FRACTAL ORGANIZATION THEORY

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ABSTRACT

Top-down hierarchies are typically characterized by command-and-control systems of authority that create harmful stress and internal competition for advancement within organizations. The pervading perception is of "limited room at the top," where positions of authority become scarce resources. Members withhold or hoard information by focusing competition energy internally rather than externally, creating silos of information and causing the negative stress reflected in absenteeism and higher healthcare costs. Voluntary turnover creates brain drain as creative individuals tire of internal politics and seek more harmonious work environments. "Change management" is an issue, as members' natural compulsion to provide feedback and insights are squelched by management dictates. The triangular shapes of top-down hierarchies are non-random and limited, according to Benoit Mandelbrot, which may explain why top-down organizations typically grow through acquisitions rather than by expanding from within.

In the equations of living systems in Nature, the mathematical constants are both random and scalable, which ensures pattern integrity during evolutionary adaptations. Fractal Organization Theory recognizes an emergent human operating system that is creative, adaptive, healthy, and evolutionary. The qualities of a fractal organization include shared purpose and values that create pattern integrity; universal participation in ideas and solutions for continuous improvement; decision making at functional levels; leadership devoted to employee development as a source of intellectual capital; and competition energy directed outward instead of inward. In fractal organizations, resource allocation is based upon desired outcomes and information is shared efficiently through daily interactions and regular conversations, which generate ideas and enable economical development and delivery of products and services. Relationship development enables the effective flow of information between individuals and among teams. At all scales of a fractal organization, members share information iteratively and make decisions collectively in response to changing conditions.

Keywords: fractal organizations, living systems, information dynamics, natural hierarchy

INTRODUCTION

Operating in a natural hierarchy comes naturally to humans—we all have a right to be here after all. Top-down systems are unnatural hierarchies that emerged to manage large projects involving many humans, most of whom were decidedly less evolved than people are today. Evolved humans, whose brains have developed a greater ability to make decisions, resent being told what to do and know intuitively that their perspectives matter. Authoritative systems perfected in the early part of the 20th century generate resentment and separate the members of organizations unnaturally. Employees in top-down structures tend to hoard information as power or leverage in gaining internal advancement, directing their competition energy inward and tearing asunder the pattern integrity of the organization. As more humans tire of the pathologies fostered in these out-dated governance systems, growing numbers of organizations will adopt natural hierarchy systems as an alternative. Most startup companies already function this way, as limited human

resources require greater collaboration and role-playing, yet many tend to adopt a top-down structure when they start to grow because it's the familiar option.

In her seminal book *Leadership and the New Science,* Margaret Wheatley introduced the concept of the fractal organization: "The very best organizations have a fractal quality to them. … There is a consistency and predictability to the quality of behavior. … Fractal organizations, though they may never have heard the word *fractal,* have learned to trust in natural organizing phenomena." (Wheatley, 1994, 132). When humans are open with perspectives and engaged with participation in collective creative efforts, we naturally thrive and create best outcomes together. The emergent collective behavior has pattern integrity, which generates trust both internally with members and externally with the public. All of the information necessary for making good decisions is available and flowing throughout the organization's structure, which ensures better use of resources and greater success.

The phrase "fractal organization" is inspired by the mathematics of Benoit Mandelbrot, the father of fractal geometry. Mandelbrot and others, including the early 20th century mathematician Gaston Julia (an inspiration to Mandelbrot), wanted to understand the geometry of Nature and how the patterns we see all around us retain their integrity over time and through evolutionary changes. Nature's operating system, as it were. A plethora of scientific and organizational literature has helped to define fractal organization theory, including the works of systems thinkers such as past ISSS president Debora Hammond, who, in her comprehensive discussion on the history of general systems theory emphasized "the central importance of reexamining the nature of management and leadership in complex social and technological organizations…" (Hammond, 2003, 260) As management authority in top-down organizations is often dictatorial, information flows are limited to one direction and decision making is constricted. The quality of decisions that social systems make determines whether the outcomes best serve their population. Fractal organization theory, inspired by systems theory, fractal geometry, quantum mechanics, information dynamics, sociobiology, epigenetics, cosmology, and evolutionary biology, describes how natural organizational structures mimic systems in Nature and enable relationships to thrive.

In top-down hierarchies, systemic issues such as internal competition, unwanted turnover, and unhealthy workers are commonplace, whereas fractal organizations are distinguished by happy, healthy employees because of their emphasis on positive information flows and relationship structures that create best outcomes. These are often the organizations voted "Best Places to Work," as their members share a purpose and core values that unite their efforts and create the pattern integrity or self-similarity that characterizes a fractal organization. Members feel appreciated for their efforts and supported by their workplace family, which boosts health naturally (a happy heart is a healthy heart). The quality of iterative information flows, from the edges of the organization to the center and back, enables successful relationships throughout; leaders are devoted to inspiring, guiding, mentoring, and empowering the "managers of things and processes" (everybody else). In fractal organizations, relationship development at all scales of the organization unites group efforts around a common purpose and attracts more resources from the external marketplace.

TOP-DOWN SYSTEMIC ABERRATIONS

Throughout history, many societies have used top-down hierarchy systems for projects in construction, farming, and manufacturing among others. Despite the decades-long union movement against wage disparity and poor working conditions, the top-down system was considered operationally effective in the U.S. until the 1950s. During that decade, the field of organizational development (OD) emerged to address systemic issues arising in a variety of institutions, most notably the inability to change in response to external conditions. "Change management" was born of the frustrations leaders in top-down systems faced when decisions made at the top were resisted by those at the bottom. Interestingly, OD emerged soon after the post-WWII G.I. Bill sent soldiers, sailors, and airmen to college and raised the intelligence quotient of thousands of farmhands and workers. As individuals become more educated, their perspectives tend to broaden and they become more capable of participating effectively in collaborative processes. One result of educating the masses is that compliance to the control of others declines proportionate to an increased level of awareness. The smarter we get, the less we want to be told what to do.

Command-and-control systems of authority that characterize top-down hierarchies create harmful stress and internal competition for advancement within such organizations. The 2008 film "Stress: Portrait of a Killer," is based upon the work of Stanford stress researcher Robert Sapolsky (*Why Zebras Don't Get Ulcers*). He documents how British civil service employees at the bottom of the hierarchy suffer stress-related illnesses while those at the top are stress-free—and healthcare benefits are the same for everyone in that system. It seems that situations in which our freedom is limited, in which others try to control our actions, are inherently unnatural and cause disease. The situation seems not to matter much, whether it's a work environment or a prison. Another Stanford researcher, Philip Zimbardo (designer of the infamous Stanford Prison Experiment), observed, "we need to discover the ways in which any given behavioral setting is perceived and interpreted by the people acting within it. It is the *meaning* that people assign to various components of the situation that creates its social reality." (Zimbardo, 2007, 221) When people perceive that others control their reality, whether literally or figuratively, it causes stress.

Negative information dynamics also affect personal health, as they contribute to stress and its dangerous results. Woody Bedell, former director of benefits at the Reformed Church of America (RCA) and Mariette Kaszkin-Bettag, scientific expert at PharmaLex GmbH (Germany) note that, in general, "Excessive work hours (75%), lack of work/life balance (65%), and fears about job loss (64%) are the foremost sources of stress affecting employees in most organizations, and significant gaps exist in companies' actions to reduce these stressors." (Bedell & Kaszkin-Bettag, 2010, 26) While many stress-relief programs offer interventions that can temporarily improve health, eliminating the causes of distress (vs. eustress) dramatically reduces healthcare costs and the need for intervention programs. When organizations do not value their workforce and downsize to save cash during trying times, greater imbalance results as overworked, underpaid, and stressed-out staff become ill from the pressures, in turn escalating healthcare costs. When individuals work long hours to make up for laid-off personnel, they lose the time to exercise and eat healthy, worry over their job security (who's next on the chopping block?), and resent unfair compensation. The costs to an organization are more than just healthcare related. Relationships with customers, vendors, partners, and suppliers also suffer when bitter and overworked individuals express dissatisfaction in numerous ways.

One factor that toxifies relationships in top-down hierarchies is the pervading perception of limited room at the top, where positions of authority become scarce resources for which members compete internally. When competition energy is focused internally rather than externally, members withhold or hoard information as they pursue their personal agendas and limit their organization's ability to be creative, adaptive, healthy, and evolutionary. With few exceptions, most species in Nature cooperate internally in order to compete externally for resources, ensuring the survival of the group. (Lipton, 2005, 42) However, we have been hoodwinked by "survival of the fittest" interpretations of evolution to perceive the opposite.

Evolutionary biologist and epigeneticist Bruce Lipton and transpartisan political advocate and humorist Steve Bhaerman explain in *Spontaneous Evolution* that while this phrase is attributed to Charles Darwin, it was a Malthusian concept promoted by the British aristocracy to justify 17th century enclosure laws. They note Darwin's remarkable detachment from his earlier adherence to that philosophy:

> "In his later years, Darwin moved away from academic Darwinism. Rather than emphasizing survival and struggle, Darwin readdressed his attention to focus on the evolution of love, altruism, and the genetic roots of human kindness. In addition, Darwin began to credit the Lamarckian concept of the environment as the driving force in evolution. Unfortunately, Darwin's disciples thought his new ideas were tantamount to sedition, undermining all that Darwinism had come to stand for. Darwinists simply held on to their version of the theory and dismissed Darwin's later ideas as the consequence of his creeping senility." (Lipton & Bhaerman, 2009, 117)

As emphasized by Darwin's erstwhile rival, Alfred Russel Wallace, natural selection is enabled by the "elimination of the weakest" elements so that the majority may survive. Systems based upon command-and-control combined with opportunistic ideas such as survival of the fittest create cultures of competition that voraciously consume precious resources (including time, money, and innovative ideas) in the interests of the few over the many. Information silos naturally develop in these situations and hinder an organization's ability to compete in the marketplace (without acquiring competitors), because information acquired at the edges of a system (the bottom in top-down hierarchies), which is required for evolutionary change and adaptation to the surrounding environment, rarely flows efficiently to the top. Stress builds among the ranks of employees whose natural impulse to be creative is squandered in such situations, to the ultimate detriment of the organization. Every person holds a unique perspective and gathers information daily, like a bee gathers pollen. If bees don't make enough honey, the hive doesn't thrive in winter. Similarly, when leaders disregard the information that members collect they restrict their organization's ability to make "honey" and must acquire it from outside the organization. Acquisitions and mergers, though commonplace for more than a century, rarely satisfy the needs of all parties involved.

The commonly held belief that competition is "human nature" belies the mismanagement or hoarding of resources at its foundation. Evolutionary biologist Elizabet Sahtouris has studied the effects of this mindset:

> "Our contemporary human society is an interesting test of the Darwinian evolutionary model that has guided its economic organization. We have assumed that competitive individualism, with profits as a bottom line, in leading to a healthy 'survival of the fittest' would somehow benefit us all. But this model

> leads to a ruthless elimination of all but the most aggressive competitors and those who can eke out their existence in noncompetitive roles or in support of the fittest. We are now reaping the unfortunate effects of this model as megacorporations flourish at the expense of a labor force 'downsized' or replaced by competitively cheaper labor in other parts of the world." (Harman & Sahtouris, 1998, 223)

Indeed, as American workers have grown more educated and aware of the value of their labor to an organization's bottom line, they have demanded a fairer share. However, most corporations are chartered to maximize profits, not share them. As Ellen Hodgson Brown notes in *The Web of Debt,* "Corporations are feudalistic organizations designed in the structure of a pyramid, with an elite group at the top manipulating masses of workers below. Workers are kept marching in lockstep, passing orders down from above, out of fear of losing their jobs, their homes, and their benefits if they get out of line." (Brown, 2012, 100) American companies that grow tired of worker demands for profit-sharing will "outsource" their manufacturing or customer service units to countries with lower standards of living and workers who are cheaper to employ. Over time, these workers will also tire of the discordant situations that unfold in these unnatural systems and heed their natural instincts to seek autonomous solutions.

Workers have unionized to create a collective voice and participate in making certain decisions, often to the chagrin of management. The successful Spanish cooperative, Mondragón, adopted a top-down system in its early years (1940s) to manage its factories and was eventually confronted with potential unionization by the early 1970s. According to researchers William Whyte and Kathleen Whyte, a newly appointed general manager, Javier Mongelos (a physicist by training), sought to understand the underlying reasons for worker dissatisfaction. He concluded that the "growing tensions in the workplace revealed the inherent contradiction between the democratic system of cooperative governance and the rigid and authoritarian system for organizing work relations according to the scientific management principles of Frederick W. Taylor." Mongelos's recommendation: "Management should explore possibilities of creating new forms of work organization that would be economically efficient yet more in harmony with the social values on which the cooperative movement was based." (Whyte & Whyte, 1998, 113) He was keenly aware that relationships were determining factors in successful outcomes.

As a result, and with the input of the workers themselves, Mondragón began a new experiment in a thermometer factory with one small group of assembly-line workers:

> "The experiment began [in 1973] with the removal of the 7.5-meter-long conveyer belt and the substitution of a 2.8-meter-long work table. Workers were seated around the table and could now set their own work rhythm and freely exchange information and ideas. The table provided more work stations than workers so that people needed to move around from time to time to advance work on lagging operations and to avoid delaying interrelated tasks. All workers were expected to perform all the tasks and could rotate tasks as they themselves decided. As they gained skill and confidence in this new way of working, the workers began to take over such supervisory and staff functions as requisitioning tools and materials and recording their output." (Whyte & Whyte, 1998, 116)

The "experiment" eventually rolled out to the entire cooperative, and in 1985 the personnel department reported: "Quality improved in direct relation to the complexity of the apparatus being assembled, due to better information regarding the work. Feedback is the basis for group self management." (Whyte & Whyte, 1998, 117) The increased level of team communication

created a situation in which the company was able to eliminate supervisory positions and trust their teams to get the work done while improving their own efficiencies. Iterative information flows determine the quality of communication in any process or endeavor. Top-down hierarchies tend to inhibit the flow of information from workers to management and thus limit functional workers' ability to expand and grow intellectually, while fractal organizations follow the laws of Nature in which information and resources flow in the same channel. (Custer, 2007)

Because top-down organizations tend to pit management against workers, they create discord and internal battles. Unions often mitigate such situations, yet they represent another layer (and cost center) between the two sides. To avoid the costs of unions or the demands of workers for value-based compensation, many companies have relocated manufacturing facilities overseas and hired foreign workers who are willing to work for a smaller percentage than their American counterparts. Such goods are shipped back to the U.S. tariff- and employment-tax-free, draining this country's economy and devastating many communities that grew reliant upon industry as generations of workers followed their parents into the same or similar factories. For many people, this guarantee of security keeps them healthy and happy; the American steel corporation, Nucor, has core values that include no layoffs and guaranteed future opportunities for Nucor employee offspring, provided they continue to emphasize worker-driven innovation. (Iverson & Varian, 1998, 84) Nucor has a flattened hierarchy, although founder Ken Iverson claims they have "destroyed" hierarchy by empowering their production workers, engineers, and inspectors to continually regenerate and refine their product line. Nucor is the largest producer of recycled American steel products and limits the size of their plants to 150 persons in order to monitor the flow of information. They know instinctually that every one-to-one relationship can create "noise" in their situation, so personal connections really matter.

THE CONSTANT: SHARED PURPOSE AND VALUES

Fractal organizations typically keep members connected through shared purpose and values, which constitute the "constant" in their fractal equation. Fractal patterns are based upon a formula that iterates and creates pattern integrity, beginning with the constant or strange attractor and evolving over time based upon changing environmental conditions. Mandelbrot rediscovered the fractal formulas of Gaston Julia, a French mathematician who was working at the turn of the last century without the benefit of computers and fell into obscurity. Mandelbrot composed a mega-fractal now referred to as The Mandelbrot Set from a variety of formulas, including those of Julia. In *The Fractal Geometry of Nature* (1982), Mandelbrot provides the basic Julia set formula that illustrates this iterative equation:

$$Z \rightarrow Z^2 + C$$

Z *becomes* Z^2 + C and continues to iterate and expand the fractal pattern each time it is squared, which ensuring its pattern integrity while allowing for the unexpected.

In fractal organizations, Z represents any individual and is the variable in the equation. The squaring of Z represents the action of dedicated leadership to furthering Z's personal growth and development. C is the constant, the shared purpose and values that maintain the pattern integrity while allowing for unique individual expression. C is akin to the strange attractor that initiates the chaos that unfolds as a fractal pattern over time in Nature and in those remarkable computer-generated images created by artists since the mid-1980's after Mandelbrot's book was published.

Each fractal pattern must begin with a strange attractor, just as every modern successful enterprise must have a shared purpose that encompasses the collective effort. One of the first researchers to write about the importance of shared purpose was Peter Senge, well-known systems thinker and developer of the "learning organization" concept. In his influential work *The Fifth Discipline*, Senge emphasizes "shared vision changes people's relationship with the company. It is no longer 'their company;' it becomes 'our company.'" (Senge, 1990, 208) A sense of ownership is necessary if individuals are to be personally responsible and accountable for their actions and communications with others. Top-down environments generally discourage personal responsibility because they concentrate decision making in layers of management who then delegate tasks and responsibilities to workers. Senge has devoted his life to promoting and training leaders for learning organizations that evolve and adapt to changing conditions. He believes that organizations can change and that "shared vision is the first step in allowing people who mistrusted each other to begin to work together. It creates a common identity. In fact, an organization's shared sense of purpose, vision, and operating values establish the most basic level of commonality." (Senge, 1990, 208)

FRACTAL RELATIONSHIP STRUCTURES

The repeating fractal patterns in flora, fauna, geography, and galaxies illustrate the expansion and flow of information within hierarchies of matter/energy. Fractal phenomena depend upon iteration and feedback loops to ensure ongoing evolutionary change, and a variety of input can lead to many varieties of a species. Oak, for example, has evolved more than 400 types of trees that all have, at their essence, oak-like qualities. In human organizations, maintaining a fractal pattern integrity requires two-way communication between team members, individuals and leaders, and among leaders themselves. Relationship structures that enable equanimity in communication practices encourage each person to play the role of information resource, regardless of their position in the hierarchy.

The idea is relatively new that the geometry of an organizational structure could affect individual connections and be the foundation for the systemic behaviors plaguing modern organizations. For the past several decades, many researchers have focused on personality as the root of our problems, designing ever more clever tests to determine whether individuals are good fits. As a result of this perception and their lack of methods for building trust, companies today resort to background checks to defend against nefarious applicants. While diagnostic tools as the Myers-Briggs Type Indicator are enlightening, they are not and never will be a lasting solution for overcoming organizational dysfunction. As Brian Martens (a graduate in Hammond's Organizational Development program at Sonoma State University) noted, "Instead of focusing on specific organizational or individual problems, leadership can start to understand the interrelatedness between the individual and the organization." (Martens, 2011, 4) The ways in which individuals interact with their environment at work determines the quality of outcomes. When leaders engage in mentoring team members and improving the quality of communication in their organizations, they help birth innovations through individual and team accomplishments.

To change the perspective of limited room at the top and vanquish the personal agenda, a new structure is needed to replace the top-down model; different types of organizations will display a variety of organizational structures. Many organizations already have flattened their hierarchies in an effort to deal with systemic issues, and sometimes this effort is good enough. In a hospitality company, for example, fewer layers of management are necessary as most of the

work is functional and customer-oriented. To further diminish the tendency toward internal competition, forward-thinking organizations may adopt an "in-out" pattern instead of top-down. For a manufacturing company, the center of the organization is where central leadership makes decisions about big-picture issues. At the edges of the organization are the functional staff who face customers, vendors, and partners and make decisions on-the-spot about their situations. In the middle are production personnel who design, build, and innovate product development and need input from both the center and the edges. Leaders in all positions ensure the flow of information from the edges through the middle and into the center as well as the flow of resources from the center all the way through to the edges.

Some organizations use "matrix" designed org charts that map relationships between numerous principles, and this seems to work well in architectural and engineering firms where partners collaborate on sequential projects. Start-ups that don't wish to mimic top-down cultures as they grow rarely choose the matrix because people in most organizations have differing levels of expertise. The fractal organization is a new and different way of envisioning the networks of relationships and how information flows in situations. The first fractal "org chart" that I imagined resembled the Milky Way galaxy. Benoit Mandelbrot, the father of fractal geometry, described the macro fractal nature of galaxies in *The Fractal Geometry of Nature*: "…[C]lustering [of stars into galaxies and of galaxies into galaxies] remains peripheral to astronomy and to astrophysics as a whole. The basic reason is that no one has yet explained why the distribution of matter falls into an irregular hierarchy." (Mandelbrot, 1982, 84) Perhaps this is because of the way taxonomies were developed to suggest larger beings as superior to smaller. Our approach to Nature, as something to be controlled rather than cooperated with, reveals this perception.

When we attempt to control anything or anyone we disrupt the pattern integrity of that system. The pattern integrity is the fractal formula, which evolves towards best outcomes (continual growth and renewal for as long as possible) when unfettered. Everything we see in the natural world around us is based upon a fractal formula, including trees, plants, animals, and insects; geographical formations such as mountains, canyons, and coastlines; and water formations such as clouds, hurricanes, waves, eddies, and tornadoes. Mandelbrot defined two types of fractal patterns, random and nonrandom. Randomness is one characteristic of chaos theory, in which "strange attractors" evolve to exhibit patterned order. Theoretical physicist Michel Baranger describes the difference between random and nonrandom fractals: "For the simplest fractals like the Cantor set and the Sierpinski triangle, successive enlargements keep reproducing always the same structure: these fractals are self-similar [nonrandom]. This is not true of the Mandelbrot set, for its successive enlargements bring an element of surprise and delight." (Baranger, 2009, 5) Random fractal patterns such as the celebrated Mandelbrot set are "chaotic" in nature. Fritjof Capra notes that fractal geometry "was invented independently of chaos theory … and would provide a powerful mathematical language to describe the fine-scale structure of chaotic attractors." (Capra, 1996, 137) Fractal organizations are more chaotic and open to environmental changes, which gives them a self-organizing quality. Edge groups are more likely to take day-to-day decision making into their own hands, without seeking approval from central leadership. In general, this idea is anathema to managers in top-down hierarchies, as decision making is a source of power and control.

When pondering the Sierpinski Triangle, a nonrandom fractal and the closest geometrical equivalent to a top-down hierarchy structure, Mandelbrot noted that "the nonrandom fractals' essential failing is that they are not symmetric enough. Second, a nonrandom fractal cannot be uniformly scaling…" (Mandelbrot, 1982, 205) In geometry, non-uniform scaling describes objects that change shape as they expand, which means they lose pattern integrity. Top-down hierarchies constrain the potential growth of individuals as opportunities to advance are limited. The majority of workers often remain in fixed positions and bide their time toward retirement, if they work for an organization that manages to survive changing market conditions through mergers and acquisitions. The need to innovate and keep up with constant change is an ever greater challenge, as collective wisdom and the expansion of information drive the desire and need for continuous improvement.

Fractal organizations enable expansion while maintaining pattern integrity. As an organization grows, new branches or arms form that allow individuals to take on new responsibilities and grow as individuals, which is our natural propensity. As Ken Iverson, the visionary leader of Nucor Corporation, so eloquently stated:

> "The great and terrible irony of modern business is that so many managers feel overburdened with responsibility, while so many employees feel unchallenged and unfulfilled in their jobs. The way to a happier and more prosperous state is clear: Concede once and for all that employees, not managers, are the true engines of progress, and dedicate your management career to creating an environment in which employees can stretch for higher and higher levels of performance." (Iverson & Varian, 1998, p. 98)

Nucor Corp. produces steel products in a variety of dispersed locations, and as workers drive innovation, their supervisors work alongside them. Teams are self-managed, pressure to perform comes from within, and they share in the profits they create from their combined productivity. (Iverson & Varian, 1998, 109) "Above" the supervisors are the plant general managers, who are also officers in the corporation. Limiting levels of management has helped Nucor to stay nimble and implement ideas and technologies driven by the workforce itself:

> "In most corporations, in fact, a command-and-control mind set has been in place for so long, it may not be easy to entice employees into sharing more of their genius. In contrast, we built Nucor under the assumption that most of the 'genius' in our organization would be found among the people doing the work. From the outset we shaped our business to let employees show management the way to goals that once seemed unreachable." (Iverson & Varian, 1998, 91)

Nucor is the one of the most successful American steel corporations, ranking 138 in the Fortune 500 2012 list, and is North America's largest recycler of industrial materials. (Nucor website, 2012)

FEEDING BACK INFORMATION FROM THE EDGES TO THE CENTER

In Iverson's book *Plain Talk* (1998), he devotes an entire chapter to "Destroying Hierarchy." A self-described maverick, Iverson believes that "by clinging to the vestiges of 'command-and-control' management, a business blocks the vast majority of its people from making those and other critical contributions." (Iverson & Varian, 1998, 93) Iverson also understood the importance of information feedback loops, critical for the growth of random fractal patterns: "When you make employees primarily responsible for the success of a business, they demand more access to information. That's only natural. They need it. At Nucor, our official information

policy is to 'share everything.'" (Iverson & Varian, 1998, 95) Sharing information not only reduces uncertainty, it also expands the perspectives of everyone in the feedback loop. In the dynamics of information flows, each person holds a unique perspective. As access to information increases, so does a person's ability to see the bigger picture and fit puzzle pieces together. In this way, members of an organization come to feel a sense of ownership, regardless of whether the company is employee-owned or not.

Employee ownership does have obvious benefits, however. One of the most successful consulting firms of the 20th century, Science Applications International Corporation (SAIC) grew to an $8 billion firm under the leadership of Robert Beyster, of a similar ilk as Iverson. Beyster was highly aware of the importance of structure in designing and running thriving operations. In his book *The SAIC Solution,* Beyster declares: "the impacts of a company's initial design can reverberate for decades into the future, and the basic structure (not to mention its employees) can be extremely resistant to change once it has been established. That design should be compatible with its operating philosophy as well as the types of markets it hopes to capture." (Beyster & Economy, 2007, 91) Beyster goes on to describe "SAIC's organic organizational structure" and "constellation of businesses" as key to its "pathway of organic growth and development." (Beyster & Economy, 2007, 100) Some leaders are naturally inclined to organize their businesses in fractal patterns, and it seems not to matter whether the company produces steel products or custom computer applications.

For some business philosophers, including Thomas Malone (founding director of the MIT Center for Collective Intelligence), the issue of structure has focused upon centralized vs. decentralized decision making, although Malone agrees that "[a]ll hierarchies, regardless of how much delegation goes on, have a common communication structure: Information is collected in a central point, where executives make decisions that govern their subordinates." (Malone, 2004, 51) A fractal organization can exhibit both qualities, with decentralized decision-making at the edges of the organization and centralized decision-making in the center. Strategic decisions regarding an organization's allocation of major resources and direction for future growth need a big picture viewpoint, best gathered in the center from the information flows that leaders throughout the organization enable. Tactical decisions that have an immediate effect on relationships with customers, vendors, and partners are best made at the edges of the organization by those persons who interact with the "outside" world on a regular basis. Edge leaders and their managers of things and processes need nimble access to resources in order to invest in changes driven by their immediate environment.

LEADERS AS CONDUITS OF INFORMATION FLOWS

In order for central or core leaders to make big-picture decisions, they need information about what is happening at the edges of their organization. Perhaps one day, when all organizations operate with natural hierarchies, the need to devote individuals throughout an organization to leadership positions will dissipate, though most organizations still need leaders to facilitate conversations. As David Bohm discussed in *On Dialogue*, everyone has individual opinions and assumptions that must be defended because we are programmed: "…assumptions and opinions are like computer programs in people's minds. Those programs take over against the best of intentions—they produce their own intentions." (Bohm, 1996, 14) Bohm also declared "…the whole of society has been organized to believe we can't function without leaders. But maybe we can." (Bohm, 1996, 17) Until the majority of individuals are self-aware and able to examine their

core beliefs, we'll need leaders of a different sort, more like those at Nucor. As Iverson observed, "[most] managers typically spend far more time planning, instructing, and inspecting than they do listening, experimenting, and analyzing. Your company's managers will have to reverse that ratio to make their employees engines of progress." (Iverson & Varian, 1998, 94)

Indeed, organizations need leaders who are thinkers—not of great ideas, as most of those come from the people interacting with the environment—but of ways to encourage personal growth and improve the information flowing between the members of their teams. Leaders must understand that each individual is programmed with opinions and assumptions that can block both their ability to expand and grow as well as to contribute to meaningful dialogue regarding workplace and product improvements. Modern leaders who spend time analyzing the nuances of interpersonal relationships (here, the Myers-Briggs assessment is a good tool for leaders to utilize) and guiding their team members toward greater personal growth and achievement are able to help members overcome limiting beliefs and achieve greatness. As futurist Willis Harman declared, "if our belief systems fundamentally change, through whatever process or experiences, our perceptions and everything else about our lives will change. That will be true individually or collectively." (Harman & Sahtouris, 1998, 218)

Leaders who encourage individuals to feel more personally responsible for the quality of work and to feel good about their contributions can improve their members' health and happiness. According to Candace Pert, neurobiologist and discoverer of the opiate receptor at the NIH (National Institutes of Health), "Health and happiness are often mentioned in the same breath, and maybe this is why: Physiology and emotions are inseparable. I believe that happiness is our natural state, and bliss is hardwired. Only when our systems get blocked, shut down, and disarrayed do we experience the mood disorders that add up to unhappiness in the extreme." (Pert, 1997, 265) As rising healthcare costs plague many a bottom line, devoting leaders to managers is a win-win-win proposition. Each individual has a personal life and interacts with their home and community environments in ways that affect their perceptions and beliefs, which they will inevitably bring into the work environment.

INFORMATION DYNAMICS

Because the quality and flow of information are so important, dedicating personnel to the role of leaders improves the flow of resources in an organization as well. In top-down hierarchies, members typically fight over scarce resources such as promotions and money for projects. The perception created by scarcity of resources inhibits the creativity of such organizations, as members spend time worrying over which projects will prevail or what departments will receive capital investment or even who will retain jobs. These worries lead to negative information flows in the dynamics of the organization, affecting the harmonics of the organization overall and building entropy that is only resolvable through great effort, if at all. Information dynamics operate much like the nonlinear Schrödinger equation, which is applied to water and optics wave functions and is not time-dependent. (Erwin Schrödinger won the Nobel Prize in 1933 for the linear version.) The reason time independence is so important for human relations is that we can greatly slow the development of entropy, or pattern dissolution, by improving the flow and quality of information between individuals.

Theoretical physicist Julian Barbour has spent his entire career exploring the idea that time is a human belief construct. He writes in *The End of Time* "…I believe that in every instant we

experience creation directly. Creation did not happen in a Big Bang. Creation is here and now, and we can understand the rules that govern it. Schrödinger thought he had found the secret of the quantum prescriptions. Properly understood, what he found were the rules of creation." (Barbour, 1999, 229) Human organizations in which members care not about successful outcomes have become rife with negative interpersonal communications, absenteeism, unwanted turnover, reduced productivity, and declining profitability, a reflection of the negative harmonics within the organization. As Ervin Laszlo notes in *Science and the Akashic Field* (2004), we continually exchange information in the "A-field" through collective holograms created by our thoughts and feelings: "…the hologram of our body and brain can 'conjugate' with the holograms of other people, especially people who are related to us and with whom we have an emotional bond." (Laszlo, 2004, 150) It's best to focus on communication that is open, honest, respectful, generous, and committed to best outcomes. (Custer, 2007) Only with these qualities will such values as trust and appreciation emerge among groups of people working together.

The behavioral qualities of openness, honesty, respect, generosity, and commitment, however, do not preclude disagreement over what and how we create. In fact, the diverse perspectives we each hold on life are rich and filled with potential genius. We can disagree on our way to alignment, enabling each perspective to emerge and enrich the dialogue. Business writer James Surowiecki asserts that the best decisions emerge from a diversity of opinions:

> "Independence is important to intelligent decision making for two reasons. First, it keeps the mistakes that people make from becoming correlated. Errors in individual judgment won't wreck the group's collective judgment as long as those errors aren't systematically pointing in the same direction. … Second, independent individuals are more likely to have new information rather than the same old data everyone is already familiar with." (Surowiecki, 2004, 42)

Organizations need a balance between individually held perspectives and the group's shared purpose to align collective actions toward best outcomes. Jared Diamond came to a similar conclusion in *Collapse*:

> "Individuals who find themselves members of a large coherent group or crowd, especially one that is emotionally excited, may become swept along to support the group's decision, even though the same individuals might have rejected the decision if allowed to reflect on it along at leisure. … Especially when a small cohesive group … is trying to reach a decision under stressful circumstances, the stress and the need for mutual support and approval may lead to suppression of doubts and critical thinking, sharing of illusions, a premature consensus, and ultimately a disastrous decision." (Diamond, 2006, 435)

Often in top-down hierarchies, leaders opinions prevail over those of their subordinates. Aligning members with shared purpose and values is best guided by leaders who are trained in using conversation tools that facilitate group decision-making.

In *Tribal Leadership,* Dave Logan, John King, and Halee Fischer-Wright propose that finding "values that cut across a group of people can take an entire tribe to [a] zone of appreciation and emotion, and lead to a level of performance that from the outside can seem miraculous." (Logan, King, & Fischer-Wright, 2008, 156) They discuss the difference between agreement and alignment in determining "values and a noble cause" and describe alignment as that "which produces coordinated action married with passionate resolve." (p. 181) If individuals' ideas are out of alignment with group intentions, they may not be a good fit for the organization. Tony Hsieh, leader of Zappos.com (online merchandise retailer), discusses the importance of

alignment in his book *Delivering Happiness*: "We've actually said no to a lot of very talented people that we know can make an immediate impact on our top or bottom line. But because we felt that they weren't culture fits, we were willing to sacrifice the short-term benefits in order to protect our culture (and therefore our brand) for the long term." (Hsieh, 2010, 153) Those who aren't excited are either there just for a job (could be anywhere) or are focused upon their personal agendas. During new-hire training at Zappos.com, new employees are offered $2,000 to quit by the end of the four-week period (in addition to their hourly pay) to ensure they are the best fit. (Hsieh, 2010, 153) When organizations do not pay attention to information dynamics, the qualities of fear, misalignment of intentions, and diction errors can lead to speed loss (time-lag) and entropy, causing misuse of time and energy in addition to depleting financial resources. (Custer, 2007) Negative communication in relationships is stressful and causes health issues.

HEALTH AS AN INDICATOR

Employee health is an overall indicator of organizational health. People are healthiest and most resilient when they feel valued, appreciated, and fairly compensated for their contributions. Our feelings are indicators of our thoughts, and at the quantum level of "reality" our thoughts are connected to the thoughts of those around us. This aspect of quantum entanglement theory is an outgrowth of the "observer effect" discovered early in the development of quantum mechanics. Schrödinger used the word entanglement when referring to persistent connections between separated particles that correlated information at a distance. (Radin, 2006, 14) A branch of consciousness research is devoted to understanding how this phenomenon works, though essentially it happens in the unified field of quantum particles of which we are all composed. Researchers Dean Radin and Marilyn Schlitz at the Institute of Noetic Sciences (founded by former astronaut and Ph.D. Edgar Mitchell) have used heavily shielded chambers and pairs of volunteers who knew each other to study this phenomenon with electrogastrograms (EGG). While one person relaxed inside the chamber, their partner, in a separate space at a distance, viewed random images of the encased subject. The EGG recorded "gut" feelings in the protected subject when their partner viewed their image. The researchers noted that positive feelings produced a greater response than neutral, and that "EGG activity increases in response to the emotions of a distant person, beyond the influence of ordinary sensory interactions. Relationships commonly reported between gut feelings and intuitive hunches may share a common, poorly understood, perceptive origin." (Radin & Schlitz, 2005, 85) How we are perceived and valued by those around us can directly affect our physiology.

Because Frederick Taylor's "scientific management" doctrine from the late 1800's and early 1900's is the foundation for top-down business organization, business leaders in top-down hierarchies tend to consign interpersonal communications as less important than production quantities and profits. Warren Bennis, founding chairman of The Leadership Institute at University of Southern California, notes in *The Future of Leadership* that business leaders have been slow to admit "…the unexpected and reluctantly accepted notion that maybe the attitudes, perceptions, and feelings of the workforce and the social architecture [top-down] they worked under could have something to do with productivity." (Bennis et al, 2001, 277) Most leaders have not been trained in situations that require a focus upon the perceptions of the persons they lead.

FRACTAL ORGANIZATION DESIGNS

More and more organizations are operating as living systems in Nature by flattening hierarchies and sharing responsibility with frontline members. Perhaps this trend reflects a growth in human consciousness and an awareness of our interconnections. Growing numbers of people are calling their organizations "democratic" although that word implies that everyone will vote on every decision. In smaller organizations that are employee-owned, a democratic approach can work. As Tom Malone said, "Even though democracy is not appropriate everywhere in business, new technologies make it much more feasible in many more situations. When it works well, a democratic approach can significantly increase employee's energy, creativity, and sense of ownership in their organization." (Malone, 2004, 71) The fractal designs I have envisioned enable democracy at the team level especially, in the sense that each person has the right to their opinion and viewpoint and to "vote" on team decisions. However, not all opinions will align with an organization's shared purpose and values, and this is why leaders are necessary as conversation facilitators. Fractal organizations likely have more meetings and conversations, yet accomplish more in less time because of efficient operating principles. I refer to them as natural hierarchies because they reflect the different levels of knowledge, skills, and abilities among members.

The fractal org chart in Figure 1 represents a training farm called Green String Farm and Institute in Petaluma, Calif. The fractal nature of Green String is evident in their training process, as many graduates of the internship program stay on subsequent semesters to train new interns and share their knowledge and information.

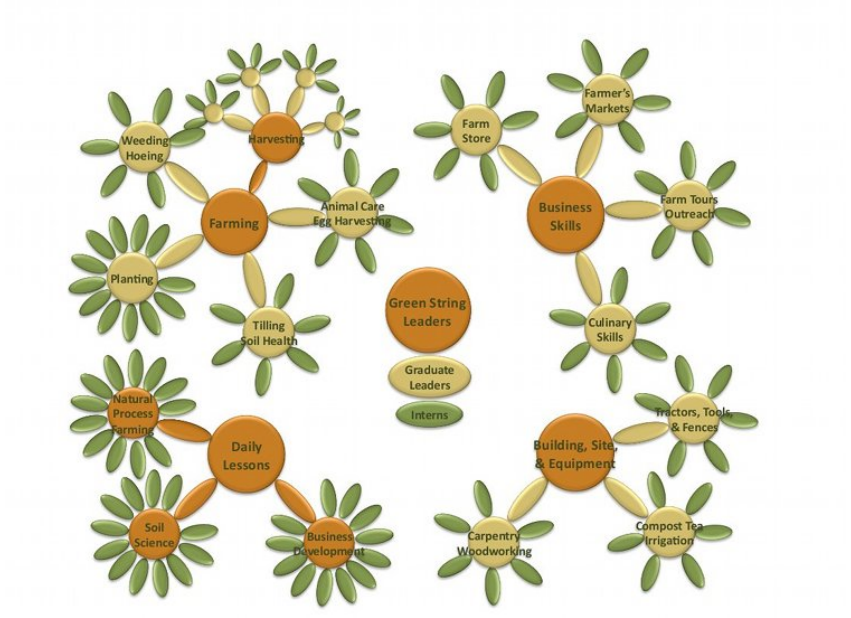

Figure 1. Floral Fractal Organization Design

CONCLUSION

All of Nature, including human beings, is composed of fractal patterns that organize everything. Fractal organizations operate like living systems in Nature, where the exchange of information is continual and part of the evolutionary process. The pervasive and lasting beliefs surrounding management in human organizations are powerful tethers to old ways of perceiving our world

and our relationships with others. Our perception of the world influences our behavior and the way we structure our relationships and communicate with each other. Resilient organizations reflect the evolution of human consciousness and the evolving desire of individuals to be responsible and contributing members in collaborative group efforts. Individuals in organizations that use top-down structures to illustrate relationships, especially those at the bottom of the hierarchy, often perceive those at the top as the ones in charge who are ultimately responsible for the outcomes of the organization. Top-down hierarchies emerged when it was common to view uneducated workers as less worthy, resulting in a lasting movement for worker's rights that pits management against workers, harms productivity, and often influences the relocation of many manufacturing businesses to overseas locations, thus draining the American economy.

The increase in turnover over the last few decades and the high costs of training replacement workers might be incentive enough to change an organization's structure from top-down to fractal, although a shift in consciousness is necessary. When leaders recognize the critical importance of feedback from workers who interact with an organization's environment in their daily efforts, they may be more inclined to institute changes in their organization that reflect the value of this information or to create structures that are more egalitarian and inclusive of participation. The practice of leaders as conduits of information flows is vital to the success of this approach, as the quality (and quantity) of information exchanges within and outside of the organization is key to successful adaptation. Leaders who monitor and work to improve the dynamics of information flows within their organizations will ensure the best outcomes in rapidly changing environments.

The health of a workforce is a direct reflection of the quality of information flowing within an organization. The negative stress of discordant relationships and poor communication practices results in physically damaged bodies that require expensive healthcare and reduce productivity. When groups of people share a purpose and core values, the result is a healthy environment where individuals thrive and collaboration is valued and rewarded. The fractal nature of such organizations reflects our shared consciousness in the quantum field where information influences both energy and matter.

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