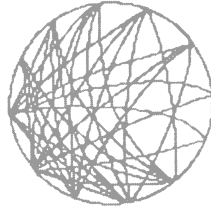# CHAPTER 14

FUTURE

We are two people among 6 billion.
With you, dear reader, we are three.
What does that mean?
Can a person grasp a planet?
Can a planet know a person?

Star Maker

Stand with us here, in a field on a mountaintop in the Adirondacks, a spot where we feel particularly in tune with the universe. Watch the weather boil over purple peaks. Close your eyes and step out. Change your scale of perception with us, so that we may find a comfortable perspective in which to place our planet and ourselves.

Step out to the Milky Way, the shimmering necklace of stars that rings the clear night sky. Quickly swing by the sun, pass the giant planets and the outer extremities of our solar system, pass Alpha Centauri and Sirius a few light-years away, and speed 30,000 light-years to our galactic center. Grow and adopt the perspective of Olaf Stapledon's *Star Maker,*[1]

become the brilliant spiraling association of 400 billion suns in a disk 100,000 light-years across that is the Milky Way.

See, close by, the minigalaxies making up the Magallanic Clouds, and our neighboring galaxies Sculptor and Fornax, part of our little local group, which extends out about 2 million light-years to include the beautiful Andromeda. Play, then, as part of our local group, with other supergalaxies, such as nearby Virgo, Perseus, Coma, and Hydra.

Raise your gaze yet farther, and look to the rims of the universe. Stretch your galactic mind to encompass your 100 billion brothers and sisters, each a bright being averaging 100 billion stars.

Ancient Hindu scripture says that our universe may be but an atom in another universe, a mote in another god's eye. But we have gone far enough to recognize our Milky Way as an individual among other galaxies that together form groups in a larger environment of cosmic groups.

So now, returning to the dense core of our own galactic perspective, look outward across your gracefully spinning body, past the Sagittarius Arm, farther out to a back eddy nestled in the Carina-Cygnus Arm, and focus on the small, second-generation star that humans call the Sun.

As we turn our perspective and sense of scale back toward the human home, passing Altair and Procyon and finally Alpha Centauri once again, notice that the solar system as a whole looms in the distance and takes on the appearance of individuality against the relative emptiness of intragalactic space. The whole system of stars, planets, satellites, comets, and encompassing energies is an entity in the galactic association of solar systems.

Parked outside Pluto's orbit, the Star Maker might wonder about the complexity of this integrated solar animal, 5 *billion* years old. A glance at the solar subsystems confirms the suspicion of intelligence indicated by the profusion of nonrandom radio signals that fill the inner solar space and that even now leak into galactic space. As our perspective narrows to the source of these signals, we approach the third planet.

Although still young, the brain of the solar system, the earth, already has 6 billion neurons and is rapidly growing more. Remarkably, as we zoom in on the pulsing marbled orb that constitutes the seat of solar intelligence and examine one of the billions of elements of this emergent planetary brain, we enter yet another cosmos. Each planetary neuron—

a person, a human being—has a brain with something like 10 billion neurons, each neuron capable of perhaps 50,000 connections.

You are home.

Right now the natural limits, smallest to largest, of human networking are at minimum one of us alone and at maximum all of us together—a range from one person to six going on seven billion people at the turn of the twenty-first century.

Certain large numbers are sometimes breathlessly advanced to illustrate unimaginable complexity: neurons in the brain, people on the planet, stars in the galaxies, galaxies in the universe—individuals and billions all. Using a third-grade-arithmetic trick, cancel out all the billions and review the cosmic journey:

> Our universe has 100 galaxies.
> Our galaxy has 400 stars.
> Our star system has a brain with 6 people.
> Our body has a brain with 10 neurons.
> Can you hold it in your hand? Universe, sun, and self?

Searching for Intelligence

A single e-mail captures the spirit of projects previously unthinkable that are now under way:

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Date: Sun, 26 Dec 1999 02:32:53 -0800 (PST)
From: "SETI@home" <setiathome@ssl.berkeley.edu>
Subject: SETI@home newsletter

Dear SETI@home user:

Thanks for your interest and participation in
SETI@home. This is our first e-mail newsletter.

With your assistance, SETI@home has been amazingly
successful. 1,500,000 people in 224 countries have
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> downloaded the SETI@home screensaver and together
> they have contributed 125,000 years of computer
> time, with the common goal of finding the first
> sign of intelligent extraterrestrial life.
>
> We've been recording data at the Arecibo radio
> telescope since December 1998, and most of the
> data through May 1999 has now been analyzed. 100
> million signals have been detected and stored in
> our database. The second-phase processing, which
> rejects [hu]man-made interference and looks for
> "repeat" signals, will start soon. This is when
> we hope to actually detect an ET signal!
>
> Furthermore, thanks to the abundance of computing
> power, we'll be augmenting SETI@home to look for
> new types of signals...

We are two of those who have downloaded the SETI (Search for Extra Terrestrial Intelligence) screen saver. In the idle time between typing these words that you read now and having a bite to eat, our computers process signals for SETI. While essentially effortless on our part, SETI could not happen without the cooperation of our 1.5 million "colleagues": a dozen companies, including Sun, Intel, IBM, and Paramount Pictures; nonprofits like University of California's Digital Media Innovation Program and the SETI Institute[2] itself; and, naturally given the times, Space.com.

The SETI screen saver is a project of the Search for Extraterrestrial Life Institute, physically located in Berkeley, California, where most of the research scientists and their teams are situated. But their phenomenal computing power, on which they depend, is global. By distributing packets of signals to a vast network of PCs around the world—basically to anyone willing to download a simple little processing program—SETI is able to do with its network what is simply undoable without it. SETI's purpose? It's recursive: to process signals sampled from everywhere in the universe to discover intelligent life, a potential finding made possible

by distributing processing among a sampling of the universe of intelligent machines.

At the Frontier

Cyber frontier: We and other writers have perhaps too often used the frontier analogy with respect to cyberspace. Thus, it is worth listening to someone who has been to "the end of the earth" for a reminder of just how really appropriate it is.

John Lawrence,[3] who organized the first UN site at the 1995 United Nations Fourth World Conference on Women in Beijing, is a fascinating character among those involved in the creation of electronic places. At one time a geological explorer for the New Zealand Antarctic Research Programme (Lawrence Peaks, part of the Transantarctic Range in Victoria Land, Antarctica, is named for him), he says today: "One simply trades one form of frontier for another. I know the feeling of stepping out onto land that no human in recorded history has stepped on. It was a feeling very similar to what cyber people are feeling now as they go out into this peculiar virtual world."

Lawrence continues, "There's an adrenaline rush as one goes over new surfaces, seeing completely new vistas that have never before been seen by the human eye. It's incredibly exciting and each person has his and her own way of coding all that. But this is different and more intriguing because explorers have gone out into new territory in physical space for hundreds of years. That particular adrenaline rush has been described for generations. But this new one has barely been described for a generation, and that's a rush in itself."

Of course, cyber explorers can be anywhere.

Protecting Prairies

Sitting in Fergus Falls, Minnesota, population 12,000, Peter Buesseler is a pioneer in the use of virtual teams who served as a key node and webmaster for the Great Plains Partnership (GPP), the initiative of 13 western states, three Canadian provinces, two Mexican states, numerous federal and local agencies, American Indian tribes, environmental and

agricultural organizations, businesses, and landowners concerned with the viability of the Great Plains.[4]

"How am I protecting prairies while I'm going around with a screwdriver in my pocket?" asks Buesseler, who is also Minnesota's State Prairie Biologist. Buesseler is friend to many Minnesotans who are trying to get online. "We're in a rural part of the country here and e-mail is not much available. I'm often involved in helping people I need to work with find out what kind of access is available to them. I talk to the telephone companies for them, and then take my screwdriver with me to their offices or homes to attach their modems."

In the mid-1980s, Buesseler could not even type. Since then he has turned himself into "a little techie," he says, in order to be able to reach the people he needs to work with. "It's a lot easier for me to do it than for them to wait three months if they made the same request from their data centers. It builds a relationship that is not as structured. We can ask each other for things that we might not think to ask each other. It's a barnbuilding type of arrangement, which gets at the core of my work."

We conduct our interview with Buesseler, along with two of his colleagues, Brian Stenquist, a strategic facilitator, and Susen Fagrelius (who has consulted to Minnesota's Department of Natural Resources), via conference call, naturally, as the three of them are 300 miles apart and we are in Boston. At one point Buesseler says, "I am sitting here mentally doodling spiderwebs which are held together and anchored at key strategic points all the way around. But the material that it takes to hold them together is pretty minor. It's both very delicate and incredibly strong at the same time. A spider can walk across it but other insects that try to walk across get entangled."

Buesseler clearly draws the analogy to the network that each virtual team spins—at once fragile but strong, unique yet constantly changing, interacting with its environment that it reconfigures to its best advantage.

"You can tell the species of a spider by the pattern of its web. Each is different, and no spider will ever make the same web twice. It's always dependent on the environment. Is it using a twig or a doorway? In the morning, it is beautiful and glistening, but it is in constant need of repair and demands a lot of upkeep. Its design is always contextual, always aware of its

environment and drawing its elements together." The same is true for virtual teams.

Islands of Trust

There are islands of trust at every scale. Couples, partners, families, groups, neighborhoods, departments, communities, enterprises, regions, industries, and nations all have stocks of social capital. Company cultures are storage vaults of social capital based on their history and current dynamics. This investment is available to capitalize (or not) new relationships. Each time a new group comes together, it plants the seed for a new island of trust.

Accelerating Trust

Social capital consists of relationships among people. It doesn't behave in quite the same way as physical capital. Matter, when used, degrades. Information, when used, accumulates. Unused, information loses value or becomes a weapon in the struggle to compete and control, thus increasing mistrust. Like communication, trust is very personal and yet cannot be possessed by a single individual. It takes two to create social capital.

Trust, or its lack, is an all-pervasive cross-cultural reality. All people in all cultures in all ages have depended on trust, but its value has greatly expanded in the Network Age.

- *People* fundamentally trust others—or not. A presumption of trust enables a successful strategy of collaboration to be better innovators, competitors, and survivors.
- If *purpose* is the glue, trust is the grease. Purposes operate through trust—the source of legitimacy for and the vital spark of networks. Trust enables people to establish purposes that they articulate in detail and maintain over time.
- Trust enables people to construct *links.* It undergirds high-performing organizations with the profuse voluntary communications of fast, flexible, integrated responses.
- Trust usually takes *time* to develop, and it also happens in an instant and ruptures just as fast.

The greater the trust, the lower the cost of communication and relationship building. The more extensive the network, the greater the opportunities arising from commonly held goals.

Conversely, mistrust creates difficulties at each step in developing and executing a purpose. It takes longer to arrive at common goals since suspicion demands greater specificity. Enforcement is costly in terms of legal, accounting, and inspection fees, and close monitoring is burdensome, sometimes proving fatally inflexible.

Among the ebbs and flows of turbulence and quiet come some defining moments—usually unexpected and often unwelcome. Crises often precipitate positive feedback loops in social capital—either viciously or virtuously. The vast Mississippi River floods of 1993, for example, drew upon and reinforced the hard-won prairie values of neighborly help. Awful as the rising water was, the flood also washed in a new wealth of social capital formed by countless helping hands as some compensation for the damage. Recovery from natural disasters, increasingly (and sadly) more prevalent, requires social capital.

Social capital is continuously accumulating or degrading. It increases and decreases through dynamics of history, circumstance, crisis, and creativity.

> *In the Network Age, horizontal connections explode. Winners in the twenty-first century—companies, countries, and people—will be those with the greatest social capital.*

All islands of trust, large or small, are embedded in larger environments of relationships that themselves represent stocks of social capital. Social fabrics can be rent by disasters—natural and otherwise, from an oil spill (Valdez) to a nuclear meltdown (Chernobyl) to hurricanes (Hugo)—that threaten the health of communities and families; by migrations and refugees; and by rippling layoffs that destroy economic and personal stability. Relationships are difficult to maintain as physical infrastructures deteriorate, inhibiting travel and communication. Poverty creates isolation, violence and fear, dependence, and lack of access to connections.

Most corrosively, poverty reaches into all communities and undermines and attacks social wealth.

The key to a society's ability to generate social capital lies in its practice of equality—political, social, and economic. Equality is under siege by the powerful global trend of an evolving two-class society, 20 percent wealthy and 80 percent poor, both within and among nations.

We have to reverse this widening disparity to reap the benefits of cooperation on a global scale. To do so, John Evans, chairman of Torstar, the parent company of Canada's largest newspaper, *The Toronto Star*, says we need "a new investment of social capital in community [and] new networks of civic engagements, involvements and commitments from individuals, private groups, corporations. . . . 'A society that relies on generalized reciprocity and mutual assistance is more effective than a competitive, distrustful society.' "[5]

Access to the net initially has created a digital divide of haves and have-nots. A social choice, not a technological imperative, rules here. The real cost of the divide is in computers and local connections, not in available information. Technology costs are plummeting, as they have for decades, while new technologies are rapidly increasing the ways people can connect to the net. The fundamentals of this new platform for human interaction support the possibility of access for all without regard to physical location, appearance, or class.

A Matter of Survival

Ross Ashby's "Law of Requisite Variety"[6] is one of the most famous systems principles. In essence, the law says that for a system to survive, it needs to be at least as complex as its environment. As the environment becomes more complex, the system—whether an organism or an organization—learns and adapts, handling more complexity. Otherwise, sooner or later, it dies.

As our world becomes more complex, faster paced, and more global, we need to smarten up. Growing smarter means incorporating more variety, gaining access to what's happening, and intelligently connecting bits of knowledge to anticipate the future. Organizations must incorporate even greater diversity to survive and thrive as the pace speeds up. More com-

plexity compels more organizations to develop networks to increase their social capital.

Networks incorporate diversity and carry reciprocity across boundaries and borders of every scale and scope. Wide-ranging webs provide the amplifying effect that social network analyst Mark Granovetter calls "the strength of weak ties."[7] He shows how connections at the edges of people's networks, rather than conversations in their core cliques, boost the effects of innovations, ideas, and opportunities.[8]

Boundary-crossing networks and virtual teams decrease the cost of transactions, open new channels of cooperation, and expand social capital, allowing new patterns of trust to develop.

Virtual teams provide extra value beyond accomplishing specific goals like developing a new chip. By bringing people together to pursue shared aims, they add to the stock of social capital. Even when people participate in networks that fail, they frame new relationships and bank trust that they can draw upon in the future.

The Biological Internet

"Trust is really essential," says Frank Starmer who for many years has led a global scientific team, with labs in more than 30 countries, comprising people who rarely if ever meet face-to-face.[9] "For a group to be creative, it must have trust. Islands of trust do not have to be vast to be vital.

"It's essential to develop a level of trust where you can say anything and not regret it or feel that it will come back to haunt you," Starmer says. "Only then are all the communication paths open. No one is wasting time trying to decide whether to say this or that. Complete openness and freedom lead to unconstrained thinking, which leads to good science or good art or good whatever you're doing.

"Collectively, we feel stronger as a team than we do as individuals. Otherwise, we'd drop out of the group. There'd be nothing to gain.

Together, we are more competitive in the science world. Each person contributes some special talent or insight into our overlapping interests."

> *"We speak of a biological Internet. Each person has a nervous system that coordinates and controls. But there is also absolute trust between every part of the body. It's essential for coordinated behavior. And our lab without walls is just a big collective organism with a common goal."*

    Imagine your organization with that level of trust. Common goals, coordinated effort, unconstrained thinking, each person contributing, more competitive, all-channel open communication—and the creative juices are really flowing.

> *Trust is the key to virtual teams.*