

## *Collaboration/Cooperation in Sharing and Utilizing Net-Centric Information*<sup>1</sup>

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### **Abstract**

In an age of increasing organizational complexity, small group dynamics are becoming more significant. Human psychological and social behaviors that interfere with interoperability need closer examination as organizations, such as those within or associated with departments or ministries of defense, increasingly rely on decentralization to achieve their goals. This paper highlights important social issues but does not focus on trying to solve them. One goal is to suggest areas of further research that can illuminate possible courses of action to influence better information sharing within people networks.

### **Introduction**

Fundamentally, the ultimate success of a mandate<sup>4</sup> to develop and expose information useful to others depends upon an individual's willingness to do so. This penchant can be hindered by cultural barriers often engendered by or encouraged within traditional organizations, particular those that have existed for a while. These barriers, in turn, can result from equating information with power, a risk-averse mentality, and/or a (negative) reward structure that punishes behavior that might benefit other organizations. Further, within an organization, the personal dynamics of groups can greatly affect healthy information exchanges between groups or among group members. Of particular interest is the potential benefit of innovative ideas from "outlier" member(s) of a group, and the degree of their acceptance by other members of the group. One challenge is to improve a group's effectiveness in how outliers are accommodated and their inputs are leveraged.

In delving at least partway into these issues, this paper will start in reverse order, i.e., with organizations and some thoughts about how an organization's leadership can help. Then, groups will be examined, followed by individuals, and finally trust will be addressed, a fundamental concept that affects all aspects of information sharing. Quotes have been liberally utilized from the literature in order to stimulate further thought and discussion.

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<sup>2</sup> International Council of Systems Engineering

<sup>3</sup> The MITRE Corporation

<sup>4</sup> Bush, George W., 25 October 2005, "Further Strengthening the Sharing of Terrorism Information to Protect Americans," The White House, Executive Order 13388 (Allen, 2006)

## Organizations

A seminal paper on this topic (Grobman, 2005) provides many insights about complex systems and how the science of complexity can inform the topic of organizational dynamics.

"In an environment that seems to be changing, organizations want to be more adaptable and better able to learn from experience in order to reconfigure themselves in the face of new demands (Cohen, 1999, p. 373). Cohen goes on to give other reasons as well: the acceleration of information technology revolution and its taxing of our ability to process information and data, and the degree to which organizations are being created, dismembered, and dismantled. The boundaries of organizations have been permeated through the use of virtual organizations, consultants, outsourcing, temporary hires, and ad hoc teams. Some of these developments can be described easily using the concepts of complexity theory, which, along with chaos theory, are useful in describing the rapid transformations undergone by non-linear dynamic systems such as organizations." (Grobman, 2005)

The increasing speed of complexity dictates that one cannot "trouble shoot" problems and engineer solutions as in the past... one must be able to see the *Gestalt*, or big picture, including a system's environment, and suggest ways to try to influence the environment or at least shape the system's further evolution for better mission capabilities. In this regard, much needs to be done in studying the application of complexity theory to organizations.

"Complexity theory is a new way of looking at how complex structures form, adapt, and change. ... it remains to be seen whether it can be successfully applied to organizations. ... there is a paucity of empirical data confirming that organizations designed on this new model are more effective and efficient. There is a view that ... self-design is more in line with emerging philosophical and ethical views about the workplace. In a normative sense, a complexity theory view can be considered more humanitarian and ethical. Writers in the field, in addition, suggest that organizational designs based on this new paradigm are likely to be more efficient and effective in turbulent environments. As more and more large organizations change their organizational design model to follow the prescriptions of complexity theorists, there will be more opportunities to judge whether these new designs work. This suggests a research agenda that uses the scientific method to determine whether the principles advocated by complexity theorists in the organizational arena can truly improve organizational performance." (Grobman, 2005)

More empirical data certainly is necessary to help bolster the complexity theory concepts in systems engineering environments. This is a "chicken-and-egg" problem: In situations typical of the existing military acquisition environment, for example, organizations may be reticent to apply complex systems engineering techniques until they have been

“validated”. However, as can be appreciated, it is more difficult to apply the scientific method strictly to investigations of human behavior—there are inherent limitations in relying solely on this approach. Again much research and experimentation remains to investigate how organizations can benefit from complexity theory.

Some things can be learned about how organizations can become more successful, or at least remain viable, by examining factors that may have led to the collapse of such complex systems as human civilizations. Perhaps there are several parallels to organizations, cf., the (present authors’) italicized passages below.

"[Societal] Collapse is manifest in such things as: a lower degree of stratification and social differentiation; less economic and occupational specialization, of individuals, groups, and territories; *less centralized control*; that is, less regulation and integration of diverse economic and political groups by elites; less behavioral control and regimentation; less investment in the epiphenomena of complexity, those elements that define the concept of 'civilization': monumental architecture, artistic and literary achievements, and the like; *less flow of information between individuals*, between political and economic groups, and between a center and its periphery; *less sharing, trading, and redistribution of resources*; *less overall coordination and organization of individuals and groups*; a smaller territory integrated within a single political unit. Not all collapsing societies, to be sure, will be equally characterized by each item on this list, and the list is by no means complete." (Tainter, 1988, p. 4)

Thus, some centralized management functions appear to be necessary for continued health of an organization. The following quote also suggests a traditional hierarchical structure to implement intentions of the central controlling body.

"In a complex society that has collapsed, it would thus appear, the overarching structure that provides support services to the population loses capability or disappears entirely. No longer can the populace rely upon external defense and internal order, maintenance of public works, or delivery of food and material goods. ... Remaining population must become locally self-sufficient ..." "Collapse is a process of decline in complexity." (Tainter, 1988, pp. 21, 31)

Note the implied undesirability of less complexity if one deems a vibrant civilization as being “good”. Thus, those striving for more advanced civilizations should embrace increased complexity. For those afraid of nuanced change this is something that may be viewed as counterintuitive.

As a result, there may be a quasi life-cycle phenomenon at play here with a continual ebb and flow of a civilization’s health between chaos and stability.

"Four concepts lead to understanding collapse, the first three of which are the underpinnings of the fourth. These are: 1. human societies are problem-solving organizations; 2. sociopolitical systems require energy for their maintenance; 3.

increased complexity carries with it increased cost per capita; and 4. investment in sociopolitical complexity as a problem-solving response often reaches a point of declining marginal returns." (Tainter, 1988, p. 194)

There is also an analogy in this between a civilization and a complex system such as an enterprise. There the phases of life cycles overlap and follow the "S-curve" trajectory with two important regions or knees in that trajectory. These knees are generally identified as tipping points or phase transitions (see Fig. 1) (Kuras, 2006). A "realized" enterprise re-invents itself through a process of continual innovation and integration that moves towards higher levels of complexity (see Fig. 2).

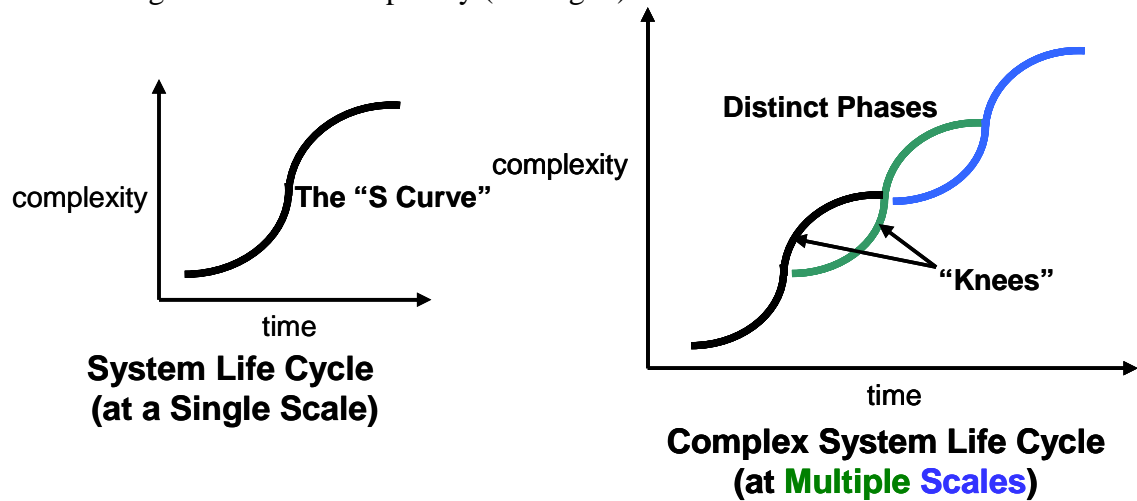


Figure 1. Comparing Complex System Life Cycle to That of a System (White, Apr 2006)

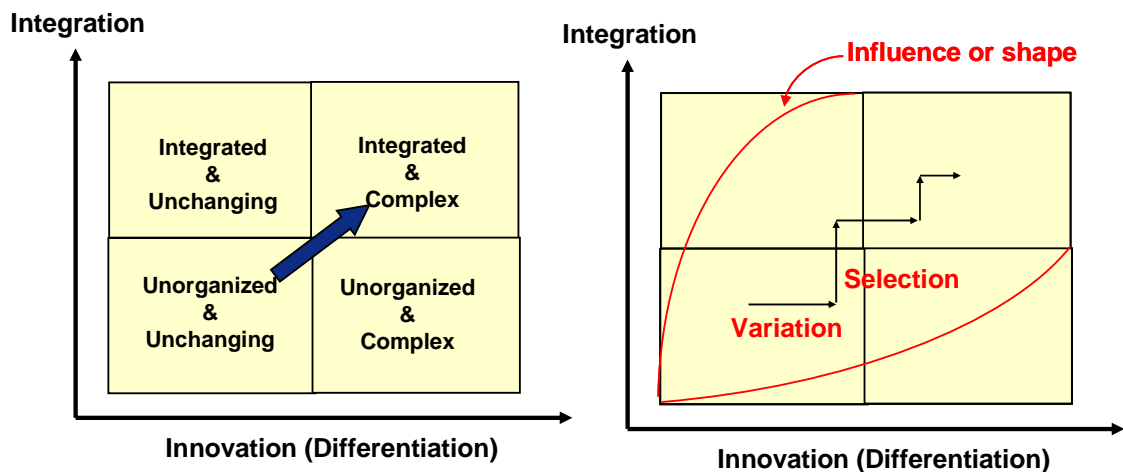


Figure 2. Ever Increasing Complexity Through Iterative Combinations of Innovation and Integration Using Continual Variation and Selection Techniques (DeRosa, 2005) (after Gharajedaghi, 1999)

"(Lewis, 1994) uses communication policy to give an organizational example of how complexity theory can be applied. He notes that some have suggested that the purpose of an organization is to reduce and block communication so things can

get done rather than talked about. An organization that has no rules concerning communication will have 'total chaos and breakdown,' because every worker will be overwhelmed with memos, meetings, and telephone calls. Yet placing restrictions on communications (such as between departments) provides control and stability, yet 'little learning or change.'" (Grobman, 2005)

Clearly, too much information flow can cause friction and collapse a system (De Landa, 1991), particularly information from uninformed or disruptive sources that can cause confusion among recipients. An effective organization needs to have a good balance between inter-organizational and interpersonal communication.

"It is no longer considered strange to read in the literature about organizational effectiveness as being described by variables that are either contradictory, or even paradoxical. Cameron writes about this explicitly: 'To be effective, an organization must possess attributes that are simultaneously contradictory, even mutually exclusive' (Cameron, p. 545). Using this framework, organizations can be both centralized and decentralized, both general and specialist, have both stability and adaptability, and diversified while "sticking to their knitting." Complexity theory, particularly when used to explain the survivability and adaptability of biological systems, makes use of paradoxical explanations, many of which appear to have applicability to describing all complex adaptive systems, such as organizations. ... Governing an organization is therefore an art, ..." (Grobman, 2005)

Organizations can be both centralized and decentralized; complexity theory can help explain this paradoxical situation. The consideration of multiple "scales" or views may be helpful here. For example, the organization and its sub-organizations and their intercommunications can be viewed at one scale of abstraction. On the other hand much of the communications among individuals can be viewed at another, more *ad hoc*, scale. We pose the idea of a hybrid organization with both hierarchical (derived from a central control mentality) and distributed or decentralized functions that are not limited to just distinct types of communication. This will be discussed later under Decentralization.

### **Leadership**

Leaders within an organization can play a pivotal role in regards to the sharing and utilization of information.

"The traditional view of management is that the manager sees something that has not gone according to plan, and tries to fix it by 'troubleshooting,' trying to find the piece that 'broke' and fix it. 'The study of complex adaptive systems suggests that *we might be better off maintaining the anxiety, sustaining the diversity, letting the thing simmer for a while longer to see what will happen on its own*' (Plsek, 1997, p. 3). For the manager, this creates a dilemma, even in the self-organizing environment. If one does not place sufficient constraints and 'control' workers, they may reach a point where the organization goes unstable. Yet too much

control limits adaptability. Those running an organization, if they want *maximum learning and growth*, have a very fine line to tread to maintain this." (Grobman, 2005)

The first sentence of this quote deals with the immediate situation only. Complexity requires that leaders look at the Gestalt, see where they want to be in the big picture, and "tweak" variables to try to steer their organization in that general direction. The authors' italics above emphasize an important concept of complex systems many leaders may not understand: Sometimes, it is more important to postpone making decisions instead of trying to appear to be "in control", e.g., behaving as an "Alpha Male" (Ludeman and Erlanson, 2004). Could some be reacting so quickly out of fear (a root cause of "rigidity of thought" that hampers some individuals from embracing new ideas)? Do they need to "stop" the problem in its tracks because of uncertainty in what may happen? A research question to consider: Is this tied to the prevalent emphasis on risk management instead of the pursuit of opportunity which seems so much more appropriate in complex system environments (White, Jul 2006)?

One needs to consider an alternative mindset: Short-, mid-, and long-term plans must continually change to better adapt to uncontrollable and unpredictable environments. Rather than making early decisions, to appear assertive and in control, for instance, a more informed policy would argue for encouraging variety to accelerate progresses of natural evolution, and waiting until it becomes clearer what to shape or select. A good research question: What are some 20%-80% rule heuristics for telling a leader when one needs to stop learning and intervene by making a decision? Perhaps this is where recent the neuro-anatomy/evolutionary biology research about how these "instincts" evolve will be helpful. Behavior patterns learned over time can become "instinctive". One no longer needs to think about what should be done, one just reacts. Can this research be used in conjunction with research about mirror neurons (Ramachandran, 2006) (Rizzolatti, 2006) to develop new training programs that get people to "break" rigid constructs of reality and their "instinctive" reactions that may no longer be appropriate? Standard counseling psychological techniques, incorporating many from group therapy, such as are implied in coaching Alpha Males (Ludeman and Erlanson, 2004) can be used as well.

"If there is too much change and freedom, then their system can tip over into chaos—witness what happens in a revolution, for example. Too little innovation, and systems become rigid-totally predictable but able to respond only through tried and established methods. Governing an organization is therefore an art, and there needs to be constant monitoring of the system to check which way it is heading. If it is becoming too stable, then change and a degree of freedom, perhaps through decentralization, needs to be introduced to push the system back to complexity. Conversely, if there is too much change and the system is threatening to melt down, restraints and disciplines must be quickly reinforced (Lewis, 1994, p. 16)." (Grobman, 2005)

This is reminiscent of previous discussion regarding organizations; again, see Figs. 1 and 2. Running an organization has a strong "art" component because leaders need to

understand themselves (first) as well as other people and their individual psychologies. This is critical to their success as leaders in shaping how their organization should evolve.

"(Plsek, 1997) offers nine management principles [see below] ... which take advantage of the insights provided by complexity science. In summary, ... view your organization as a complex system rather than using the machine metaphor; provide minimum specifications, and don't script plans in minute detail; don't always 'go with the data' when 'going with your gut' feelings may be more appropriate; take your organization to the 'edge of chaos' by fostering a level of anxiety, diversity, discomfort, and contentiousness to promote creativity; take advantage of paradox and tension rather than fighting them; let solutions to knotty problems emerge; promote informal communication networks in the organization rather than banishing them; and use the 'tit-for-tat' strategy of competition-cooperation to forge positive, symbiotic relationships as a first strategy and abandon that as a strategy only when your 'partner' does not reciprocate." (Grobman, 2005)

Human intuition processes information at higher brain levels than we are consciously aware, laterally “connecting the dots” of minute information subconsciously and consciously gleaned through observations (Clark, 2001). Some people don’t react in predictable ways. For them this will not work as intended, so how do leaders deal with them in the workplace?

"More practical suggestions are provided by group members of VNA, Inc., Anonymous (1999), Edgeware-Applications. Web site: [http://www.plexusinstitute.com/edgeware/archive/ed\\_gplace/map.html](http://www.plexusinstitute.com/edgeware/archive/ed_gplace/map.html). ... :

1. Increase the flow of information in the system.
2. Use fundamental questioning to keep organizational members thinking about solutions to organizational problems
3. Keep the size of work teams to 12 or less, and organizational units to 150 or less, to be consistent with the number of relationships people can handle.
4. See the manager as a participant and part of the work system, rather than as an outsider.
5. Promote redundancy, and fight against the traditional practice of guarding information and skills to ensure longevity or security.
6. Don't be afraid of letting unstable situations simmer until a solution emerges rather than forcing a solution.
7. Consider doing large group interventions where the people put in a room to solve a problem are not just organizational leaders, but a cross-section of organizational members." (Grobman, 2005)

Our selected comments regarding: 1: As alluded to above, what is the critical point that causes too much friction and a collapse of the system? 3: What is the critical number of relationships people can handle? 5: How does a leader get people to trust and to share information? How does one get them to step outside their basic human nature? It takes

time to build trust in a traditional way [see Trust section]. Is the time available in a complex structure where things happen at an exponential rate? How can a leader “shortcut” the time needed to develop a relationship and build trust, as well as group cohesion? Group cohesion and trust among members often can be built through “in-sync” physical activities, through enduring hardships in the group, as well as through problem solving as a team. But, these methods take time to accomplish? 6: Again, move away from the macho, decision-making hierarchical culture of the Alpha Male. 7: This may cut down on “Group Think”, but what about intimidation and fear of those who are not organizational leaders? How does a leader minimize subtle and overt intimidation tactics?

"Good managers and organization leaders know when to change communications rules to move the organization to the edge of chaos ... in order to promote organizational learning. (Lewis, 1994) suggests that top-down change designed to make an organization more effective and flexible is doomed to failure, because of the impossibility of predicting the outcome of any change. He points out that major change is usually the result of 'a mutant subculture which spreads within the organization' and takes over because, to paraphrase him, it is better able to adjust to the outside environment it deals with." (Grobman, 2005)

One function of the hierarchical portion of the organization is to encourage the right kind of information exchange without creating too much distraction such E-mail exchanges for their own sake! For example, E-mail “chains” seem to be rampant in some organizations. Many refuse to make an extra click or two of their mouse to reach a discussion web site on a topic. Instead they waste time and paper by reading and/or printing every iteration of an exchange. It is ironic how the original intent of E-mail was to free individuals to concentrate on their more important work while being able to be more efficient in handling routine communication when they got around to it. Today, unless they respond within minutes, or perhaps hours, they are viewed as sluggards by their peers!

"... the senior executive's ability to implement a true learning organization is overrated. ... 'You don't drive a human system. If you try, you might end up doing more harm than good.' ... If you doubt the limited power of chief executives, consider the usual ways they try to bring about change: They articulate new strategies. They devise new cost-cutting campaigns. And, most popular of all, they restructure their organizations -- often more than once. They do so because there is little else they really can do. ... Executive leaders can develop guiding principles. ... senior executives must do two things: develop personal learning strategies, and understand the context in which they work. ... Truly innovative, adaptive companies recognize that a healthy leadership ecology requires three kinds of leaders: local line leaders (branch managers, project team leaders, sales managers, and other credible front-line performers); internal networkers (front-line workers, in-house consultants, trainers, or professional staff who spread ideas throughout the organization); and executive leaders." (Senge, 1996)

Here we're interested in all three categories of leaders but particularly, the last category, internal networkers, especially the professional staff. See the Individuals section.



"Harnessing complexity involves acting sensibly without fully understanding how the world works." "... When we look for insights into harnessing complexity, we should ask how we can change the pattern of avalanche (or traffic jam) sizes, the shape and size of patches that form, or the number and complexity of routines that can be created. The theories often do not give us control over specific events. Rather they help us find interventions that may affect the averages of what happens, that may allow adaptation or learning, even without knowing in advance just what will change, or just what will be learned." (Axelrod, 2000, pp. 45, 114)

Modeling does not predict, nor tell a leader "how" to solve a particular problem, it does, however, help one gain deeper insight into the underlying dynamics at work within a system. That, in turn, may help leaders to recognize destructive patterns emerging within their organization and disable them before they cause damage. Bottom line: Leaders need to bring a degree of humility to the complex systems arena, i.e., their organization.

### **Decentralization**

Decentralization is necessary in order to make an organization more agile and flexible in an increasingly competitive and dynamic world. The Department of Defense (DoD), with a tradition of hierarchical command and control, is no exception.

"... by relentlessly reducing the costs of communications, new information technologies are taking us across a threshold into a place where dramatically more decentralized ways of organizing work become at once possible and desirable. ... We are, it seems, on the verge of a new world of work in which many organizations will no longer have a center at all – or, more precisely, in which they'll have almost as many 'centers' as they have people." "Now, we are in the early stages of another revolution – a revolution in business – that may ultimately be as profound as the democratic revolution in government." "For the first time in history, technologies allow us to gain the economic benefits of large organizations, like economies of scale and knowledge, without giving up the human benefits of small ones, like freedom, creativity, motivation, and flexibility." "The most extreme kind of business freedom occurs in markets because, in this kind of organization, no one is bound by a decision to which he or she doesn't agree." (Malone, 2004, pp. ix, 4, 7)

Malone further expounds on the power of decentralization and individual freedom within organizations. Because of the low cost of communication, it is possible to retain the advantages of a centralized but loose hierarchy while empowering staff. One is free to innovate and achieve a variety of goals, many of which can be based on personal values as well as a corporate or directorate vision. However, consider the hypothesis: Complete decentralization will not work; it will cause disintegration. Recall the discussion of collapses of civilizations in the Organization section. A hybrid organization with a management hierarchy to maintain "loose-coupled" communication among organizational sub-elements is seen as a minimum deterrent.

Perhaps one need not fear complete decentralization. This may be a rare event because it could be that the hierarchical management structure is self-perpetuating. Many of those in positions of power within the hierarchy got there by adopting a command-and-control (Alpha Male) mentality of their bosses. Being so successful, why should they be motivated to change this culture? They may have very little personal vested interest in nurturing, viz., coordinating and cultivating, significant degrees of decentralization! Such managers have experienced success with certain types of behavior, thus, creating “instinctive” patterns of response. It is very hard to break behavior thus engrained in physically created neuronal pathways in the brain. One has to consciously, consistently create new pathways and cause the previous ones to disintegrate through atrophy to actually change the behavior and, thus, one’s mental model or view of reality.

“When people are making their own decisions, for instance, rather than just following orders, they often work harder and show more dedication and more creativity.” “We need to shift our thinking from command-and-control to coordinate-and-cultivate. ... rigid standards in one part of a business system can sometimes – paradoxically – allow much more flexibility and freedom in other parts of the same system.” “... workers are being rewarded not for efficiently carrying out orders but for figuring out what needs to be done and then doing it.” “When they have more freedom, their work becomes more interesting and enjoyable, and they’re better able to juggle the various demands that life places on them.” “Why can’t power, ownership, and initiative be distributed throughout a whole market, rather than being imposed from the top of a hierarchy?” “Decentralize when the motivation and creativity of many people is critical.” “What percentage of the intelligence and creativity of the people in your own organization do you think your organization actually uses?” (Malone, 2004, pp. 10-12, 35, 76, 121, 153)

Caveat: with such decentralization comes increased conflict—“turf battles”. Current modeling research demonstrates that this can cause less integration (people preferring to be with others like themselves) and more “bumping” of group boundaries, thus creating more conflict, e.g., factional fighting within Iraq, and initially after the fall of the Soviet Union, among former member republics. Prior to that strong centralized authority “forced” the various groups to cooperate.

"In order to resolve the deficiencies fundamental to the structure of hierarchy, we must, by definition, abandon hierarchy as an organizing principle. We must confront hierarchy with its opposite: ... Rhizome acts as a web-like structure of connected but independent nodes, borrowing its name from the structures of plants such as bamboo and other grasses. ... Each node ... stands autonomous from the larger structure, but the nodes work together in a larger network that extends benefits to the node without creating dependence. The critical element of a world that focuses power at the level of the individual, ... while providing the flexibility and potential to achieve greater goals, remains the small, connected and relatively self-sufficient node of this rhizome structure. In human terms, such a node

represents an economic and a cultural unit at the size preferred by [us]: the household and the tribe. Functionally self-sufficient but not isolated, cooperating but not controlled, the rhizome economy, combined with a self-awareness of control structures, provides the real-world foundation of stability and freedom." (Vail, 2004)

This rhizome paradigm is powerful but we still need some organizational functions to be handled in a hierarchical fashion, i.e., a hybrid organization that is a mix of hierarchy and decentralization, might work well. What combinations of the respective roles of hierarchy and decentralization might work the best from a systems engineering point of view?

"Centralization and stratification produce ever-greater losses in efficiency due to the increased cost of distribution, coordination and communication. Hierarchy has incredible strength, but the accompanying inflexibility and top-heaviness can make it brittle and unstable. The networked, rhizome structure not only facilitates greater individual freedom, it also creates a more flexible and resilient structure for human ecology. The resiliency of rhizome may prove the deciding factor in our long-term survival as humanity encounters a host of potential threats. In the face of super-viruses, climate-change and overpopulation, the richer, more complex, more rhizomatic ecosystem has historically demonstrated greater survivability." (Vail, 2004)

One function of the hierarchical portion of an organization would seem to be to continually try to track and shape the decentralized portion while ensuring that the overall vision, mission, and policies of the organization are being followed. This is probably much easier said than done. Other typical functions are salary administration, e.g., providing raise packages to sub-organizations, administering flu shots, etc.

"With a foundation of self-sufficiency established, a node can take advantage of a second strength of the rhizome pattern: network. Loose network connections, such as those in rhizome structures, actually demonstrate far more efficiency at information transfer and processing than the close, authoritarian connections of hierarchies, according to complexity theorist Mark Buchanan ["Nexus: Small Worlds and the Groundbreaking Theory of Networks", Mark Buchanan]. The more intense, closely held connections within hierarchy prevent information from quickly spreading among large or diverse groups. The weaker, more distributed connections of a network can more quickly disseminate information to a much broader audience ..." (Vail, 2004)

This suggests that the communications functions of the hierarchical and decentralized portions of a hybrid organization should be distinct. How would these functions be partitioned?

"... most people are still more comfortable thinking about organizations in fixed, mechanical terms rather than in adaptive, decentralized terms." (Axelrod, 2000, p. 29)

This is a holdover from the Industrial Revolution over a century ago. We are now coming full circle in understanding the centrality of biological systems in understanding how systems work. The classical hierarchical management structure probably is well ingrained as the correct construct in the thinking of most managers. Do we have to wait for a new generation of leaders for this mindset to change?

"When members of an organization assess a situation from different evaluative angles, they generate a greater variety of new possibilities that, if not excessive, can have great value for the organization (Cohen, 1984). But it is clear that beyond some level, variety in performance measures can also be a source of debilitating inconsistency and conflict. ... consider the difficulties of learning if victory is the sole criterion of success. ... In a seeming paradox, you increase the chance of winning by concentrating on a set of criteria that does not include winning." (Axelrod, 2000, p. 122)

Chess playing is used as an example, where one reevaluates remaining pieces and their positions continually, particularly in the middle game, to improve future chances of winning, without using a metric directly connected to "winning".

"Harnessing complexity requires taking advantage of variety rather than trying to ignore or eliminate it." "In complex systems, it is difficult to determine what should be rewarded or which choice is appropriate. ... In the short run we are not likely to have a direct approach that 'gets it completely right'." (Axelrod, 2000, pp. 130, 137, 138)

It's about a process of "variation and selection" (see Fig. 2) to continually try to find the right balance as one progresses toward more complexity, e.g., a shaped and enhanced combination of more innovation and integration. Emergence, i.e., "surprises" coming from the interaction of parts of the whole, and the interaction of the whole with its environment, is responsible for this. One cannot predict what these interactions will produce.

"Abstract: The five management concepts under the new decentralization paradigm present several organizational problems. These concepts are founded on the idea of the inherent goodness of human nature, which is unrealistic and impractical. Despite this basic flaw, the new decentralization paradigm is expected to govern the restructuring of many businesses." "The five concepts are: 1) 'radical' restructuring; 2) customer and process orientation; fractal and modular factories; 4) virtual corporation; and 5) atomized organization." "... their design is vague, contradictory and non-operational. ... lacking a theoretical foundation ... untested hypotheses. ... [from HRM perspective] barriers crop up which are hard or impossible to surmount and which are, above all, a result of the limited knowledge and abilities of the necessary personnel available and an all too idealistic notion of human nature underlying these new concepts." (Drumm, 1995)

One implication of the human nature comments with regards to the more creative thinking members of a team is likely to be possible conflict within the team. “Outside the Box” thinking often can engender fear and antagonism from other team members resulting in alienation of the more creative members of the team and general disruption of the group effort.

“... it is likely that a growing need for coordination and an increase in transaction costs will result from a decentralization of decision making and enterprise functions.” A “plausible structural element” used to characterize the paradigm: “... (12) complementary central supervision of the decentralized units - at least at the strategic level; central, profit-oriented supervision ... by means of financial control.” (Drumm, 1995)

Even in non-profit organizations certain elements are appropriate for the hierarchical portion of the management structure (see the Organization section), e.g., formulation and communication of organizational vision, overall mission, and general strategies for attaining same; funding/salary administration and capital budget allocations, etc.

### **Groups**

Less central control comes with a greater dependency on the individual to work well within small groups, which, in turn, are expected to make independent decisions that move the organization towards its collectively stated goals. It is hoped that the individuals will be able to set aside personal motivations and limiting personality characteristics, and act cooperatively with others within their own group and with other groups with whom they interact. This presents a challenge within the DoD and other Federal agencies. For example, there is a strong traditional tendency to treat the control of information as a source of power and institutional or political advantage. Thus, despite high managerial level mandates to share information across institutional boundaries to achieve enterprise goals<sup>5</sup>, the reality of residual cultural bias at the working level prevents this from happening in meaningful ways.

“Breaking down our associative barriers is the first challenge we face ... But how do we do it? ... In essence, ... people succeeded at breaking down ... barriers because they did one or more of the following things: 1) Exposed themselves to a range of cultures; 2) Learned differently; 3) Reversed their assumptions; and 4) Took on multiple perspectives.” (Johansson, 2004, p. 45)

However, getting people to actually set aside their personal view of their reality and take on alternate perspectives of others has been shown often to be a very difficult task. How well one is able to understand or process varying types of information can determine the success of accepting or taking on multiple perspectives.

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<sup>5</sup> Wolfowitz, Paul, 2 December 2004, “Data Sharing in a Net-Centric Department of Defense,” Department of Defense, ASD(NII)/DoD CIO, Number 8320.2

“Working with a diverse group of people, then, is a great way to increase creativity.” “What is surprising ... is not that people are attracted to people who are similar; this is something we know from personal experience. What is surprising is how predictable this effect is. ... ” so much so “that it can be expressed through a regression equation. The similar-attraction effect can have a devastating impact on our efforts to create diverse teams.” “If you are thinking about recruiting a candidate because ‘I like her’ or ‘He’s just like one of us,’ these might actually be reasons not to hire the person, assuming the job or team requires creativity.” (Johansson, 2004, pp. 80-82)

But while it will help add diversity, this will also increase conflict within the group. How does one compensate for this? This highlights the particular challenge for small groups to truly embrace those that are different, the outliers, such as those that offer relatively radical ideas.

“So how do you reward failure? ... 1) Make sure people are aware that failure to execute ideas is the greatest failure, and that it will be punished. 2) Make sure everyone learns from past failures; do not reward the same mistakes over and over again. 3) If people show low failure rates, be suspicious. Maybe they are not taking enough risks, or maybe they are hiding their mistakes, rather than allowing others in the organization to learn from them. 4) Hire people who have had intelligent failures and let others in the organization know that’s one reason they were hired.” “Explicit rewards, then, can be an effective way to kill off our creativity. ... If intrinsic motivation is high, if we are passionate about what we are doing, creativity will flow. External expectations and rewards can kill intrinsic motivation and this kill creativity. ... Stephen King puts it this way: ‘Money is great stuff to have, but when it comes to the act of creation, the best thing is not to think of money too much. It constipates the whole process.’” (Johansson, 2004, pp. 129, 138)

In complex (enterprise) environments, it is better to have an opportunity exploration mindset as opposed to a risk mitigation mindset. Usually, money is not the best, most effective, long-term reward or motivation for individuals, as stated in other sources. But monetary compensation should be at a comfortable level for the individual, and outstanding performance should be recognized in a way that is personally meaningful for the individual concerned. Whether it is through external validation or through the challenge of the work itself, understanding individually tailored motivations is essential. Another problem can be jealousy within the group. How can jealousy be mitigated to an acceptable level so that it does not jeopardize the group working as a team?

“People who are driven to perform do so based on internal drive, not on external incentives. They want to do a good job.” “People at the Intersection must believe that they will get the reward they deserve for their work – even though no one at the outset knows exactly what the reward will look like.” “If we wish to succeed at the intersection of fields, we have to break away from the very networks that made us successful.” “ ... the prime principle of creativity: You must take risks.

All creativity lies in the unknown, not in the known.” “Take a good look around you and try to spot those things that have become critical pieces of your value network over the years. I am not suggesting that you abandon them, but if you wish to enter the Intersection, you must stop depending on them.” “... the risk of failure [what others may think] can weigh more heavily than what is at risk.” “Loss is more vivid than gain. It is easier to imagine. It is more painful. And we fear it.” [This can influence our choices in an irrational way.] (Johansson, 2004, pp. 140, 141, 146, 147, 156, 157, 163, 174)

One of the best talents of good managers, e.g., group leaders, is to recognize what motivates their staff and to leverage those motivations. One of the best talents of good leaders is to create an environment where risk taking and opportunity pursuit is rewarded in ways that motivate people.

"The best compromises appear to occur at the phase transition between order and chaos...Democracy may be far and away the best process to solve complex problems of a complex evolving society, to find the peaks on the coevolutionary landscape where, on average, all have a chance to prosper" (Kauffman, 1995, p. 28). The edge of chaos is also the point where small changes in a system produce cascades of change consistent with a power law. ... This law is illustrated in nature by performing a classic experiment first conceived by physicist Per Bak in which a grain of sand is dropped continually upon a pile. When a critical point is reached, a grain of sand will trigger either small landslides or even large avalanches with a frequency approximating  $1/x$  where  $x$  is the size of the avalanche (Kauffman, 1995, p. 28). ... One often takes for granted that most natural phenomena are distributed consistent with the normal distribution but, in fact, another distribution more aptly describes them in situations labeled as 'self-organized criticality' (SOC)." "The power law is also known as the  $1/f$  law.": Can we use this idea in predicting that basic human nature will always interfere with group dynamics? It is common, it is indigenous, it is small scale, but can add up to great problems if allowed to go unchecked. What heuristics can inform management techniques for maintaining this critical productive balance point? (Grobman, 2005)

The democratic idea may not always work in small enough groups. Democracy can marginalize the outliers and their potential contributions. Individual “quirks”, tolerated over time, may eventually cause a disastrous confrontation within the group, like the landslide in the sand experiment. Another research topic is the investigation of power law distributions concerning human actions and group dynamics.

"Because [self-organized criticality] SOC systems follow power laws, and because fractals also show a similar mathematical pattern, then it may be the case that many naturally occurring fractals, such as tree growth, the structure of the lungs, and so on, may be generated by some form of self-organized criticality" (Lindberg, 1999). Kaufman suggests that evolving to the edge of chaos gives the [complex adaptive system] CAS a selective survival advantage, compared to

outcome systems that are not at the edge of chaos. He theorizes that it is through the large avalanches, not the small cascades, which result in evolutionary change that survives (which is a direct contradiction of the conventional wisdom that biological evolution resulted from the aggregation of small changes over billions of years). Perhaps this model can be applied to public organization lifecycles and other phenomena as well. In 2001, after reading Per Bak's fascinating book *How Nature Works: The Science of Self-Organized Criticality*, I became excited about applications of his theory in public administration settings. I looked for  $1/f$  law behavior in the magnitude of line items in the Commonwealth of Pennsylvania's FY 2000-2001 state budget and the number of pages of Acts enacted by the General Assembly the previous two years. In neither case did I see evidence that the distribution followed a power law." (Grobman, 2005)

However, there is new research about evolutionary physiological changes occurring within two or three “generations”—not billions of years! How do human systems manifest this? Cultural collapse models demonstrate this effect. Do small groups manifest it, as well? What dynamics are required to reach “criticality”? How many grains of sand can the group handle before the psychological pressure builds and there is a breakdown? This model can be applied to other phenomena, as well, e.g., the American and French Revolutions.

"Where egalitarian cooperation is essential for survival, hoarding and self-aggrandizement are simply not tolerated. It is only in societies already following a trajectory of developing complexity that such tendencies are allowed expression. Why is this? Can it be that the fulfillment of individual ambition, in certain contexts, has society-wide benefits, just as its suppression does in other settings...?" (Tainter, 1988, p. 36)

Outliers can have positive, as well as negative, effects. They can bring new and creative ideas and perspectives to the group, but, that same variety and diversity can cause friction within the group. Sometimes the friction is caused by jealousy, power struggles, turf battles, or a general fear and rejection of ideas not understood. This goes back to basic evolutionary theory, which espouses that organisms are programmed to maximize their potential to succeed in their particular evolutionary niche. Individuals, as a result, are inherently selfish in order to survive. Self-sacrifice and acting for the greater good of the group is a culturally learned phenomenon. Often, when stress is introduced into a system, cultural norms break down and individual programming takes precedence.

### **Individuals**

This problem of sharing information can be addressed in multiple ways. One of the most fundamental would be at the individual and small group interaction level. There are many factors that contribute to one's unique individuality that can cause problems for intra-group and inter-group interactions. These include psychological, sociological, and even biological factors.



"How does the brain, with its diverse and distributed functions, come to arrive at a unified sense of identity? ... Could we speak of a person's brain without, ultimately, speaking of the person? ... Belief in an inner essence, or central core, of personhood, was called 'ego theory'. The alternative, 'bundle theory', made more neurological sense but offended our deepest intuitions. ... [i.e.,] An embodied brain acts, thinks, has certain experiences, and that's all. ... The idea that certain forms of insanity were 'disorders of the self' had been around for two centuries and more, but now the concept was being refined. The core deficits of autism and schizophrenia, for example, were revealed as faults in the brain circuits underlying personal awareness. ... In the process, it gave definition to that fundamental unit of social intercourse: the person. Just as the brain had evolved systems for guiding interaction with the physical world so, we rather belatedly realised, it had also evolved specialised mechanisms for enabling the interaction of 'self' and 'other'." (Broks, 2006)

This has implications for the basis of Aspergers/Autism Spectrum Disorder and the reason why some people, in general, can't understand or are less willing to accept others' perceptions of reality. Again, consider "instinct" as being just patterns of behavior established over time through repetition. Thus, it is hard to break such ingrained response patterns. Couple that with the way the brain is hardwired and one can begin to see the difficult underlying dynamics involved with group interactions, perhaps putting in question many management theories proposed over the course of the past several decades.

"The discovery of 'mirror neurons' in the 1990s ... Mirror neurons were activated not only in response to self-generated behaviour (reaching for an object, say) but also in response to actions performed by other individuals. Pain and emotional behaviour were similarly mirrored. ... we were a composite of two phantoms. ... the so-called 'minimal' or 'core' self - was, ... 'a transient entity, recreated for each and every object with which the brain interacts'. ... The other phantom was the 'extended' self: a unified, continuous being journeying from a remembered past to an anticipated future, with a repertoire of skills, stores of knowledge and dispositions to act in certain ways. This 'autobiographical' self emerged from language and long-term memory networks. ... we are all just a stumble or burst blood vessel away from being someone else. Selfhood is malleable. ... The neurological diseases ... tended to [show that] one occasionally saw what appeared to be clear dissociations of the two 'selves'. ... [Also,] Now it is not so clear where one person ends and another begins." (Broks, 2006)

This recent research is exciting because it gives some physiological basis and understanding for what may underlie some destructive group dynamics.

"Not everyone, however, sees fundamentalism as inherently damaging. Some scholars believe that, by offering psychological security and social identity to people otherwise adrift, it offers the best hope for a stable future. 'A case can be made that someone with a strong, confident religious identity is better qualified to

survive in a globalising world of shifting and collapsing identities,' says historian Philip Jenkins of Pennsylvania state University. ... Some scholars even argue that fundamentalism is religion's last hurrah. Jenkins says the history of movements such as Calvinism suggests that fundamentalist movements eventually become secular. Fundamentalism, he suggests, may be a 'necessary way station on the road to enlightenment'." (MacKenzie, 2005)

Fundamentalism is a “safe haven” in a world of uncertainty and confusion; one doesn’t have to think or understand; one just has to believe. There is a strong analogy here (again involving rigidity of thought) that informs us about why “heroes” in small working groups may be ostracized. They may perceive solutions or problems in ways not often seen or understood by the rest of the group and threaten the common view of the way things should proceed in the workplace. Many of the ideas espoused by (Ludeman and Erlanson, 2004) about coaching Alpha Male executives apply here, as well.

"Building learning organizations requires personal transformations or basic shifts in how we think and interact. As W. Edwards Deming says, nothing happens without 'personal transformation.' And the only safe space to allow for this transformation is a learning community. But at the heart of any serious effort to alter how we operate lies a concern with three dysfunctions of our culture: fragmentation, competition, and reactivity. ... [Fragmentation] The walls that exist in the physical world are reflections of our mental walls. ... [Competition] Fascinated with competition, we often find ourselves competing with the very people with whom we need to collaborate. ... Our overemphasis on competition makes looking good more important than being good. The fear of not looking good is one of the greatest enemies of learning. To learn, we need to acknowledge that there is something we don't know, and to perform activities that we're not good at. [Reactivity] We have grown accustomed to changing only in reaction to outside forces, yet the well-spring of real learning is aspiration, imagination, and experimentation." (Senge, [Date?])

Thus, it would seem that group performance can be improved, particularly in utilizing outliers, or the more creative thinkers in the organization or group, by training everyone, including the outliers themselves, in the three tenets of a learning organization culture, viz., integration, collaboration, and proactiveness.

"Are you...arrogant? No one likes a know-it-all. But believing in yourself and your own personal view can really work to your benefit, says psychologist Jonathan Fugelsang from the University of Waterloo in Ontario, Canada. ... Self-belief can make for better managers and decision makers because self-assured people feel able to take the initiative, make choices, and don’t feel the need to surround themselves with committees and supporters in order to get things done. According to a study by Fugelsang and colleague Kevin Dunbar of Dartmouth College in Hanover, New Hampshire, our brains are predisposed to learn information consistent with our convictions. ... Belief in your own abilities clearly helps. ... Another benefit of strong beliefs is that they can make people more

authoritative – and that makes other people believe what they are saying. Studies ... show that people are more likely to believe an untrue fact if they are told it by someone in authority. So if you need to convince someone ..., you had better be a little arrogant and authoritative. And make sure you believe in them yourself." (Phillips, 2006)

Here's a paradox: The more creative individuals (outliers) are more often right while others are not. The outliers process information faster, solve problems faster, and more correctly than others. They are impatient with others who cannot think as fast (Ludeman and Erlanson, 2004). With respect to perceived arrogance, what can help these creative outliers who are so valuable to a team to be able to see how some of their behaviors may be perceived negatively by the rest of the group? As stated already their being so different can trigger other unwanted behavior by the rest of the group and interfere with the team progressing successfully towards their stated goals.

### **Trust**

A number of interesting questions can be posed. How does one help individuals trust others with whom they work or interact? How does one build bonds within groups to allow them to work together well instead of competing, or worse, sabotaging operations through passive aggressive behavior, for example? Can one "shape" physical and/or virtual working environments to harness the natural motivations of people in positive ways that will mitigate their tendencies to be distrustful and compete with one another? If so, what does this suggest about improving performance within their extended operational networks? Do small group dynamics scale to the larger organization and/or an encompassing enterprise? What "good traits" might people have in common that address this issue? For example, is there a natural tendency for self-actualization once the more basic personal needs are met? What type of individuals can achieve that final step in Maslow's Hierarchy of Needs? How might one motivate individuals or shape their behavior, leveraging these common good traits, to achieve or approach organizational or institutional goals?

"The study results point to two specific types of trust that are instrumental in the knowledge sharing process: benevolence-based trust and competence-based trust. When most people think about trust, they are typically thinking of its benevolence-based form—in which an individual will not intentionally harm another when given the opportunity to do so. However, another type of trust that plays an important role in knowledge sharing is competence-based trust. Competence-based trust describes a relationship in which an individual believes that another person is knowledgeable about a given subject area." (Levin, 2002, p. 2)

Knowledge sharing depends on competence- and benevolence-based trust, i.e., when someone is believed to be knowledgeable about a given subject area, and will not intentionally harm another when given the opportunity to do so.

"Executive Overview: In many organizations, informal networks are the primary means by which employees find information, solve complex problems, and learn how to do their work. Two forms of interpersonal trust—trust in a person's competence and in a person's benevolence—enable effective knowledge creation and sharing in these networks. Yet, though conceptually appealing, trust is an elusive concept that is often difficult for managers to influence. We conducted interviews in 20 organizations to identify ways in which interpersonal trust in a knowledge-sharing context develops. Based on this work, we summarize behaviors (e.g., discretion, consistency, collaboration) and practices (e.g., building shared vision, ensuring transparency in decision-making, holding people accountable for trust) for managers interested in promoting trust (and thereby knowledge creation and sharing) within their own organizations." (Abrams, 2003)

Informal interpersonal networks are the primary means for finding information, learning, and solving complex problems. Interpersonal trust includes two basic forms, coming from competence and benevolence. Often it is difficult for managers to influence trust among the staff.

From start of Chapter 3, p. 19: "Perhaps there is no single variable which so thoroughly influences interpersonal and group behaviour as does trust . . ." (Golembiewski and McConkie, 1975, p. 131) "We inhabit a climate of trust as we inhabit an atmosphere and notice it as we notice air, only when it becomes scarce or polluted." (Baier, 1986, p. 235) (Marsh, 1994)

Trust is a big influence on interpersonal and group behavior just as cultural (lack of) trust prevents groups or organizations from sharing information. In (military industrial complex) classified worlds, those with the special clearances and particular domain experience do not trust anyone without those same "tickets" and "branding". There are also cultural barriers between intelligence agencies. Many other government agencies probably suffer from the same problem, e.g., consider the situation of hurricane Katrina. In the 1960s Soviet computer technology was "classified", while similar developments in the U.S. were largely "open". This likely prevented the Soviets from advancing at anything approaching the high rate of technological advance as the U.S.; they "hid" information from themselves, and this mentality was possibly a contribution to ultimately losing the Cold War. On the positive side, enabling trust by removal of "need-to-know" helped greatly in the development of DoD's Intelligence Information System (DoDIIS).

"We are concerned with interpersonal trust as a central characteristic of relationships that promotes effective knowledge creation and sharing in networks." "The need to keep confidences is particularly important in the advice-seeking context, because the most useful advice often comes about as a result of a back-and-forth sharing of all potentially relevant information." "It just seems safer to play your cards close to your chest, not to talk or stick your neck out. You don't get anything but grief if you do." "Many companies can say that they value integrity; not as many will put their employees through training; and few will formulate a working evaluation system and tie in compensation." "In

many ways, non-work connections made other people seem 'real' and therefore approachable and safe." (Abrams, 2003, p. 65, 66, 69-71)

Interpersonal trust promotes knowledge creation and sharing. The best advice comes from sharing all relevant information but confidences must be kept. Often it is safer to withhold information because one often gets penalized, and rarely rewarded, for sharing.

"In the interviews, we learned that people look for six key behaviors when assessing trustworthiness:

1. Demonstrate what you know
2. Deliver information clearly and consistently
3. Display consistency between actions and words
4. Respect others' vulnerability and confidential information
5. Broaden the conversation beyond work
6. Recognize and share what is valuable" (Abrams, 2005)

Generally, people look for certain behaviors in assessing trustworthiness.

"Interviewees had six suggestions for management and company policy to foster trust in the organization:

1. Allow appropriate latitude in completing tasks
2. Create an environment where people can ask questions and learn from mistakes
3. Allow time and space for people to get to know each other
4. Hold employees accountable for demonstrating the value of trust
5. Apply standards and policies fairly
6. Transparency demonstrates to employees that the organization trusts people and treats them fairly" (Abrams, 2005)

Overall, people understand how management and policy can foster intra-organizational trust.

"Individual trust is distinctly different from organizational trust. (Kramer, Brewer & Hanna, 1996) The complexity of an organization, varied personalities, organizational structure, budgets and politics can perturb a trust relationship immensely. Individuals in each organization may trust each other, but that does not guarantee inter-organizational trust. While individual trust is easily measured in a succinct series of interactions and performance, organizational behavior is far more complicated. ..." (Baron, [Date?], p. 5)

Individual trust within an organization is different than inter-organizational trust; the latter is more complex.

"The Rules of Trust: Common sense tells us that there are seven cardinal principles of trust we should keep in mind: Trust is not blind. It is unwise to trust people whom you do not know well, whom you have not observed in action over time, and who are not committed to the same goals. ... " "Trust needs boundaries.

Unlimited trust is, in practice, unrealistic. ... Freedom within boundaries works best, however, when the work unit is self-contained, having the capability within it to solve its own problems. Trust-based organizations as a result, reengineering their work, pulling back from the old reductionist models of organization, in which everything was divided into its component parts or functions." (Handy, 1995, pp. 44, 46)

Just as an organization needs both some hierarchical control, as well as some decentralized structure to facilitate individual and group interactions, so too, does trust need boundaries but freedom within those boundaries, e.g., pulling back from the reductionist organizational model.

"Trust is tough. ... When trust proves to be misplaced-not because people are deceitful or malicious but because they do not live up to expectations or cannot be relied on to do what is needed - then those people have to go, ... Therefore, for the sake of the whole, the individual must leave. Trust has to be ruthless. ... It is because trust is so important but so risky, that organizations tend to restrict their core commitments to a smaller group of what I call trustees." (Handy, 1995, p. 46)

Trusting others can make one more vulnerable. In organizations, vulnerability can affect your job performance, reputation, and even whether or not you remain employed. But, without it the organization cannot function well.

"Trust needs bonding. Self-contained units responsible for delivering specified results are the necessary building blocks of an organization based on trust, but long-lasting groups of trustees can create their own problems, those of organizations within the organization. For the whole to work, the goals of the smaller units have to gel with the goals of the whole. Paradoxically; the more virtual the organization, the more its people need to meet in person. ... Trust is not and never can be an impersonal commodity." (Handy, 1995, p. 46)

Trust needs bonding, particularly among individuals between organizational groups.

"Trust needs touch. Visionary leaders, no matter how articulate, are not enough, A shared commitment still requires personal contact to make it real. ... Paradoxically, the more virtual an organization becomes, the more its people need to meet in person, The meetings, however, are different. They are more about process than task, more concerned that people get to know each other than that they deliver. Videoconferences are more task focused, but they are easier and more productive if the individuals know each other as people, not just as images on the screen." (Handy, 1995, p. 46)

Trust needs personal contact outside of meetings to develop.

## Conclusion

Many problems concerning organization constructs, leadership roles, decentralization, group dynamics, individual behavior, and trust are raised. Although not all these issues are new, we feel they are not receiving enough attention in the context of engineering net-centric systems. It seems clear that complexity theory and/or systems science is not only applicable but perhaps critical in solving some of these problems.

We suggest several areas of research that could greatly improve progress towards the goal of the effective/efficient development and sharing of information in net-centric environments. The results of such research also could positively impact knowledge management and the return-on-investment in systems engineering in general.

1. What are the most effective/efficient combinations of the respective roles of hierarchy and decentralization in a hybrid organization?
2. Assuming the communications functions of the hierarchical and decentralized portions of a hybrid organization are distinct, how should these functions be partitioned?
3. What would help accelerate the adoption of a hybrid organization other than just waiting for a new generation of leaders for this mindset to change?
4. What factors explain the prevalent emphasis on risk management instead of opportunity (or uncertainty) management? How can this be rectified?
5. What heuristics might help leaders know when it is appropriate to make decisions?
6. How many relationships can people realistically handle in a net-centric environment?
7. How does a leader of a small group (that includes an “outlier”) facilitate trust and collaboration while mitigating fear and subtle/overt intimidation tactics?
8. Can neuro-anatomy/evolutionary biology research be used in conjunction with research about mirror neurons to develop new training programs that get people to “break” rigid constructs of reality and their “instinctive” reactions that may no longer be appropriate?

One more practical suggestion to start: We recommend up-front training in group dynamics for the collections of staff that ultimately will be formed into groups. One emphasis should be on how to: a) embrace outliers to take advantage of their ideas; and b) help outliers be perceived as less abrasive/arrogant and more acceptable to the group. More generally, this type training could be done routinely for all staff.

9. What physical and/or mental activities for a small group most strongly promote or build trust?
10. What are some good techniques for balancing the strength of diversity with the potential for conflict within small groups?
11. How can jealousy within a group be mitigated to an acceptable level so that it does not jeopardize the group working as a team?
12. What relevance has the power law distribution to human actions and group dynamics? What dynamics and/or psychological accumulation of events are required to reach a breaking point?
13. How do human systems manifest evolutionary physiological changes within a relatively short time-span?
14. What are some good ways of changing one's "instinct" considering the physiology of how the brain is "wired".
15. With respect to arrogance, what can help these creative outliers see how some of their behaviors may be perceived negatively by the rest of the group?
16. How can one improve the performance of extended operational networks through influencing individual behavior?
17. To what extent might individual behavior and small group dynamics scale to the larger organization and/or an encompassing enterprise?
18. How might one motivate individuals or shape their behavior, leveraging common good traits, to approach organizational or institutional goals?

The authors welcome constructive suggestions from readers of this paper. Please E-mail us at [bewhite@mitre.org](mailto:bewhite@mitre.org) and [gay.mccarter@gmail.com](mailto:gay.mccarter@gmail.com).

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## Biographies

B. Gay McCarter received her M.S. degree in Counseling Psychology from Florida State University and her M.F.A. degree in painting from the Memphis College of Art. She has worked in both the private and non-profit organizational arenas as Assistant Director of a corporate management assessment program, and as Executive Director of the Jackson (Tennessee) Symphony Orchestra. Since 1990 she has worked as an award winning artist focusing on human dynamics, as well as exploring the inherent effects of complexity and the "edge of chaos" on human consciousness. Most recently, as a member of the International Council of Systems Engineering's (INCOSE's) Systems Science Enabler Group (SSEG), Ms. McCarter is concentrating on researching people-centered strategies for complex organizational systems. This involves individual psychologies, organizational transformations, and social dynamics utilizing multiple scales of creative, intellectual, and organizational management capacities. Currently she is co-authoring three technical papers on the topic of complex systems and the impact of psychological and sociological variables.

Brian E. White received Ph.D. and M.S. degrees in Computer Sciences from the University of Wisconsin, and S.M. and S.B. degrees in Electrical Engineering from M.I.T. He served as an Air Force Intelligence Officer, and for 8 years was at M.I.T.'s Lincoln Laboratory. Dr. White spent 5 years as a principal engineering manager at Signatron, Inc. In his 24 years at The MITRE Corporation, he has held a variety of senior technical staff and project/resource management positions. He is presently Director of MITRE's Systems Engineering Process Office. He is an Assistant Director of INCOSE (for Systems Science) and is leading the Systems Science Enabler Group (SSEG). His most recent conference publications discuss the fostering of intra-organizational communication of enterprise systems engineering (ESE) practices, a lexicon of ESE terms, a regimen for complex systems engineering, and enterprise-scale opportunity and risk.