CHAPTER 13

THINK

Reaching for Possibilities Together

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.

What does this make possible?

Humanity has progressed by substituting brain for brawn. We see the rise of smarter groups as new forms of human networks intertwine with the electronic world of technology networks.

Mind

In the Industrial Age, organizations were likened to machines. In the Information Age, both organization and computer networks feed off the same metaphor, the human brain/mind. Where once the extension of limbs and senses occupied center stage in the human development of tools, today digital technology amplifies gray matter.

The most distinctive feature of networks and virtual teams is the abundance and variety of links—of media, interactions, and relationships. For the initial analog phase of computer development, physical-brain analogies between corporate networks and human nervous systems are apt. As we rocket into web worlds interrelated through hypertext links, *mind metaphors* are coming to dominate descriptions of virtual organizations.

The characteristics of these emerging models reach back to roots in traditional hierarchy and bureaucracy as well as cast forward to the new capabilities in networks.

> *On the web, people express links and relationships in context.*

On intranets, extranets, and the Internet, a dynamic distributed human intelligence comes together and grows with the group. With hypertext links, the team's ability to create and use shared cognitive models crosses a fundamental threshold. The nature of the online space is no longer primarily an artifact of the hardware/software structure of the technology. It is a matter of choice, the human intellect creating a shared mental space.

Origins of the Search for Intelligent Life Online

George Boole struck the spark that ignited the conceptual soul of the now-maturing Information Age in 1853. His book, *An Investigation of the Laws of Thought,* established the binary logic that remains the essence of all computing today. Thus, at the very dawn of this epochal movement toward the digital era, Boole put forward the connection between human thought and its abstract representation in complementary 0s and 1s. He began his groundbreaking work thus:

> *"The design of the following treatise is to investigate the fundamental laws of those operations of the mind by which reasoning is performed . . ."*[1]

Portents of the vast change to come developed slowly and virtually imperceptibly through the next 100 years as Boole's engineering descendents, notably Charles Babbage and Ada Lovelace, created a mechanical means of configuring binary logic into a human cognitive helpmate. However, not until ENIAC was built in the mid-1940s did Boolean processing reach electronic speed and pure digital form.

Over the next decade, a few visionary thinkers began to see that computers not only reflect how individuals reason, but how groups of people connected by computers can reach new capabilities of reasoning together. One visionary was Joseph Licklider, the legendary founder of the ARPA office that spawned the Internet. In the 1950s, this original net wizard was "touting a radical and visionary notion: that computers weren't just adding machines. Computers have the potential to act as extensions of the whole human being, as tools that can amplify the range of human intelligence and expand the reach of our analytical powers."[2]

In 1962, after ARPA recruited Licklider, he personally connected the leading computer scientists of the day in the major research universities and a few companies. This human network was the embryonic beginning of the collaboration that in time stimulated development of the ARPANET, forerunner to the Internet. He called this group the "Intergalatic Computer Network," by which he came to mean "not just a group of people to whom he is sending memos but a universe of interconnected computers over which all might send their memos."[3] In Licklider's mind, networks of people and computers were conjoined.

The acknowledged hands-on pioneer in the area of large-scale cognitive computing is Douglas Engelbart. Engelbart's four-decade exploration and development first came to public view with publication of a 1963 article, "A Conceptual Framework for the Augmentation of Man's Intellect." Five years later, he demonstrated how to turn the technology part of his theory into practice with a stunning presentation to a conference of computer professionals. Twenty years before the industry considered them commonplace, Engelbart's system featured such innovations as a mouse, bitmapped graphics, multiple windows, and hypertext linking features—in 1968! Over the next two decades, Engelbart continued to develop the technology, initially known as the NLS system and later as Augment, while simultaneously bootstrapping organizational knowledge through the experience of the Augment development team.[4]

In contrast to artificial intelligence, which views the computer as an autonomous thinker, *augmented* intelligence views the computer as a tool to support and increase *human* intelligence. Moreover, human intelligence is extended to include our organized relations with others as well as the conventionally understood individual intelligence. Generalizing about intelligence, Engelbart (1963) writes:[5]

> *"Intelligence . . . seems primarily to be associated with organization. All of the social, biological, and physical phenomena we observe about us seem to derive from a supporting hierarchy of organized functions (or processes), in which the principle of synergism applies . . ."*

From the beginning, Engelbart emphasized the complementary nature of the "man-artifact" interface, the need to coevolve the human system (that includes elements like methods, skills, knowledge, language, training, and organization) along with the technology system.

When the history of group intelligence is written, Murray Turoff's name is also likely to be on the list of major contributors. Turoff created what was probably the first large-scale conferencing system in 1970 at the Office of Emergency Preparedness in the executive office of the president. He then designed and implemented, initially under National Science Foundation funding, the Electronic Information Exchange System (EIES), which continues today as the grandparent of online discussion platforms.

Turoff's conception of computerized conferencing grew out of his pioneering studies with Harold Linstone on the Delphi method. Delphi is an iterative paper-and-mail process "designed to structure group communication in such a way as to attempt to capitalize on the strengths and minimize the weaknesses of collective problem solving."

In *The Network Nation,* the 1978 classic of online conferencing, Turoff and his coauthor, sociologist Starr Roxanne Hiltz, raise the "philosophical or meta issue" involved in comprehending "the basic purpose of computerized conferencing systems"[6]:

> *Is it possible to conceive of a collective intelligence capability for a group of humans? Is it possible for a group of humans utilizing an appropriate communication structure to exhibit a collective decision capability at least as good as or better than any single member of the group?*

A largely untapped potential for computer-assisted communication lies in its cognitive contribution to the organization as a whole. As a virtual group's structure begins to appear online, it starts to develop a computer-enhanced intelligence.

Why Smarter Groups?

When we say, "That's a smart move," referring to a company or group announcement, we show respect for the organization's thinking.

Is there always a single smart person doing the thinking for every smart move by a group? Or are our metaphors of "brilliant" or "dumb" groups clues to a hidden reality of group cognition?

There *is something more* to the thinking of groups than is found in the thinking of individuals in the group. That *something more* is different from, not better than, personal thinking. Moreover, this reality is not hidden. Rather, it is very open, beneath our collective noses, awaiting only a shift in perspective to see the cognitive richness of our everyday lives.

> *The payoff for seeing how groups think is great:* smarter groups.

But we don't have to wait for tomorrow for smarter groups. Most people have at one 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. A small general improvement in people's ability to think and act collectively will have a great impact on solving the world's problems, large and small.

As the planet rapidly interconnects, sheer complexity puts an understanding of the whole beyond the reach of a single individual. Collective problems require collective solutions. Where success is a matter of agreement, as in a negotiation, it is the intelligence of the group that counts more than finding a correct answer, as in a spelling bee.

No single person is going to solve the problem of population or address environmental, viral, economic, genetic, or other really big issues that loom over the twenty-first century. They only can be tackled through collaborative action. If we do not understand how our groups think—or even that they do think—then we will be unable to meet the challenges of our rapidly changing world.

We need smarter, self-organizing groups to cope with complexity and claim our possibilities. To help get there, we begin with an abstract idea of how groups think and end with how to integrate cognitive capabilities into our four-wall virtual team room.

How Groups Think

Thinking is the functional ability to create, use, and adapt cognitive models.[7]

As individuals and as groups, we use models to understand the world. When data pours in, we sift it and sort it—by categories. We develop cognitive models from the pattern of relationships between categories.

Basic Categories

Thinking begins not with any old kind of category, but with a specific kind of category called a *basic-level category* in cognitive science.

Basic-level categories are simple ideas that everyone directly understands: cars, homes, jobs, and families. On the range of concepts from very general to very specific, people seem to understand ideas in the *middle.*

This is called the *basic level,* not meaning the lowest level, as the word *basic* might suggest, but the most common, most widely understood middle level.

According to research, people grasp the idea of "dog" (an intermediate concept) more directly and easily than "animal" (a more general idea) or "golden retriever" (a more specific concept).

People categorize from the most accessible part of their experiences. Categories begin in the middle. This *basic level* anchors our gestalt sense of whole things and allows us to extend concepts upward to more *general levels* and downward to more *particular levels.* Chairs are a basic-level category; furniture is more general (up, or superordinate) than chairs, whereas rockers are more specific (down, or subordinate).

Groups also categorize from the middle. For example, a planning group tries to define yearly goals at the appropriate level of generality—where the idea is easy to grasp and easy to sell. Basic-level goals then anchor very specific (subordinate) tasks that spell out how to achieve the goals. Looking up, the goals relate to broad (superordinate) organizational strategies, mission, and vision.

Basic Patterns

To basic categories we add the idea of basic patterns. Patterns are the configuration of connections among categories.

The *container* is perhaps the most basic pattern of our daily experience. We are ourselves containers. Our bodies are, quite literally, vessels. Things go in and out of ourselves. Our physical body is a container—like a can, cup, or box. We are also contained. With our bodies, we constantly move in and out of other containers—like rooms, houses, and cars.

Our everyday human experience as both containers and contained gives us a typical way to think about containers in general, an abstract *schema.* The container pattern consists of just three elements: inside, outside, and boundary. Schematically, it looks like a circle with a point of reference inside or outside.

We use the container schema all the time as we move through the concrete and abstract categories of life. Imagine the typical morning of Rebecca Stillwater, who lives in the Boston suburbs and works in the city. She goes *out* of her house, *enters* her garage and gets *into* her car. She pulls *out* of the garage and the driveway, eases *into* a flow of traffic and drives *into* the city. She pulls *into* her parking space, gets *out* of her car, and goes *into* her building. She shows her badge and signs *in.*

When Rebecca signs in, she enters a very different kind of container than her home or car, but it is no less real. She enters an organization—a social structure, with an abstract inside, an outside, and a boundary. Her badge shows that she belongs inside the social box.

Containers represent a level of human experience common to everyone. This pattern allows us to build mental bridges from physical activities to abstract ones. We metaphorically extend physical vessels, for example, to social ones via the *container* pattern.

Containers help us structure our daily lives. They also provide structure for some of our most sophisticated philosophical ideas, including the idea of categories itself. Categories are containers: They hold related instances.

From biology to economics to engineering to business, the container schema underlies the concept of "system." Indeed, the recurring container pattern in human experience is what makes a systems theory possible. Anatol Rapoport sees system science as rooted in classification, which he considers "perhaps more fundamental (because it is more elementary) than measurement."[8]

Whole-part is another basic pattern, which inherently structures the whole-part principle. It provides one of the primary means to extend categories, the use of one part or member to stand for the whole, called *metonymy* (the categorical representation of leadership). And, just as the container schema underlies the concept of system, the whole-part schema underlies the systems idea of "hierarchy," the sets-within-sets structure of complexity.

Basic Models

In this view of human thought, cognitive models tie categories and patterns together.

Concepts—which are in fact categories—are meaningful in the context of an encompassing model. "Tuesdays," "weekends," "workweek," and "day," for example, are concepts in a culturally and astronomically defined cognitive model of "a week" that makes sense only in context. Given the model, everyone understands what it means when we say a meeting is scheduled for next week; and everyone understands when we say, "It takes a week to get anything done around here."

A cognitive model is a system of categories related through recurring patterns.

Containers and whole-part patterns are common to both personal and group cognitive models. All cognitive models represent information by chunking experience into labeled containers, or categories. And all models have at least three levels of structure: the model as a whole, its categories (parts), and the content items populating the categories.

While categories may differ, both groups and individuals connect categories in similar ways.

The notion of category itself reflects these two aspects of cognitive models: the common framework and the differences of content. For while the content of a category varies, the container structure of the category does not. Categories are simply containers. Categories are vessels that can hold an infinite array of ideas and experience.

An organization chart represents a group cognitive model, a system of linked categories (work groups) structured by the whole-part pattern, which gives meaning to the enterprise as a whole. A group also has other cognitive models, such as those based on purpose, plans, and conversations.

Group Cognitive Model

Picture an organization chart. What the chart represents is a default view of how the group sees itself: its categories of roles, job descriptions, and titles. A complex group forms and names subgroups, divisions, departments, and task teams. Each box is a category that shows a part of how the group divides up its inner world.

Both people and subgroups of people represent categories in the membership model of a group. A vice president of marketing is a role category that is "filled" by a person. A marketing department identifies a major subgroup category; it denotes a specific function within a larger architecture of functions that together constitute the whole organization. The title, VP of marketing, for example, is meaningless by itself; it acquires meaning as a node in a network of groups and titles that together constitute the configuration of an organized whole.

Reporting categories, invariably connected through whole-part, hierarchical relationships, comprise a cognitive model. How is the configuration of subgroups and roles a default model for a group? Consider the processing of incoming information, a basic function of our personal thinking apparatus.

When a group receives information, say an e-mail or a letter with a request, it is routed to the most relevant person (role) or subgroup for assessment, or meaning. The group's cognitive model functions effectively when people in a group easily and quickly pass information, problems, and possibilities along to "the right place." If, however, new information arrives and no one knows what to do with it, the shared cognitive model does not function well. Because there are no established roles or subgroups to handle the input, the group experiences frustration.

An organization chart is a literal picture of a group's membership model. Each box in the chart is a category, a container representing specific responsibilities and information. These boxes are connected by whole-part relations often shown in a tree configuration, a single cognitive model.

The importance of how a group chooses to divide itself up, to create its cognitive model, becomes apparent when a group consciously goes about changing this model. Reorganization, a frequent activity in rapidly changing environments, is a collective cognitive process.

When a group reorganizes, it usually does so to improve performance, to be more effective, to be, in a word, *smarter.* How a group differentiates itself, how it names its parts, is a critical determinant of how smart it will be. During reorganization, a group creates new categories, new organizational positions and subgroups (perhaps hiring people), deletes some existing categories, abolishes some subgroups (perhaps laying people off), and rearranges existing relationships (e.g., changing reporting structures). At the end, there is a new cognitive model, represented by a new organization chart.

Group Reality

So where do human categories come from?

There are two major schools of thought about this. The view that reaches back to Aristotle is that categories are abstract, independently meaningful concepts, unrelated to human vagaries. The new view is that human categories are concrete; they emerge from being human and having bodies. We draw on the concrete view of categories and apply it to groups.[9]

The Body

As *Homo sapiens,* all people share fundamental similarities, a common pool of categories connected to activities like eating, drinking, and sleeping. The most basic and common categories emerge from our earliest childhood experiences, and they transcend cultural differences. Basic categories are surrounded by a vast penumbra of other categories that spring from differing environments and histories.

> *If individual human thought is based on the human body, then what is the thought of a group based upon? Group thought is based on group realities.*

Communication that is external to individuals is internal to groups. The stuff of group cognition is what people say, write, and do, particularly communication that lasts. Memories with emotional impact, written words, rules agreed to, and symbols rallied around carry the traces of people's interactions with one another and part of what it means for a group to be embodied—to have concrete experience.

Group entities are concretely real. Not concrete like individuals, but concrete like groups. While human bodies are distinctly singular and centralized in nature, group bodies are essentially multiple and distributed.

Immense variations in size, longevity, and purpose suggest that group categories are different from individual categories and that the range of differences among groups is much greater and content is much less common than it is among individuals.

The distributed nature of groups makes them difficult to see from a single perspective. For our conceptual lens, we use four views, each representing a different dimension of group reality, a different facet of the "quality without a name" of a living group.

Typically, we see groups through the people dimension, because human groups are quite obviously made up of people. Common sense tells us to know a group through the people that make it up—its members. Thus, the group includes (the two or more) people that comprise the group. Since this dimension is more generally about the nodes that comprise the network, it also includes things that a group owns or uses. Property, resources, and technologies are very material, very concrete, parts of group reality, particularly for long-lasting and/or large groups.

Groups have purposes. People *group* for a reason. It takes work to form and maintain a group. Purposes may be implicit, such as those of friendship networks, or explicit, such as those expressed in company charters and annual plans. In teams, purpose and the achievement of goals motivate the group. Without its tasks, a work group has no coherence, no integral reason for being. For every human organization, large and small, there is a pattern of activities, reflecting its certain set of purposes.

In groups, people communicate. They establish relationships. No relationships, no group. Communication—talking, writing, physical cues, digital connections—weaves another dimension of group reality. Groups may also have rules, communications, and interactions that have been formalized and habitualized. Norms, rules, policies, and laws are conceptual models based on communications that become independent artifacts within a group.

Groups exist *in time*. They are organic human entities that reflect change and adaptation over time. Groups also have life cycles, which can be very short—hours or days—to months, years, centuries, and, in the case of some religious organizations, millennia. Calendars, agendas, schedules, and milestones provide various ways in which groups develop time-oriented cognitive models.

People, purpose, links, time—four dimensions of group reality. While these certainly are not the only ways to see groups, they are basic and broad enough to shed insight into how groups think.

Cognitive "Stuff" Online

"Computers are to mind what machines are to muscle." As the cliché reflects, computers are natural cognitive media. It is not surprising, then, to find the same general cognitive patterns infused throughout the hardware and software interfaces that people use on a daily basis.

Most cognitive scientists believe we think by using language. Many believe we also use images to think, and some believe in even more forms of cognitive representation. On the face of it, the online contents of e-mail and threaded discussions are sets of natural language statements, a list of propositions—public mental representations. While text predominated online for decades, the newer technologies and economics of imagery on the web make all forms of expression, including audio and video, common to the group memory in the new millennium.

Categories, levels, and networks infuse the online environment. The online database memory has a thoroughly hierarchical architecture. Online communities create mailing lists, conferences, meetings, topics, and the like—intermediate group structures. These groups have an autonomous online life, yet are interconnected as a network whole. Static databases, too, have their own integrity and special purpose, and yet are often linked together in networks. Most significantly, the physical substrate of online groups is a computer network, itself built upon a telecommunications network.

An online group memory that includes "live" participants has recall ability not available to individual thinking entities: the ability to ask questions.

Asking and answering are the essence of human networking. As in personal memory, where recollection can prompt a chain of thoughts leading to insight, so asking a question online may prompt a series of responses that take all participants beyond the understanding they started with. More generally, conversations that flow in digital space are naturally captured and capable of recall, summarization, categorization, and connection.

A Place to Think

A virtual room, a cyberplace, is a team's basic container. A place to be enables a vital human system to develop, which in turn configures and transforms the place that it lives in.

An application's user interface is software that helps people leverage computing power. The interface usually draws from the craft of the capability being enhanced: Spreadsheets are natural to accountants, documents to writers, and graphics to artists. Most software assumes an individual is the user, but in the networked world, teams are also users of software: E-mail is meaningless if only one person has it.

How can we devise a team interface in digital technology? By creating and using shared cognitive models in an online place, a room where people generate their own customized "Group GUI" (Graphical User Interface).

People filter incoming information through cognitive models, recall old memories through models, and create new models to predict the future. So do teams. They can explicitly create and manipulate these models in a computer-mediated environment. For the globally distributed groups made possible by technology, there is an especially urgent need for visible, explicit, shared models to give meaning to the online world.

Behind the four-wall virtual team room is an interactive environment that naturally enhances the team's intelligence. People are able to use the tools and displays of their shared information in practical but intelligent ways without regard for the abstract underpinnings. Cognitive capabilities lie deep in the conceptual architecture of the room and its technological substrate, an invisible electronic infrastructure that supports human relationships.

Portals

The virtual team room *portal* page provides entry to a place that holds the identity of a virtual group. This expresses both the basic container pattern and the central idea of hierarchy, a point of reference.

The virtual team and its portal page are the locus for a mission and the focus of internal leadership. The portal also identifies the top level for planning and managing a task-based project. In the language of the Internet, the portal represents the home page of the team web site. It bespeaks the central focus of the team and offers selected links to the things most relevant to that focus. Also associated with setting up a new group home is a new database for the group's growing profile, plan, and process information.

Whole Parts

Organizations and individuals are themselves complex containers. Underlying the freewheeling ad hoc ability to profile members and construct groups on the *people wall* is the immensely powerful whole-part functionality of a hierarchical tool.

With the extended-organization chart, you can see up and down the levels of the organization from a given point of reference. This capability underlies the team's ability to differentiate itself as its purpose unfolds. As a team works, it subdivides and reorganizes itself to best fit the configuration of tasks. An even moderately complex team will soon form subteams, a natural step that is all too often taken unconsciously, with little thought and allowance for the review and feedback process required to get any set of basic categories right.

Hierarchical clustering infuses throughout the architecture of any web site and, of course, any online room. Navigation schemes set the handful of high-level categories that best span the range of information contained in the site. These "getting-around" schemes typically are available in frames at the top and/or sides of web pages, and clicks on a major head often reveal a subhead level of outline detail.

The team table also has center-periphery pattern features. Core, extended, and external team members are arrayed in three rings of involvement. The central membership of the team exists inside the penumbra of people participating less intensely.

Pursuit

The *purpose wall* contains the "goal-path-result,"[10] the pursuit of objectives through time. This design is the same as the "input-throughput-output" model that we use to organize the taxonomy of virtual team elements (Figure 12.1). It is the simple human idea of starting somewhere with an idea, an intent, and proceeding through a series of steps to reach some end—a goal, an outcome, or a result.

The very human process of aligning around vision and goals can be messy, particularly for virtual teams. The map of organizational purposes (Figure 7.4) provides a common framework for constructive conversations on collaboration.

The project management system and the electronics behind the purpose wall support planning and tracking goals, tasks, meetings, decisions, and concrete outcomes.

Meshing Links

Links, the mental construction tool for the ephemeral fabric of the *links wall,* represent a very basic pattern, the connection of point A to point B. The essential meaning of the web is "to link." Links provide the extraordinary ability to move instantly from anywhere to anywhere on the planet—both literally and figuratively. Links connect us to others in networks, and links connect technologies together as networks.

Different media offer people pathways with different connecting characteristics. Depending on the medium, different senses and brain structures engage, which translates to a need to employ multiple media to fully enable group cognition.

Patterns of enablement, removal of restraint, compulsion, diversion, counterforce, attraction, and blockage bespeak the range of relationship configurations people use to shape their social world.[11] These rule-driven processes are at the heart of replicable workflow models that use technology to move work from person to person.

By linking categories together into cognitive models, a team creates its mental reality. While individual relationships are the spice of our moment-by-moment experience, it is the pattern of relationships that creates a social whole over time.

Learning

Since digital reality ultimately expresses itself as data, we stand on the threshold of a new era of social self-knowledge. More and more of group life will occur online and be captured in a data model underlying its team room. There, at the data level, the basis for true social science emerges.

The fundamental problem with the human sciences is often characterized by analogy with the Heisenberg uncertainty principle, which says that at the level of quanta in physics, the interference of observers dependent on light or other electromagnetic means to measure subatomic phenomena means they can know a particle's whereabouts or its speed, but not both at the same time. What is applicable in the physical domain of quantum mechanics far from the levels of sensible experience is an in-your-face limitation on the human sciences. You cannot bring natural groups into a lab, and scientist-observers always affect the behavior of people in a group being observed.

But when a group naturally gathers data on itself online, it creates the potential to learn through feedback loops. How are we doing against our plan? What tools do we use to address conflicts? How long does it take to reach decisions using different media? What's the inflow and outflow of members? Answers to myriad questions like these gradually will build a base for collective self-knowledge.

Popping up a level, we see knowledge harvested across many teams that are learning from their own processes. Many teams within a common culture, such as a global enterprise, as well as many teams coming from many cultures, will provide a vast new scientific territory to explore and mine for deep knowledge as well as immediate application. Because this new scientific gold mine is embedded in the practical everyday use of collaboration technology, knowledge gleaned from this environment is highly likely to be relevant to boosting the performance of digitally endowed human entities.

Our vision is of an emergent level of group thinking that in turn stimulates the evolution of individual human consciousness.

Do groups think? Can we imagine they do and make it real by creating thinking groups? These are big questions to hold in our individually small hands.