REFERENCE SECTION

Transforming Bureaucracies and Systems

For the truly deep divers in organizational design, this section is for you. If your job involves navigating complex bureaucracies or trying to change prevailing systems, you will find this material helpful.

? Bureaucracies spawn three major types of teamnets: functional, divisional, and matrix. Compare your teamnet with these types and become familiar with the risks associated with each.
? Each of the Five Thamnet Principles has a systems principle corollary. This offers hooks into the vast literature of systems approaches to business and management, as well as immediate handles on distributed systems of all types—economic, social, and technological.

If you already consider yourself a systems thinker, you can regard this section as a new way to approach systems principles. If your interest is more general, think of this section as providing deep background on the essential ideas of the book. Even if systems thinking has never appealed to you, you might find helpful extrapolations that connect with other ideas you hold dear.

Bureaucracies and Teamnets

For many centuries, technology and organization have been engaged in a complex dance. Advances in technology spawn new forms of organization that encourage the development of new technology. One great wave of change comes on the heels of the European Renaissance and the invention of mechanistic science. Steam engines follow Isaac Newton's laws of motion, as do bureaucracies. Specialized, formal, machinelike organizations and assembly lines clack along behind the steam engines and their energetic offspring. In the movie *Modern Times,* Charlie Chaplin satirizes the human cog in the Industrial Age machine.

This organizational machine mentality fights to retain supremacy as another great wave of change breaks over the 20th century. The fertile minds of Albert Einstein and his colleagues first glimpsed a new age in the early part of the century. It fully bursts forth in the waning days of World War II as nuclear knowledge explodes over Hiroshima and Nagasaki in 1945. By mid-century, the use of television and computers fully reveals the outlines of the technological drivers of fundamental change.

As we speed toward the 21st century, we are living the Launch Phase of the Information Age. Today, global networks are emerging in the wake of' new knowledge, technologies, and the world economy. Networks do not replace hierarchy and bureaucracy; rather, they include them. To understand better where teamnets came from, we look more closely at hierarchy and bureaucracy.

CENTRALIZED HIERARCHY AND SPECIALIZED BUREAUCRACY

Traditional 20th-century organizations derive the coordination of centralized control from hierarchy and the power of replicable specialization from bureaucracy.

The separate uses of these two organizational dynamics—*centralization* and *specialization—are* clearly visible in the military: everyone has (a) hierarchical rank and (b) a specialized function. Similarly, the organizational title "vice president for finance" identifies both dynamics: a rank (vice president) and a function (finance).

"Specialization" is an abstract term that translates into jobs. Your job is your specialty. At the level of the firm, specialization defines the business you are in and what differentiates you from other companies. Specialization is where purpose gets specific.

In "Fighting Fire with Organization," chapter 12, we highlight the importance of getting the purpose right. Purposes come together in three basic ways: through complementary needs, common needs, or through a mix of both. These three ways of combining specialization correspond to three basic types of bureaucracy: functional, divisional, and matrix.

- ? Hierarchy
- ? Bureaucracy
  - Functional
  - Divisional
  - Matrix

- ? Centralization
- ? Specialization
  - Complementary
  - Common
  - Mixed

Complementary departments are the basis for the *functional* form of bureaucracy. These one-of-each-kind organizations combine capabilities such as marketing, design, production, service, and sales. Historically, the pure classical railroad-and-steel-type bureaucracy works best for producing standard products in a slowly changing market. Where these conditions don't prevail, the legacy of functional bureaucracy—awesomely exaggerated in government—plagues every aspect of society today. People are not joking when they call them dinosaurs.

A functional bureaucracy is a set of different specialties that come together as a special-purpose machine under central control.

In the early 1900s, bureaucracy begins to spawn a significant variation on the classic form. Faced with the need to achieve even greater economies of scale—particularly for capital utilization—the largest of firms forge *divisions*. At General Motors in the 1920s, Alfred R Sloan invents large, semiautonomous operating units, each with its own complete complement of functions. To the public, these divisions become well known by their product names—Chevrolet, Pontiac, Buick, Oldsmobile, Cadillac, GMC Trucks. After World War II, divisions proliferated in many large companies, usually organized either by related products or services, or by marketing regions.

A divisional bureaucracy is a centralized cluster of similar special-purpose machines.

As the Information Age reaches early adolescence in the 1960s and 1970s, conventional functions and divisions proved increasingly inadequate in fast-moving industries. So the third child of bureaucracy formed: the *matrix*. Instead of inserting a divisional layer and duplicating functions, companies maintain relatively stable functions, intersected by a number of relatively quickly changing divisional markets or products. With its dual reporting structure—one to the function and one to the project under way (or product, or region)—the matrix enables organizations to adapt more quickly to markets.

A matrix offers the stability of functions and the flexibility of divisions.

WHY BUREAUCRACIES FAIL

Each bureaucratic form has a tendency to fail in different ways.[1]

Functional firms fail when they grow beyond their ability to fully use all their special skills and machines. Sometimes failure occurs insidiously slowly, as a company loses its ability to tell how well a function does its job or how much value it contributes to the whole enterprise. While sheer size alone overloads a functional organization, so does widening the scope of products or services beyond the capabilities of centralized management. It is far too easy to take on too much as the pace of change accelerates. Success—and giddy bureaucratic growth—are often the precursors to dramatic and seemingly sudden failure.

Divisions have a different problem. While sharing some of the autonomy found in networks, divisions suffer from the weakness of their centralized superstructure. Typically, corporate executives *force* cooperation across divisions, undercutting the self-reliance and market sensitivity of the business unit. While self-initiated cooperation across divisions works, mandated cooperation—something of an oxymoron—does not. Divisional bureaucracies also overreach themselves when they buy or create new divisions that stray too far from their core expertise.

Matrix organizations have yet different weaknesses. Subject to the vagaries required to balance between stable and changing factors, the matrix manager has considerable difficulty serving two masters. Either the functions are too strong, and the projects are too weak—or vice versa. Centralized control and the complexity of the interrelations do not an easy mix make. What they do create is many middle managers with much responsibility but little authority. The

complexity of matrix management too easily overloads central control mechanisms. When companies exert a centralized effort to maximize global enterprise benefits, they also tend to limit the adaptability of local units.

BYE-BYE BUREAUCRACY

People often contrast networks with hierarchy, and even hold them in opposition to one another. The clash between centralization and decentralization is epic and sometimes brutal in specific circumstances. From a distance, however, it appears to be much more a dance of dynamic balance. In the end, there are always aspects of both in any successful human organization.

> *Networks do not eliminate hierarchies— they balance and reduce them.*

While hierarchies are likely to be leaner in well-networked organizations, bureaucracy may be decimated altogether. Networks offer a more direct challenge to bureaucracies because they offer an alternative way of organizing specialized units, promoting autonomy rather than dependence.

> *For many purposes, networks replace bureaucracy.*

As traditional companies find themselves pushed to become more networked, they can move beyond bureaucracy in both internal and external ways. Whether attention is on internal or external

changes, or both, companies need to carefully create and nurture the Co-opetition Dynamic. Healthy networks integrate and sustain the forces of *competition—independent* members and multiple leaders—with the forces of *cooperation—unifying* purpose and voluntary links.

Problems in particular teamnets follow from both excesses and deficiencies in the forces of co-opetition. To develop a "failure detection device," we look at the weaknesses of different teamnet types in terms of competition and cooperation.

The teamnet types discussed here follow the same form as those presented in "In It Together," chapter 4, and "Inside-Out Teamnets," chapter 5, and summarized in "Fighting Fire with Organization," chapter 12, particularly in the chart "From Bureaucracy to Teamnets." Here, they appear for easy comparison with their bureaucratic progenitors.

TEAMNETS OF THE FUNCTIONAL PERSUASION

Teamnets that develop among functions thrive on *complementary* needs. Together, these functional components form an economically viable whole:

? Internally, through cross-functional teams, sociotechnical systems, and top teams; and
? Externally, through core firms, joint ventures, and vertically integrated flexible business networks.

Internal Functions

Cross-functional teams, such as Conrail's Strategy Management Group, in which a companywide cross-section of managers makes strategic decisions, or Digital's Calypso team, are the most common type of teamnet that springs up in bureaucracies. They thread

across the company's functions, choosing one from Column A, one from Column B. Usually operating under hierarchical oversight, cross-functional teams coordinate activities among multiple specialties.

Internally, functional networks are at risk for many competitive reasons:

? Turf wars, the all too familiar situation where organizational territory takes precedence over corporate strategy;
? Decision making so protective and cross-functionally feeble that it grinds to a halt in gridlock;
? Disenfranchisement, in which cross-functional teams receive so little legitimacy from the hierarchy that they end up as just another committee.

There are also cooperative reasons for failure, such as:

? Excessive involvement, where people think everyone needs to be consulted in everything, which, of course, brings all progress to a halt; and
? Groupthink, where people lose their critical thinking faculties, resulting in bad decisions.

External Functions

Functional networks also form across company lines, often driven by big companies in trouble. This was exactly how Harry Brown found Erie Bolt when he took over the Erie, Pennsylvania, bolt maker. It was losing money and "looked like a mini-GM," he said. As part of a value chain, Erie Bolt, the producer, forms market-based relationships with a few upstream suppliers and downstream distributors. In Denmark, Alphabetica, a network of small firms, provides complete interiors for buildings—from interior design to delivering the plants for the lobbies. These networks, whether organized by a core firm or a group of complementary firms, provide

diverse expertise with reduced risk. Responsibility for assets spreads across all the firms, separately stimulating each partner to make full use of his own capabilities by maintaining other relationships outside the network.

Intercompany functional teamnets fail for competitive reasons when:

? Upstream and downstream businesses unduly rely on one core
firm and unhealthy co-dependencies emerge; and
? In a small group of firms, total dependence on one another for business success leaves them subject to the same inefficiencies as a rigid functional bureaucracy.

They fail due to cooperative weaknesses, including:

? Pressure of excessive coordination, compromising the creativity of specialized partners, or retarding a swift response to market changes.

DIVISIONAL TEAMNETS

Common needs are the basis for teamnets with divisional structures, in contrast to the complementary needs that bind functional teamnets.

? Inside companies, divisional teamnets include service webs, empowered clusters, study circles, and empowered work groups; and
? Externally, divisional teamnets appear as horizontally articulated flexible business networks and the numerous industry associations of "like" companies.

Internal Divisions

When a company creates divisions and reaggregates as internal networks, it does so by reducing business units to the smallest independently viable size. At Procter & Gamble, this means forming many self-directed work groups. In British Petroleum's clusters, units of 40 to 50 people effectively perform all administrative functions. W L. Gore & Associates limits a new factory to 200. These internal units operate within their hierarchy's guidelines; their relative autonomy and small size enable them to cope rapidly with diverse local conditions and global market changes.

Divisional networks are competitively weak inside companies when:

? The autonomous parts have too little understanding of the whole enterprise; and
? The effort to maximize the unit's economic results means sub-optimizing the corporate whole.

Divisional networks fail in the cooperation domain when:

? The hierarchy, ever lurking with the executive impulse to control, takes over in a crisis, and crises seem to multiply; and
? Units adhere to a too-detailed strategy that squelches incentives for local initiatives.

External Divisions

The Philadelphia Guild is a group of businesses that has designed a line of home office furniture. They differentiate around unique pieces of the line, while they pool their common needs as woodworkers. These small business "divisional" teamnets typically form in industries with limited economies of scale and circumscribed opportunities for vertical integration, such as garments, metal-working, and woodworking. Such teamnets also are common in

industries with a high rate of change and a dependence on very skilled people, like high-tech and bio-tech.

Such divisional networks have competitive weaknesses when:

? Partners become overspecialized, burrowing into a niche so small that other firms with broader expertise take over the role.

Among externally divisionalized networks, cooperative failures arise from:

? Linkages that persist with no economic advantage even after circumstances have changed; and
? Opportunities are missed because of preexisting exclusive relationships.

MATRIX TEAMNETS

Matrix teamnets are the most complex. They use the glues of both functions, which are stable and complementary, and divisions, which are changing and common, in very fast-moving environments:

? Internally, they appear in kaizen management approaches and development of internal markets; and
? Externally through keiretsu, voluntary geographies, and SME economic development.

Internal Matrix

Very large, very lean organizations that require large capital investments are the ultimate in internal matrix networks, the purported direction of the new decentralized IBM of the 1990s. Internal market mechanisms calibrated by the external market test the value of multiple commonly owned business units. Internal market

controls replace perpetually out-of-date administrative procedures, as the electrical equipment business of Asea Brown Boveri attests.

Matrix teamnets fail competitively when:

? Internal units with specialized assets produce more than the internal market can absorb at competitive advantage over external sources.

Cooperative weakness of the internal matrix is inevitable when:

? The residual hierarchy cannot control the temptation to issue commands instead of using influence and incentives to guide component operations.

External Matrix

The external matrix teamnet is a dynamic environment where many independent firms create multiple relationships drawing from a large number of possible partners. Relationships form, dissolve, and reform based on both complementary and common needs. Japanese keiretsu are an early form of sub-national matrix teamnets:
many separate firms in different industries with multiple interdependencies cluster around a common bank. Emilia-Romagna and Denmark are dynamic economies of many flexible business networks, a development strategy for countries or regions with many small firms.

These large-scale dynamic teamnets are prone to competitive paralysis because:

? People all around the world initially respond to the idea of business networks in the same way: “We are too independent to cooperate.”

Cooperative failure at this level results when:

? A “we’ll do it for you” attitude on the part of core firms, brokers, or other leaders results in an unhealthy number of dependency

relationships and subsequent distortion of economic realities; and

? Overzealous public agencies or strategic planners at a lead bank slip from a suggestive into a directive role.

This section summarizes the taxonomy of teamnets and their risk points. This is an example of using systems theory to manage complexity: it pulls a disparate variety of cases into an integrated framework to leverage common principles. We expand upon the systems infrastructure next.

Holism for the Left Brain

"Network" is a general concept like "system." Networks of molecules, neurons, waterways, transportation, television stations, and computers share common features, such as nodes (members) and links.

Consider the next few pages an extremely short course in systems thinking. Use it to help you simplify complexity. Each of the network concepts has an analog in general systems theory. By associating these concepts with one another, we leverage the phenomenal power of such complexity-busting tools as the systems principle of hierarchy:

NETWORK PRINCIPLE	SYSTEMS PRINCIPLE
• Network	• System
• Purpose	• Synergy
• Members	• Holons
• Links	• Relationships
• Leaders	• Representation
• Levels	• Hierarchy
• Co-opetition	• Complementarity
• Phases	• Logistic growth curve

NETWORKS ARE SYSTEMS

Systems theory the world around permeates advanced management techniques such as the quality movement and sociotech approaches. When W Edwards Deming, the father of quality, turned to science, he did not borrow from the traditional reductionism of Frederick Winslow Taylor. Rather, he viewed science holistically, as do other great systems scientists, such as Herbert Simon and Kenneth Boulding. Deming's business systems model is very straightforward:

> *Every value-producing organization receives inputs from suppliers and provides outputs to customers.*

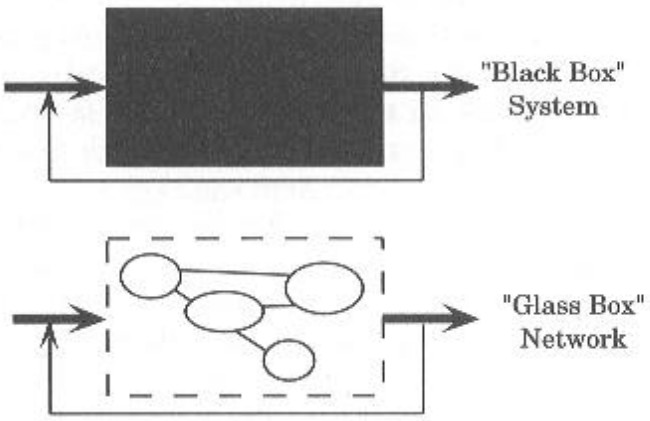
Networks are systems, pure and simple. Anywhere a systems concept will work, so will a network concept. Indeed, for many systems, particularly social systems, networks are an easier sell.

In the social world, people do not much love the word "system." It's easy—and often justified—to hate "the system." Some people hate it so much that they are blind to their aversion.

Little wonder. Most traditional systems are "black boxes." Think of the tax system or the international monetary system or even the municipal garbage system. Most systems portray themselves as beyond the comprehension and control of ordinary mortals. Traditional systems science is much the same. It also offers an obfuscating self-portrait of systems as black boxes, unfortunately too complicated for just anyone to understand.

With networks, you can take the wraps off systems. Instead of "black box" systems, create "glass box" networks. Make the outer boundary of the whole transparent. See inside to the parts—the members—and to the relationships—the links—between the

Black Box, Glass Box



parts. The more clearly you lay out the network-system elements, the easier it is to understand.

It is difficult to "see" a physically distributed organization. Turn this liability to advantage by promoting "whole systems awareness." Emphasize how all the parts interrelate. A systems view enables you to grasp a network as naturally as the hand of a friend.

PRINCIPLE 1: SYNERGY BECOMES YOU

"The whole is more than the sum of the parts." This systems principle is so popular that it's almost a cliche. In networks, purpose is the "more than" that defines the whole, what Buckminster Fuller called "synergy." Purpose is what enables a group of independent people to do something together that they cannot do alone. Together, synergy is possible; in isolation, it is not.

To function, your system—no matter how minimal—has to have some synergy or purpose.

Purpose relates very practically to how people become legitimized in networks. In a simple hierarchy, you gain legitimacy from the authority structure, with its system of rewards and punishments. In bureaucracies, control comes from charters and all manner of legalities and policies. In networks, legitimacy is an altogether different animal. You gain real legitimacy through contribution to the shared purpose.

Develop purpose as a resource for your team, just as people develop procedures and policies using law as a resource. Encourage your members to participate in planning and decision making to internalize the purpose for themselves. Externalize the purpose through explicit plans, information access, and by creating symbols—logos, nicknames, acronyms. Instead of controlling one another through one-way orders or endlessly detailed policies, boundary crossing teamnet members exercise control through their shared process.

PRINCIPLE 2: THE BEST MEMBER IS A HOLON

Each of us is a *whole* person who plays *apart* in businesses, families, and communities.

What sorts of things are simultaneously wholes and parts?

Everything. Arthur Koestler, the author and systems thinker, coined the word "holon" to stand for this whole/part characteristic of everything.[2] This "systems within systems" feature of nature is fundamental to understanding complexity.

View teamnet members as holons. The autonomy of teamnet members means that they are independent parts; they have their own integrity and own life processes of survival and growth. This is true whether the members are alliances of firms or individual peers on a team.

Parts and wholes have names. Companies, departments, divisions, functions, projects, programs, and teams all have names. From a systems perspective, these names label *categories*. They differentiate the parts of complex systems. Bureaucratic boxes and

network nodes both function as categories; they both collect people, things, and activities into coherent clusters. In real life, we are all parts of many categories, many social clusters, many boxes. Sometimes, the same name represents both a bureaucratic box and a network node: an engineering group is both a node in the product development boundary crossing teamnet, and a bureaucratic departmental box at the same time.

There are important differences here. While you play multiple roles in multiple networks, in hierarchies you appear in one and only one box. As a network member, you are relatively independent and demonstrate strong tendencies to autonomy. In a bureaucracy, you are relatively dependent and look for precision fit. When it comes to the independence-dependence continuum, network nodes and bureaucratic boxes lean to opposite poles.

PRINCIPLE 3: THE INTERCONNECTED WEB OF RELATIONSHIPS

Relationships are elusive things. For some people, they are real; for others, they are not. Some people literally cannot see relationships, even indirectly. These people do well in organizations with a rule to govern every aspect of behavior. They don't fare well in teamnets. Relationships are at a network's core.

There are so many relationships involved in life, and so many different kinds of them everywhere you look. To simplify this vast interconnected mess, traditional organizations have many one-way signs. Hierarchies and bureaucracies take an extremely limited approach to how parts interconnect. Generally speaking, orders and information flow in a minimal number of formal channels. Information flows up and commands flow down. This traffic pattern gives rise to the walls, stovepipes, silos, and other hard-to-penetrate boundaries in organizations.

By contrast, in networks, connections are many rather than few. Information and influence flow both up and down the levels through links, as well as horizontally within levels. What is the situation with

your boundary crossing teamnet? Do information and influence flow along a two-way highway, or are people stopped for going against the traffic?

Systems thinking has historically emphasized relationships. Peter Senge's book, *The Fifth Discipline*, is an excellent example of a systems approach to complexity for business based on understanding processes and relationships.[3] Gregg Lichtenstein, one of the leading facilitators of flexible business networks, wrote about "the significance of relationships in entrepreneurship" for his doctoral dissertation in social systems science.[4] June Holley and Roger Wilkens have developed a systems dynamics model of flexible networks to guide the development of networks of small manufacturers in southern Ohio.[5]

PRINCIPLE 4: REPRESENTATIVE LEADERSHIP

Nothing in groups is as complicated as leadership. One way to simplify complex wholes is to grasp a part that represents the rest. For example, Wall Street is shorthand for America's financial system; the White House stands for the executive branch of government; the Oval Office represents the White House.[6] In the search for simple ways to "grasp a group," leaders come in handy. Leaders are people who stand for a group.

All organizations have leaders, even self-directed groups, where leadership comes from within rather than from without. Networks are rife with leaders. By definition, leaders are partial representatives whose views others need to supplement.

To Americans, hierarchies in the social sense are single-pointed pyramids. Unfortunate as the burden is impractical, in a hierarchy everything supposedly comes together at the top in one perfect person. In a hierarchy, the rule is the fewer the leaders the better—with as little change as possible for as long as possible.

The same is not true in networks. As we stress repeatedly, the more leaders the better. In the best of networks, everyone is a leader. Everyone provides guidance in specific realms of expertise,

their talents and knowledge all contributing to the success of the group. People alternate between leadership and followership roles in fast-moving networks with many parallel interconnected activities.

PRINCIPLE 5: HIERARCHICAL LEVELS

While in some ways boundary crossing teamnets are very different from hierarchies, in others they are the same. Do not despair. This is not some sort of depressing truth that makes us want to say, "See? I knew there was nothing different here, after all." Consider it instead a great source of comfort. Since you already know a great deal about hierarchies, draw on your experience as a source of strength.

Were you schooled in the analytic, "break-it-down," mechanistic, one-size-fits-all strategy approach to anything complicated? We were, and so was nearly everyone else in the West. This half-brained approach to thinking has its strengths but also its limitations in solving life's problems. From a systems perspective, it ignores the parallel value of synthesis, the "build-it-up" holistic strategy, critical for all living systems, including human ones.

> *What systems am I part of? What environments is the team part of? What contexts is the company part of? What systems.*

One of the great ironies of systems science lies in the term "hierarchy." Hierarchy is the most common principle threading through the multitude of systems theories.[7] Every comprehensive systems theory uses it, regardless of its native discipline. According to Herbert Simon, the father of information science, hierarchy is

nature's "architecture of complexity."[8] Confusion over the word, which literally means "priestly rulership," has kept this idea from being widely understood where it is needed most, in human affairs.[9]

Hierarchy is what we mean by *levels*.

The social use of the term "hierarchy" includes the scientific one, levels of organization. Unfortunately, when people apply the word to organizations, they also add another characteristic: vertical control. In social hierarchies, the higher you are, the better off you are, and the more power you have; the lower you are, the worse off you are, and the less power you have.

As true as this may be in your local hierarchy, let us say most emphatically that *top-down* is only one of many possible relationships between levels. Exclusive one-way control is *not* natural in nature's hierarchies. Rather than dominating one another, levels are interdependent. More inclusive levels have critical dependencies on lower levels. Molecules would have a tough time without atoms. Organisms wouldn't be much without cells, which rely on molecules. The life of cells follows its own rules quite apart from an organism's life, which has its own special rules. These are all examples of hierarchy in the natural scientific sense.

Complex boundary crossing teamnets *are* "systems of systems within systems." Every teamnet is a hierarchy of wholes and parts. Thamnet members are systems of systems. The systems principles of segmentation and inclusion apply every time a group splits up into task teams or an alliance jells.

LOVE AND MARRIAGE, HORSE AND CARRIAGE: THE COMPLEMENTARITY OF CO-OPETITION

"Co-opetition" brings the complements of cooperation and competition into one word. This dynamic between the self and others is one of many ways *complementarity*, the second fundamental principle of systems (after hierarchy), shows up in networks.'[0] When you see your teamnet as both structure and process, you see complementary views of the same thing.

Both hierarchy and complementarity appear everywhere in nature and society. They are grand boundary crossing concepts that cross many terrains of knowledge. Physicists use complements like positive and negative charges, matter and antimatter, and right and left spins. They see fundamental reality as both particles and waves at the same time. In biology, we see life and non-life, birth and death, male and female, as basic complements. In society, people struggle between *self* and *group*, a natural dynamic that is central to families, communities, and nations alike.

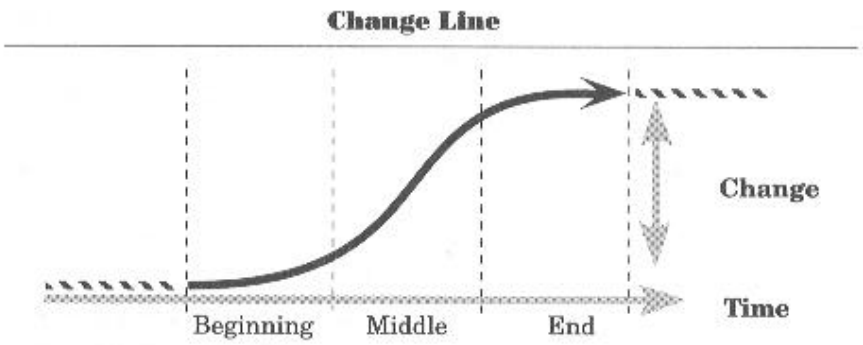
Tension erupts when complements begin to grate against one another. In reality, the tension of duality is always there. When the system begins to shake, stress becomes noticeable as relationships form, break, and re-form. You can use the principle of complements as a simple tool in many teamnet situations. For example, you can take a complementary approach to conflict, using such simple homilies as "There are two sides to every story."

PHASES OF GROWTH

The teamnet concept of process derives from a key pattern recognized by general systems theory. "General systems"—initiated half a century ago by the biologist Ludwig von Bertalanffy and the economist Kenneth Boulding among others—is a scientific discipline that focuses on common patterns, mathematical and otherwise, found in physical, biological, and social systems.

The S curve, also known as the "logistic growth curve," which we use to represent the change process, appears in the original paper von Bertalanffy wrote establishing the field of general systems.[1]' It was his first example of an "isomorphy," a general principle that holds across scientific disciplines. *An isomorphy is a boundary crossing principle.*

To track the cumulative progress of some change over time, add a second dimension to the simple time line. Now, the straight-arrow process path looks like an S curve. It generates a *plane of change,* a very typical result when you plot change data against time.



The S curve does equally well at charting the growth of bacteria in a petri dish and the rate at which new technology spreads, for example, the penetration of a cable television franchise into a new area.'[2] "Limits to growth" is the common factor in these processes, a major law of all life on this planet.'[3]

The S curve charts the common dynamic when change starts small, develops slowly, then "suddenly" takes off rapidly filling out the available opportunity, slowing as it reaches limits, and stabilizing into a new slow- to no-growth pattern.

Well understood in a wide variety of disciplines, the S curve represents great acquired knowledge, available to those who want to deepen their understanding of process.

The S curve becomes the "stress curve" when you pay attention to

the turbulence associated with the two bends in the curve (see "Teamnet Phases of Growth" in chapter 10). The stress curve is a very handy pocket tool for anyone involved with teamnets. Use it as an extremely valuable process aid to plan meetings and conferences of all sizes. Look to the points of turbulence in the process. Use them as alpine skiers do the bumps on the downhill trail: racers anticipate and pre-jump the bump, leveraging momentum from the bump's back side rather than being thrown for a loop by flying off the front.

Smarter Groups

Human evolution has progressed by substituting brain for brawn.

We see the possibility of much smarter groups as new forms of teamnets integrate with the electronic world of technology networks. Remember:

> *Only a few generations of humans have had instantaneous electronic communications, and only now are we launching groups linked with the historically unique cognitive (digital) technology of computers.*

In the broad cultural context, electronic and digital technology stimulates and shapes the sociological response of global networks. Networks are the unique response to the driving forces of information, just as hierarchy developed in the Agricultural Era and bureaucracy matured in the Industrial Era.

But we don't have to wait for tomorrow for smarter groups. Most people have at some time or another been a member of a group that

really “clicks”—a family, work, political, religious, or volunteer effort. Most people intuitively know the tremendous personal satisfaction that is possible with high group performance. Only a small but critical general improvement in people’s ability to think and act collectively may have a great impact on solving all the world’s problems.