

In stark contrast to management theories that speak about control and predictability, this perspective moves from systems to human interaction as the primary actor in complexity. It says that systems such as rewards, measurements, or rules do not control outcomes. Instead, outcomes are influenced by 1) the human tendency for self-interest and relating everything to their own experience, 2) conversations

that shape people's understanding of what is true and what is appropriate action (although sometimes the conversation takes place silently within), and 3) the radical unpredictability of the direction in which connections and relationships evolve.

Within this complex web of interactions between individuals, one observes people solving problems, adapting, and getting the work done without explicit directions. As people learn from each experience, organizations struggle to keep current on documentation of procedures, organizational charts, and strategic plans yet it is ultimately the individual responding to a specific stimulus and his/her ability to adapt that may determine success. According to Edgar Schein, sociologists have long found that, "…without such innovative behavior on the part of employees, the organization might not be as effective." (Schein 2010:60)

It may be that safety professionals also view the individual's awareness and problem solving ability as potent lever to improving safety performance. In 2011 seminar, 50 safety professionals identified their biggest challenge as it related to creating a positive safety culture. Fifty percent of the participants identified "Changing the attitude that it can't happen to me," or "I've been doing it this way for a long time without an incident." When asked what tools they were most likely to use to address these issues, the answers were "procedures, training, hazard recognition, and job planning." (Carrillo 2011) The group acknowledged these tools had helped to reduce accidents, but were largely dissatisfied with progress in the arena of "attitude" and "behavior."

The research on complexity management lends insight into these "soft issues," how human beings make sense of reality, and how that guides their decisions and actions. Change at this level means working with feelings, emotions, and relationships. The challenge is the difficulty of measuring progress in these areas, and the difficulty of obtaining the management support to work at this level. To address these considerable challenges, this article offers research based tools designed by respected scientists, and practitioners. Used with skill, they can leverage the effectiveness of training, rules, and procedures.

A theory that focuses attention on self-organizing processes and emergent outcomes hardly fits into the mental model of managing safety through regulation, rules and procedure. The proposal is not to eliminate those aspects of management. It is to acknowledge that the reality of how the work is done in organizations fits more in the complexity model than the Newtonian mechanical model. Ignoring reality will not change it. Instead, designing our training, education, and communication forums to fit the way people understand and solve problems could be what leads to the next level of safety excellence.

3. AES, a Success Story Illustrating Complexity Management Principles

The benefits of designing organizational processes around complexity theory are based on observation of successful organizations. Dennis Bakke, former CEO of AES Corporation, lead one of the largest power companies in the world for many years. Under his leadership it grew from a from a $1 million dollar investment into an $8 billion company. As described by Bakke (2005), from its inception AES set out to eliminate all formal approval mechanisms at the company so that teams would make decisions at their level about everything from hiring to permission for vacations and budgets. He created an environment where leaders coached decisions more than made them. He was also a big proponent of building relationships, rather than rules.

Under Bakke, there was no safety or human resources department. AES held everyone responsible for safety. Substantial bonuses were given for reaching safety related goals. When the company experienced fatalities, the bonus was reduced for everyone. The intention was to motivate employees to participate in identifying the causes and preventing them in the future. He describes how teams were responsible for everything about the area where they worked. He felt specialists did not understand operations and operating groups did not understand finance and strategic planning. By eliminating "specialists," teams of people interested in the whole operation were created. During his tenure AES had a better than average safety record (2001 Manz & Sims)

Bakke also emphasized the promotion of relationships through performance reviews and employee surveys. Within the senior team performance, reviews were done in a group. Per Bakke, "It honored each

individual as an important member of team, regardless of title…it allowed us to show our respect for one another. It brought us closer together as a group." (110) He built the same respect with employees by reading and responding to every single comment sent to him through the bi-annual perception surveys. In the beginning, it took one hour to read the comments towards the end it took about five months to read them because employees realized it was a real means of communicating their concerns. (114)

The 2008 financial crisis ended the AES experiment as stock prices crashed in energy related stocks and Bakke was removed by the board of directors. Nevertheless, AES was built and grew to an $8 billion dollar company using principles where individuals were empowered and trusted to make important decisions without the bureaucracy of corporate control. At least for a period of time, one leader found a way to bring profit, engineering and human relationships together. If it happened once, it is possible for other leaders to duplicate this success.

4. Sensemaking

Sensemaking has been applied extensively to investigate the root cause of disasters and their prevention (Weick 1993, Snook 2001, Dekker & Lutzhoft, 2004). Smaller incidents could benefit from the sensemaking process as well, particularly to prevent the unintended outcome of new procedures or policies that don't make sense to the workforce or add to the problem. In one study, the perception that "safety rules that do not make sense" was identified as the second largest issue undermining safety. Trades people described the rules as "knee-jerk" reactions and a "dumbing down" of their knowledge and experience (Sardone & Wong 2010).

Sensemaking and its related concepts, ***practical drift*** and ***polarity management*** open the way for innovative analysis of the human factor in accidents and their prevention. By using these tools to help organizational members understand why accidents happen or how to respond to the risks they are facing in a safer manner, managers and supervisors could create self-enforcing social contracts to follow safety procedures. Sensemaking is the activity humans use to make sense of their experiences and put them into context with their understanding of the way the world works and to construct meaning. It is a constant ongoing process that will go on with or without the leader's input. The leader's conscious use of sensemaking can help him/her gain greater success for change efforts. Karl Weick (1993, 1995) introduced the concept of sensemaking to organizations. One of its strongest contributions is its emphasis on action, which he maintains is the primary process that informs the decision to act because acting on a belief is a way of testing its validity. Sensemaking is related to the concept of "safety culture" in that it embraces the human propensity to form norms and assumptions around the right way to do things. These conclusions are arrived at through sensemaking, which may be a more acceptable word than "culture change" to some portions of the workforce who might view the latter as "brainwashing."

Practical drift (Snook, 2002) and ***polarity*** (Carrillo, 2005) were introduced in safety management to help explain why people appear to disregard procedure and work unsafely. Both concepts will be described under the context of sensemaking because they are processes that the human mind uses to make sense of its environment. Knowledge of how these processes work can lead to more effective communication and training.

4.1 Change Agent as Sensemaker

"Common sense" derives from sensemaking. When a group arrives at a consensus on what is "true," and that explanation solves the problem, over time the explanation becomes "common sense." For this reason, change initiatives that align with the holder's common sense have a much greater potential of acceptance than those that do not. It might be concluded that if a manager attempts to initiate a change that violates common sense, his or her capacity for sound judgment may be questioned and, consequently, their reputation may no longer remain in good standing. (Moon 2008)

Thus, to effectively use sensemaking to get employee buy-in for change, the leader observes and listens closely, collaborating with organization stakeholders to make sense of the best way to proceed

(Jacobs & Coghlan, 2005). This process of sensemaking is couched in constant informal conversations and observations in which leaders engage during their interactions with the organization's stakeholders (McCormick & White, 2000). The leader respects the boundaries of common sense and presents evidence of changed circumstances for everyone to examine. Guidelines for facilitating this conversation are:

1. Listen for ways in which the desired change violates common sense perspectives and why.
2. When a conflict with common sense is uncovered, understand the employee point of view and restate the change so that it fits within the current framework of the participants.
3. Training and conversation are continuous until the changes are accepted and integrated (Weick et al., 2005).

Change agents become important for their ability to make sense (Weick 1995) of dynamics under way. Instead of seeing him or herself as a mover who creates change, the sensemaker is someone who recognizes the changes taking place and redirects them. S/he articulates what is going on and reframes it so that it makes sense within the context of people's experience and the desired outcomes. The tools of the change agent are words that explain upheavals, where people are headed, what they will produce if a new path is followed, and how things will be better. They do this through dialogue, and helping people see them selves acting under a different set of beliefs.

Recalling earlier research that that the most frequent causes of failed change efforts reside in the fear of loss, misunderstanding of the change itself, and anxiety, the sensemaking process becomes a potent tool to increase the possibility of success. The influence of the change agent as sensemaker is twofold. First, s/he demonstrates an open mind and respect for other's opinions. Second, by demonstrating their own belief in the process, they are able to help people engage despite possible doubts or fears. The act of gathering information from all levels of the organization and taking the time to exchange points of view is a powerful intervention. Listening and reflecting back what is heard creates the opening to be heard in return. This is not a one-step process. In a low trust environment, the conversation must take place many times before a common sense emerges. Too often, the process ends when one of the parties becomes frustrated by slow progress or a perceived betrayal. Master change agents know that change can happen quickly. They also know that it is a slow, gradual process. They are able to provide assurance by pointing out small steps of progress and holding the belief that it can continue to get better if people follow the process.

4.2 Resistance to Investing in Conversation

Weick places an emphasis on face-to-face communication for sensemaking, but it is often least preferred by managers because of the time demands (Weick & Sutcliffe 2007). Thus, complex issues are routinely addressed through written policies, email, or perfunctory training. Yet, we do have evidence that it pays to take the time to develop quality relationships among staff members. Health care facilities that have long been concerned with patient safety found that the quality of relationships correlate with the quality of health care staff delivers. (Andersen et al, Gittell, J.H. 2009, Godwyn & Gittell 2011)

The author has found resistance to increasing face-to-face communication among most managers and safety professionals. Preferred communication methods include having important policy changes read and signed. Safety committees do root cause investigations and post the results. In absence of conversation, there is little proof that the message was understood as it was intended, or that any agreement was reached on how to solve the problem. Research and experience show people favor plausibility over accuracy in accounts of events and explanations (Currie & Brown, 2003; Brown, 2005; Abolafia, 2010): "in an equivocal, postmodern world, infused with the politics of interpretation and conflicting interests… an obsession with accuracy seems fruitless, and not of much practical help, either" when it comes to influencing change. (Weick 1995: 61).

4.3 Conflict Resolution

Organizational change cannot be achieved by changing the individual (Stacey 2007). The conscious facilitation of the sensemaking often takes place in one-on-one conversations, but is a powerful management

tool in groups because individuals emerge with a common definition of the problem and how to solve it. This "common sense" then becomes the right way to do things. Employing sensemaking as a management tool facilitates a common understanding of what is expected, and reduces ambiguity, thus has the potential to reduce stress and conflict. (Weick 1995) One of the most potent uses of sensemaking may be during mergers, downsizing and acquisitions because as Weick notes, when the formal hierarchies are dismantled, "micro dynamics such as those associated with close relationships may be more influential in organizational sensemaking." (1995:174)

Sensemaking is the ultimate conflict resolution when it is used to arrive at a common understanding, a common purpose, and a sense of mutual respect. The Harvard Negotiation Project presents many useful techniques to create "learning conversations." (2000 Stone, Patton & Heen) Powerful examples illustrate how changing the story about how something happened, changes the feelings, conclusions and relationships. How does the story change in sensemaking? It changes when different perspectives bring in new data that birth new conclusions. Stories are powerful communications. They can either support the change effort or sink it.

4.4 Conflicting Priorities: Managing Polarity

It is a management function to clarify priorities. In several focus groups and seminars held in 2010 to introduce sensemaking in a large regulatory agency, the author confirmed Schein's (1996) findings that first line supervisors are constantly faced with choosing between inevitable trade off's and would like upper management to recognize the difficulty of their role. This was especially prevalent in the safety arena. One of the insights that emerged for the supervisors that participated was that their direct reports suffered from the same sense of isolation and lack of support from management. By increasing their one-to-one and group communication within their work unit, they experienced a qualitative increase in collaboration and decrease in frustration with the workload. These conversations are real world examples of sensemaking—arriving at a common understanding of what is important. Even a very specific list of tasks, deadlines, and cost constraints leaves plenty of room for ambiguity as unexpected hold ups and information surfaces. Relationship building and sensemaking are powerful management tools to help people arrive at common sense of tough questions like "What does safe looks like?" "What is acceptable risk?" or "Why should I change the way I've always done it if I've never gotten hurt?"

Examples of conflicting priorities exist between field and office, headquarters and operations, or even within teams. The local team may feel the best way for the organization to succeed is to focus on getting the work done rather than meeting demands for paperwork from corporate. Meanwhile headquarters views its demands as necessary for the survival of the organization, and the local behaviors as resistance to change. The term polarity or paradox has gained popularity in describing these types of conflicts because the term captures a basic dilemma constantly faced in organizations. What makes these conflicting priorities ***polarities*** is that for an organization to be successful both objectives must be met. If management focuses on getting the work done but neglects planning and administration, the business suffers. If employees fulfill all corporate demands unquestioningly important information may not emerge that would save the company time and money. Another useful dynamic included in the term, polarity, is that the parties in conflict only see the up side of their perspective, and the downside of the other.

Leaders identify and communicate about polarities in a way that can be understood and worked with. What should we work on first? How far can we let the other one slide? According to Schein, some of the principal ways leader's influence behavior is through what they pay attention to, measure and reward. (2010:236) A major challenge is making sure that what followers perceive as important is actually what the leader intends. "When managers assume that managerial topics are understood in the same way by everyone, they surrender the opportunity to lead effectively. Leaders who explicitly say what they mean are better able to leverage the energy and commitment of their followers." (Hamm 2006)

The challenge of communicating the same message across the organization is enormous because multiple subcultures exist, each with their own language and assumptions (Schein, 1996). At times a manager feel s/he has been very clear on what they want done or corrected only to find that some time later their

requests have not been fulfilled. Many accepted management practices exist to address how to handle such a situation. However, managing polarity (Koestenbaum, 2002, Johnson, 1992, Carrillo, 2005, Collins and Porras, 2002) offers a new way to look at this recurring challenge.

Polarity illustrates one of the causes for the apparent lack of clarity in priorities or goals that exists in most organizations in spite of leader's attempts to clearly articulate them. The purpose for exploring how leaders might deal with polarity through sensemaking is to illustrate that to communicate, leaders need to take into account the role of the listener in constructing intention. Furthermore, "the meanings they come up with may depend more upon shared background and culture than their individual skills in managing impressions and devising rhetorically sensitive messages." (Ziegler et al, p.290)

The leader cannot decide priorities in isolation. Mangusson (2010) noted in his study that, "Other factors, such as the commitment and willingness from employees to accept and understand which factor should be in first hand between safety and production, are also seen as determinants of the safety success in the company." (22) Since leadership cannot be present to make each decision, structures and guidelines are necessary to reinforce the priorities. Nevertheless, polarity management must begin with leadership since it entails recognition, education, and an environment of trust and open communication that allows for open discussion of the perceived conflicts.

Some suggestions on the use of sensemaking with setting priorities would be:

- Cultivate discussion about setting priorities that goes beyond a leader-centric approach to leadership. During job briefings, first, address the employee's role in interpreting priority statements, including their attributions to leader's intent.
- Consider shifting the vocabulary away from "setting priorities" to communicating priorities as a process. Consider how this might transform the briefing process instead of adding another item to an existing briefing checklist. Indeed, expand the notion of leader's intent beyond the initial briefing, and engage in exercises that help subordinates to interpret and reinterpret the leader's intent when conditions change.
- Involve employees in setting priorities and explore when and how a work group can practice resolving shifting priorities. The goal of this exercise would be to cultivate a shared mindset for evaluation and questioning.

4.5 Making Sense of Why People Don't Follow Procedure

P*ractical drift* is the human characteristic of not following procedure when negative consequences fail to materialize after stopping. The drift occurs for the purposes of practicality and efficiency. Scott Snook (2002) coined the term "practical drift" after a two-year investigation of the accidental friendly fire shoot down of U.S. Black Hawks over Northern Iraq. Using organizational psychology and social construction theories to analyze the results, he wrote, "There weren't any bad guys; hence, no one to blame. There were not any catastrophic failures of material or equipment; hence nothing to fix. No gross negligence or act of God caused this tragedy. The more I looked for traditional culprits, the more I realized that this accident occurred as the result of normal people behaving in normal ways in normal organizations." (Snook: 202)

Most of the time, there are no adverse consequences to practical drift. Many times, there are benefits, and employers rely on it to improve efficiencies in the way work is done. A sensemaking focus group to determine why employees were not following procedures in lab testing yielded an interesting perspective. Everyone had been trained in one method but a month later; no one was following the written procedure. The experienced operators saw nothing wrong with this. In their mind, it was expected to take the basic information and improve upon it based on experience. In fact, the operators in individual interviews insisted that they were following procedure, but "using different techniques." The uniformity of language indicated that conversations about the matter had taken place and agreement had been reached among the operators. After the focus group and retraining of the personnel, the operators followed the lab procedures for a period of time. The lab manager changed jobs, and after a while drift returned.

Furthermore, research shows (Schein 1996) the operational culture believes that no matter how

clearly the rules are specified they cannot cover every contingency because the production process is dependent on a system of interdependent functions. Schein concludes, ”The tragedy of most organizations is that the operators know that…neither the incentive system nor the day-to-day management system may support those assumptions. Operators thus learn to subvert what they know to be true and "work to rule," or use their learning ability to thwart management’s efforts to improve productivity.” (1996: 14)

Possible lessons from this example are that if a procedure is critical, it will require consistent monitoring and retraining. The use of sensemaking as a management tool could make the effect of the training last longer because people are involved in defining best practices.

A suggestion for planning a sensemaking session on practical drift may include:

1. Definition of Practical Drift
2. Identify an area where alternative practices have emerged that vary from procedure
3. Identify (1) where there has been an improvement and why, (2) where the drift might have created a potential danger. A person that is an expert in the inner workings of the process or equipment needs to be present.
4. Record findings in two columns for positive and negative potential. Hold an open dialogue to look for patterns that can lead to arriving at a consensus on what is acceptable drift, and what is not.
5. What is the process for recording or communicating changes to procedure?
6. Identify any “cardinal” safety rules that must never be violated.

4.6. Complexity Management Theory in Practice

Complexity theory informs that you cannot change a group by changing the individual. Since humans understand the world around them through thoughts and words, conversation is the primary tool for creating change. Note that conversation is not top-down, one way, nor is it written documentation. Changes in conversations reflect the internal changes in the way people will feel, think, and act. It might change from, "Why do we have this mindless bureaucratic rule to always lock the gate?" to "Locking the gate reminds us we are entering an area where safety risks are higher." Sensemaking describes how conversations move into the private thoughts of the individual to become common sense, which directs behavior. How can this process be utilized to shape the safety decisions and behaviors of an organization? Four common approaches are:

1. One-to-one conversations to solicit safety concerns, ideas for improvement, and obstacles to getting the job done. The conversation is two-way so there is opportunity for the leader to express his/her expectations and concerns as well. Follow up and feedback on these conversations is necessary for them to have the desired effect. The objective is to eventually arrive at a common sense of what is needed to be safe, how to define safe, and the best way for the supervisor/manager to support the work.
2. "Appreciative inquiry," a group interaction technology designed by David Cooperrider (2005), has shown very good results in solving complex problems while creating trust and open communication. This approach gathers people to learn from what is going right. Potential solutions emerge in a way that promotes buy-in. There is an appreciative inquiry website that has many successful case studies at http://appreciativeinquiry.case.edu/
3. Surveys, focus groups, and action planning processes can be very productive when participants receive feedback and their suggestions are responded to or implemented in a timely manner. In the AES case, the fact that the CEO was reading the comments and responded proved to be a powerful reinforcement to the culture of personal accountability. Many of these efforts fail because it takes to long to respond or employees see no response to their feedback.
4. Use of task forces and cross-functional teams is another powerful tool for sensemaking with the caveat that the team must be trained in the art of dialogue. Investing in facilitation training is

also important if new ideas and perspectives are to emerge. Two other important elements to the success of this approach are supplying the support and resources to implement team results.

The above processes work because they build relationships through trust and open communication. Common purpose and expectations develop as people keep commitments. When management does not respect the work of the teams or feedback from employees, the relationship terminates or is damaged. The resulting outcome is typically unsupportive of organizational performance. On the other hand, when a leader acknowledges the wisdom inherent in the group and learns from it, s/he is able to communicate new ideas and the need for change within a context that people are more likely to accept. Acting from this position of respect and recognition strengthens relationships and fuels the movement towards more successful outcomes.

4.7 Sensemaking Tools

The ability to see and select correct data increases the quality of decision-making, however, it is quite the challenge to motivate people to invest in the time and effort it takes to get past the "apparent truth" to what *might* be the "real truth." (Chengalur-Smith et al, 1999, Fisher 2003, Kerr & Tindale, 2004). While sensemaking is a constantly ongoing process, here it is being examined as a conscious tool to solve problems, improve the quality of communication, and raise safety awareness. Constructive sensemaking conversations help people see hidden problems and innovative solutions that were previously invisible because they were misunderstood or not part of the collective common sense.

Leaders are natural sensemakers, but they can be trapped by their own assumptions, and thus miss important information that would help them make better decisions. The incorporation of sensemaking into supervisory and management training would help managers learn how to increase their own awareness and problem solving capability by observing and listening to the people around them. One fundamental tool to develop an open mind is the "ladder of inference." (Argyris and Schon, 1974), popularized by Peter Senge in the "Fifth Discipline." Some of the beliefs that can prevent groups from seeing and using valuable information are:

- My beliefs are the truth
- The truth is obvious
- My beliefs are based on true data
- The data I select is the important data

Figure 1

The Ladder of Inference, Figure 1, can aid in breaking through these obstacles by explaining how pre-existing beliefs block or limit the ability to see reality. The progression of the Ladder shows how people move from observation to action. At the bottom of the ladder, reality is initially perceived as *Real Data & Experience*, such as that captured by a movie camera. The human mind then selects a set of *Selected Data &*

Experience to which it pays attention. To this *Selected Data & Experience* it affixes *Meaning*, develops *Assumptions*, and comes to *Conclusions,* which become *Beliefs*. Beliefs then form the basis of *Actions*, which create additional *Real Data & Experience*. The movement up this ladder is unconscious and automatic. It happens in an instant. One of the inherent problems with this process is that experience often causes one to see what one expects to see as shown in figure 2, "Seeing Is Believing."

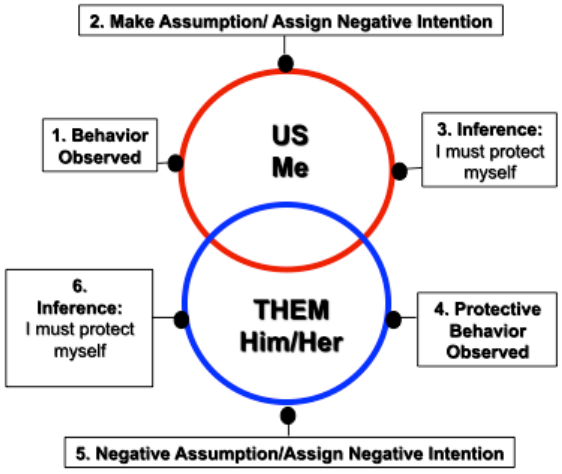
Figure 2.

In the second figure, **Beliefs** influence the **Selected Data & Experience** the mind pays attention to causing an internal reinforcing loop is established which short circuits reality. The tendency is to select data to support the existing beliefs. Once this loop is in place, it is very difficult to introduce new interpretations of the data.

This dynamic of "seeing is believing" is dramatically illustrated in negative relationships between union and management. Once the belief that "they" can't be trusted is ensconced in the culture, it is very difficult to introduce collaborative approaches to safety. Small miscommunications become "betrayals" and grounds for stopping progress. Figure 3, Cycle of Mistrust, illustrates the negative effect of the ladder of inference can have on breaking down trust. Mistrust is initiated when people assign negative meaning to an event or behavior. If the assumptions are not verified, the mistrust could be misguided.

There are many examples of how this cycle can negatively impact the acceptance of safety improvement efforts (Carrillo 2002). There are also examples of how leaders have broken this cycle by calling people together to re-examine their assumptions, explore new meanings, and experiment with trust in small ways that built new beliefs about the integrity of both union and management leaders (Carrillo 2002, 2004).

Figure 3. Cycle of Mistrust



Recommendations for Use of the Ladder

Managers and employees can learn to use the Ladder of Inference to question their beliefs and assumptions. This, according to Weick and others, is what distinguishes high performance organizations that succeed in complex, hazardous environments. Facilitators can consider the following actions as strategies for reducing the barriers that miscommunication can present and for using conversation to leverage what is working well.

- Hold workshops on the Ladder of Inference. Focus on listening, questioning, and problem solving. Introduce it to teams, committees, and all levels of management.
- Create time and space for conversations to improve all aspect of the work. Make safety an important topic.
- Evaluate existing structures such as safety teams and committees. Is there time allotted for sensemaking or has the conversation become rote.
- Where are the real conversations taking place? Can they be leveraged?
- Look for opportunities to address people's frustrations. Where is there confusion about priorities, ambiguity?

Weick (2009) also offers seven principles of sensemaking.

5. Implications of Complexity in Managing Safety Culture

The purpose of research is to seek a wider perspective from which to understand complex problems in a way that allows new solutions to emerge. Thus, the researcher contemplates not only what has gone wrong, but also where things have apparently gone well to try to discover any underlying principles that might exist to explain success or failure. It is hoped that through understanding these principles others will be able to influence like effects.

This article has been arguing that the main implication of complexity and its related theories on the role of relationships in organizational performance is the way it refocuses attention away from management controlling what organizational members should be doing to learning from what they are already and have always been doing. If there is a recommendation for leadership, it is to pay more attention to how management is relating and managing its relationships. The generation of productive conversation should be considered as one of the foundations of intervention efforts.

Following this recommendation may be difficult. Building relationships is generally viewed in the sphere of emotions and feelings while business culture values logic, technological fixes, and measurement. However, complexity theory presents evidence that there is logic at work that is far different from cause and effect. Small actions can produce large unintended results (good and bad). These interactions take place constantly and the only way to influence them is to be involved in the sensemaking process before, during or after the work is completed. It is a never-ending process because sensemaking evolves with every new factor or condition that appears. This conversation is the act of relationship building. Thus, when organizational members engage in meaningful conversations, everything changes.

The skills necessary for reaping the benefits of complexity dynamics and guiding them to some extent is the capacity for self reflection, acknowledging one's contribution to existing conditions, skill in facilitating constructive sensemaking conversations, and the ability to capture and feedback the knowledge and information surfacing in conversations. Perhaps the greatest value of complexity theory is to question assumptions of how the world works so that managers and safety professionals can come up with new, more successful ways to solve complex problems.

Are any of the tools and interventions described here brand new? They might be to a young professional. What is new, are the underlying assumptions about how organizations work, and how things get done. Essentially, it's good-bye control and command. The idea that managers can control and predict outcomes brings with it a set of attitudes that close down the crucial communication that can alert one to an unexpected or unseen danger or opportunity. While, moving from control to trust unleashes startlingly high levels of productivity and creativity.

Managing polarity, conscious facilitation of sensemaking, harnessing practical drift requires a transformation in one's behavior and way of thinking. Living in ambiguity and helping others manage it is an exercise in courage. First, the leader connects with people. Without this connection, a leader cannot create the trust and credibility to gain followership. This trust is gained by communicating the messages, "I respect you," "You are valued." Organizations cannot expect managers to develop these competencies without investing in their education on a continuous basis. Nor can they expect managers to facilitate this amplified level of communication without the proper resources (time and personnel). Education and engagement are the most powerful tools an organization has to institutionalize sensemaking as a constructive practice to build safety awareness. To do this, front line leaders need the complete support of middle management who in turn needs the support of senior leadership. Without organizational support, the individual leader can still make a difference within his/her sphere of influence. However, when complexity management principles become a part of the way leaders run an entire organization, the potential for greatness and an accident free workplace is exponential.

Bibliography

Anderson R., Benjamin F. Crabtree, David J. Steele, and Reuben R. McDaniel, Jr.(2005 a). Case Study Research: The View From Complexity Science. *Quality Health Res*. 15(5): 669–685

Anderson R.A., Ammarell N, Bailey D.E., Colon-Emeric C., Corazzini K., Lekan-Rutledge D, Piven M.L., Utley-Smith Q. (Apr-(June 2005b) The power of relationship for high-quality long-term care. *Journal of Nurse Care Quality*. 20 (2): 103-6.

Antonsen, Stian. (2009). Safety culture: theory, method, and improvement. Ashgate: Farnham, England.

Argyris, C.; Schon, D. (1974). T*heory in Practice.* Increasing professional effectiveness. San Francisco: Jossey-Bass.

Bakke, D. (2005), *Joy at Work*. Seattle, WA: PVG.

Beer, M., Eisenstat, R. A., & Spector, B. (1990). Why change programs don't produce change. *Harvard Business Review*, 68(6), 158-166.

Buckingham, Marcus and Curt Coffman. (1999). *First, Break All the Rules*: What the world's greatest managers do differently. Simon & Schuster: NY.

Carrillo, Rosa A. and Steven I Simon. (1996) *Grassroots Safety Leadership*. Seal Beach, CA.

Carrillo, Rosa A. and Steven I Simon. (1996) *Grassroots Safety Leadership Series*: Volumes I-IV. Seal Beach, CA.

Carrillo, Rosa Simon. (1998 June). Managers' Leadership Role in Safety. *Professional Safety,* 38-41.

Carrillo, R.A., (2002 June). Breaking the Cycle of Mistrust to Build a Positive Safety Culture. *Occupational Hazards*.
Carrillo, Rosa Antonia. (2002 March). Safety Leadership Formula: Credibility + Trust + Competence = Results. *Professional Safety,* 41-46.
Carrillo, Rosa Antonia, (2005 July). The Safety Leadership Paradox. *Professional Safety*, 31-34.
Carrillo, Rosa Antonia, (2010a May). Positive safety culture: How to create, lead, and maintain, *Professional Safety*, pp. 47-54.
Carrillo, Rosa Antonia, (2010b). Data gathered internally for the Nuclear Regulatory Commission.
Carrillo, Rosa A. (2011). "A Positive Safety Culture." Naval Safety Professional Development Conference. San Diego, CA. Unpublished.
Chengalur-Smith, I., Ballou, D. P., & Pazer, H. (1999). The impact of data quality information on decision making: an exploratory analysis, IEE Transactions on Knowledge and Data Engineering vol. 11, pp. 853-864.
Collins, James C. and jerry I Porras. (2002). *Built to Last: Successful habits of visionary companies*. Harper Collins: NY.
Cooperrider, D., Whitney, D. (2005). *Appreciative Inquiry: A Positive Revolution in Change*. Berrett-Koehler.
Fisher, C., Chengalur-Smith, I., & Ballou, D. P. 2003. The impact of experience and time on the use of data quality information in decision making. *Information Systems Research* vol. 14, pp. 170-188.
Ford, J. D. (1999). Organizational change as shifting conversations*. Journal of Organizational Change Management*, 12(6), 480-490.
Griffiths, Frances Ann. (2007). Fam Med From the North American Primary Care Research Group: Complexity Science and its Relevance for Primary Health Care Research July; 5(4): 377–378.
Guldenmund, F.W. (2000) The nature of safety culture: a review of theory and research. *Safety Science*. 34: 215-257. Downloaded 10/11/10 academics.ewi.tudelft.nl/live/binaries/55e4afad-b4c5-4e33-b60c-68a9c6bcfc3c/doc/safetyscience2000.pdf
Godwyn, M., Gittell, J.H. (2011). *Sociology of Organizations: Structures and Relationships*. Thousand Oaks: SAGE Publications.
Gittell, J.H. (2009). *High Performance Healthcare: Using the Power of Relationships to Achieve Quality, Efficiency and Resilience.* New York: McGraw-Hill.
Hamm, John. (2006 May). The five messages leaders must manage. *Harvard Business Review*.
Jackson, Susan E, Randall S. Schueler, Steve Werner. (2009) *Managing Human Resources*. Cengage Learning: Mason, OH.
Jordan, Michelle, E, Holly J Lanham, Benjamin F Crabtree, Paul A Nutting, William L Miller, Kurt C Stange, and Reuben R McDaniel, Jr Implement Sci. (2009 March). The role of conversation in health care interventions: enabling sensemaking and learning ; 4: 15. Published online .
Jacobs, C., & Coghlan, D. (2005). Sound from silence: On listening in organizational learning. *Human Relations*, 58(1), 115-138.
Kerr, N. L. and R. S. Tindale. (2004) Group Performance and Decision Making. Annu.Rev.Psychol. 55:623-55. http://neuron4.psych.ubc.ca/~schaller/Psyc591Readings/KerrTindale2004.pdf Downloaded on 3/27/2011.
Koestenbaum, P. *Leadership: The Inner Side of Greatness.* San. Francisco: Jossey-Bass, 1991.
Kotter, J. P. (1995). Leading change: why transformation efforts fail. *Harvard Business Review*. 73(2), 59-67.
McCormick, D. W., & White, J. (2000). Using one's self as an instrument for organizational diagnosis. *Organizational Development Journal,* 18(3), 49-62.
Magnusson, Henrik. (2010). Did the message go through? A qualitative study on communication-mapping as a safety assessment and development tool at LKAB, Luleå University of Technology Master Thesis, Continuation Courses Security Department of Human Work Sciences Division of Engineering Psychology. Retrieved on Sep 7, 2010 from http://epubl.luth.se/1653-0187/2010/029/LTU-PB-EX-10029-SE.pdf
Moon, Michael Y. (2008). Making Sense of Common Sense for Change Management Buy-In. California State University, East Bay. Retrieved on Sept 2, 2010 from http://www.roleanalysis.com/documents/CommonSenseOrgChng_Moon20080702.pdf
Matlow, A.G., J G Wright, B Zimmerman, K Thomson, and M Valente Qual Saf Health Care. (2006). How can the principles of complexity science be applied to improve the coordination of care for complex pediatric patients? April; 15(2): 85–88.
Manz, Charles C. and Henry P. Sims, Jr. (2001*). The New Super Leadership: leading others to lead themselves*. Berrett-Koehler:San Francisco
McMillan, Elizabeth. (2008). *Complexity, management and the dynamics of change: Challenges for practice*. Routledge: NY.
Miller, D. (2002). Successful change leaders: what makes them? What do they do that is different? *Journal of Change Management*, 2(4), 359-368.

Peter M. Senge (1990). *The Fifth Discipline: The Art and Practice of the Learning. Organization*. New York: Doubleday Currency.
Pink, Daniel H. (2009) *Drive: The surprising truth about what motivates us*. NY: Riverhead.
Plsek, Paul E. and Tim Wilson. (2001) Complexity, leadership and management in healthcare organizations. BMJ. September 29; 323(7315): 746-749.
Reason, James. (2000). Safety Paradoxes and Safety Culture. International Journal of Injury Control and Safety Promotion, V.7, Issue 1 March, pp3-14.
Sardone, Giuseppe and G. Wong. (2010). Making Sense of Safety: complexity based approach to safety interventions. Proceedings of the Assoc of Canadian Ergonomists. Kelowna, BC.
Schein, Edgar. (1987). Process Consultation: Volume II. Addisson-Wesley:MA
Schein, Edgar. (2009 June). shared his concept of "cardinal safety rules" and first line/operation assumptions in a conversation with the author regarding how to apply practical drift to improve safety performance.
Schein, Edgar H. (2010). Organizational culture and Leadership. John Wiley: San Francisco.
Simon, Rosa A. (1996, October). The Trust Factor in Safety Performance, *Professional Safety*, October: 34-39.
Simon, Rosa Antonia and Steven I. Simon. (1995, March). Redesigning the Safety Function for the Year 2000. *Professional Safety*, v 40:3.
Simon, Rosa A. and Steven I. Simon. (1996). Improving Safety Performance Through Cultural Interventions. Chapter in *Essentials of Safety & Health Management*, CRC Press/Lewis Publishers.
Snook, Scott. (2000). Friendly Fire: the Accidental Shootdown of U.S. Black Hawks over Northern Iraq. University of Princeton: NJ.
Schein, Edgar H. (1996). Three Cultures of Management: The Key to Organizational Learning. *Sloan Management Review*, Fall
Shotter, J. (1993). *Conversational Realities: Constructing Life through Language*. London: Sage.
Stacey, R.D. http://www.plexusinstitute.com/edgeware/archive/think/main_filing14.htm
Stacey, Ralph D., Douglas Griffin, and Patricia Shaw. (2002) *Complexity and Management: Fad or Radical Challenge to Systems Thinking?* Routlage: NY.
Stacey, Ralph D. (2007) *Strategic Management and Organisational Dynamics*. Prentice Hall
Strebel, P. (1996). "Why Do Employees Resist Change?" *Harvard Business Review. May/June.74(3), 86-92.*
Taylor, J. R. (2006). Communication As Complex Organizing, in G. J. Shepherd, J. St. John, & T. Striphas (eds) *Communication As . . .: Perspectives on Theory*, pp. 132–42. Los Angeles, CA: SAGE.
Thayer, L. (1988). Leadership/communication: a critical review and a modest proposal. In Goldhaber, G. and Barnett, G. (Eds.), *Handbook of organizational communication: Advances in theory*. pp. 231-264 Norwood, NJ:Ablex.
Weick, K. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster , *Administrative Science Quarterly,* Vol. 38
Weick, Karl. (1995) *Sensemaking in Organizations*. Sage Publications: Thousand Oaks, CA
Weick, Karl E., Kathleen M. Sutcliffe, and David Obstfeld. (2005) Organizing and the Process of Sensemaking. *Organization Science*, V 16, Issue 4, July-August.
Weick, Karl E. (2009) Making sense of the organization. Blackwell: MA
Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, *16*(4), 409-421.
Weick, K. E. (2005) Managing the unexpected: complexity as distributed sensemaking. In Reuben R. McDaniel, Jr., & Dean J. Driebe (EDS.) *Uncertainty and surprise in complex systems: Questions on working with the unexpected.* Springer-Verlag.
Weick, K.E., Kathleen M. Sutcliffe. (2007) *Managing the unexpected.* Jossey Bass: San Francisco.
Weick, K.E. and Sutcliffe, K. (2006). Mindfulness and the Quality of Organizational Attention, *Organization Science* 17(4): 514-24.
Waldrop, Mitchell M. (1992). *Complexity: the Emerging Science at Edge of order and chaos. NY: Simon and Schuster.*

Ziegler, Jennifer A. and Michael T. DeGrosky. (2008). Managing the meaning of leadership: Leadership as "communicating intent" in Wildland Firefighting. *Leadership*, *4,* 271-297. Retrieved Sept 9, 2010 from http://blogs.valpo.edu/jziegler/files/2007/10/Ziegler-DeGrosky-2008.pdf