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How Intelligent Organizations Attain Supremacy through Information Superiority

Dr. Rick Hayes-Roth¹

Information Sciences Department,
Naval Postgraduate School,
Monterey, CA

¹ Dr. Hayes-Roth is Professor, Information Sciences, Naval Postgraduate School, Monterey, CA. He may be reached via email at: hayes-roth@nps.edu.

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Preface

This book may alarm you. It describes a new state of nature, not yet fully evident, that I see coming soon to our planet. The dominant beings in this emerging environment are neither animals, nor plants, nor mechanical whirligigs. Rather, they are human-machine hybrids that spread their tentacles over thousands of miles. They communicate at the speed of light, and they conquer their opponents through a combination of superior intelligence and physical precision. I call these creatures *hyper-beings*, because they have the focused intent of a unified being yet possess physical and intellectual dimensions vastly exceeding those of all previous life forms. Hyper-beings are the naturally selected dominant forms of a world unified by intelligent information systems. These systems enable hyper-beings to operate as if borders did not exist. These systems exploit ever-increasing capabilities in computing, communication, and information processing to achieve unprecedented levels of awareness and physical reach. As with other technological revolutions, if channeled and governed wisely, these new capabilities can yield great benefits. On the other hand, if misunderstood or misdirected, they can run amok and threaten global well-being.

I am, mostly, a technophile and optimist. I think that hyper-beings can lift humanity to new levels of wealth and well-being, if we design them well, administer them reasonably, and govern them responsibly. So my principal goals are to help more people participate in this revolution, to hasten the opportunities, and to help avert some predictable problems. To assure that the anticipated changes improve human welfare, rather than diminish it, we will need to inform people about the coming changes and stimulate appropriate political dialogue, policy-making and social engineering. I hope this book ignites readers' creative energies. We need creativity in two complementary spheres. First, we want to accelerate the development of these extraordinary intelligent creatures so they can produce for us better, faster and cheaper goods and services. At the same time, because hyper-beings compete supremely well and naturally rise to dominate vast arenas, we must invent improved mechanisms of transnational, post-industrial governance as a check against unbridled power and extreme imbalances in economic conditions.

I first coined the term *hyper-being* while participating in a special "Bold Ideas" group established by and for the support of Marv Langston, who was in 1998-2000 the Deputy Chief Information Officer of the U.S. Department of Defense, under the Assistant Secretary of Defense for Command, Control,

Communications and Intelligence, Art Money. Dr. Langston formerly directed DARPA's Information System Office, the group responsible for creating radical new possibilities to enhance DoD's performance through superior use of information technology. DARPA, the Defense Advanced Research Projects Agency, had famously brought other revolutionary technologies to fruition, including the Internet, artificial intelligence, massively parallel computers, and autonomous aircraft and robots. The US Government has demonstrated repeatedly that patient, focused, visionary R&D yields extraordinary results. The Bold Ideas group surveyed the landscape and pretty quickly determined that hyper-beings would produce the next revolution in the arena of powerful players on the world stage.

The context for the group's work included a recognition in the '90s at DoD of the need for a "revolution in military affairs" (RMA). The contemplated RMA recognized that the US and its allies would become involved in a widening range of conflicts and needed a new approach to make this affordable and effective. One key goal was to exploit our superior technology to enable our forces' to perform excellently over the entire spectrum of engagements, from peace-keeping and humanitarian relief at one extreme to hot conflicts in major battlefield theaters at the other. Everyone recognized that a new asymmetry existed. The US has huge physical and technological advantages, but threats to security would come from an expanded range of actors, expected increasingly to be non-nation-states. Nation states, tied as they are to physical assets, wealth, and infrastructure, are sitting ducks in conflicts with superior forces. Natural selection would quickly weed out such opponents. Natural selection, at the same time, would favor challengers who could operate "below the radar" so to speak, diffusely, without fixed physical structures. Thus, by envisioning how competition would play out, it was clear that opponents to US hegemony would need to take amorphous forms, move continuously, and operate outside the networks and channels easily controlled and monitored by the US and its allies.

But what form would US power take, and would the answer differ for military organizations versus commercial ones? Assuming that technology would continue its rapid rate of progress, that competitive pressures would operate, could we foresee the shape of dominant beings that would emerge? Could we help assure that these superior beings would be on our side and not on the side of terrorists and despots? These questions led to our recognizing the emergence of hyper-beings. Once we had the concept and knew what to look for, we found evidence supporting the hypothesis nearly everywhere.

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This book aims to share those insights and explain the principal mechanisms at work. Even without directly teaching the details of technology to implement hyper-beings, I expect the reader to get the big picture and begin to perceive the everyday events confirming these major ideas. Many readers I expect will then start adapting to the changed circumstances so they find ways to prosper and, hopefully, keep out of the tar pits².

I've written this book with several different sorts of readers in mind. First, this book addresses the modern intellectual who wishes to understand enough about technology and its effects on social evolution to participate knowingly. Participation can range from creative roles in developing and implementing the technology, to management and investment in associated businesses, to leadership roles in industry, government or non-governmental organizations. This book will provide enough information and understanding to give these readers what they need so they can directly participate in shaping the future. Second, the book aims at students of the key areas, including intelligent systems and post-industrial management and organization. There's a lot of business to be done with hyper-beings, and this book enables the student to understand the required fundamentals. I expect this book belongs in computer science, information systems, business administration, military science and public policy curricula. The third group of readers I hope to address includes military officers and contractors, who provide our service personnel the doctrine, tactics, training, and systems to do their jobs. These people must race to implement the concepts in this book, so our armed forces and civil security agencies rise to the highest levels of performance, as quickly as possible.

I'd like to acknowledge the many colleagues and sponsors I've worked with over the years whose support has made it possible for me to develop these ideas. My colleagues at MIT Sloan School of Management, Carnegie Mellon Department of Computer Science, The Rand Corporation, Teknowledge Corp., DARPA, and the Naval Postgraduate School are too numerous to name individually. Each of these institutions provided me time to think, quality colleagues to work with, and patient capital to bring difficult

² In Los Angeles, the La Brea Tar Pits hold remains of many formerly great dinosaurs that became stuck in tar while looking for water. As the environment becomes less hospitable, each creature incurs increased risks as it moves out of well known "comfort zones" that previously provided viable habitat. If the environment changes extensively and quickly, only highly adaptable critters survive.

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ideas to fruition. I hope this book reflects well on them and brings many dividends to their current and future faculty, students, engineers, and policy analysts. I feel incredibly lucky to have lived through the early decades of the information revolution, and I'm confident that we've collectively not seen anything yet!

1. Introduction: The Big Picture

Working smarter beats working harder. This aphorism reveals much about our competitive world and how it has evolved from earlier times when physical mass, size, and strength determined the success of individuals, enterprises, and military forces. Labor, capital, and know-how constitute the three big ingredients in almost any organization. The relative importance of these varies over time, reflecting changes in supply and changes in technology. For the last twenty years at least, technology has been changing rapidly, while both labor and capital remained relatively plentiful. Technology is related to all three big inputs, but is most directly tied in contemporary settings to the know-how factor. New technology means one group can do things another group cannot, because it possesses enabling know-how. Especially as such know-how becomes embedded in computer software, machines and appliances, we can easily replicate and deploy it widely. Further, as time intervals required for innovating, decision-making, and deploying new ideas continue to shrink, working smarter requires knowing more valuable things, having access to better information, and making better decisions faster than competitors can. In short, working smarter means thinking better thoughts and implementing them better, faster and cheaper than others can.

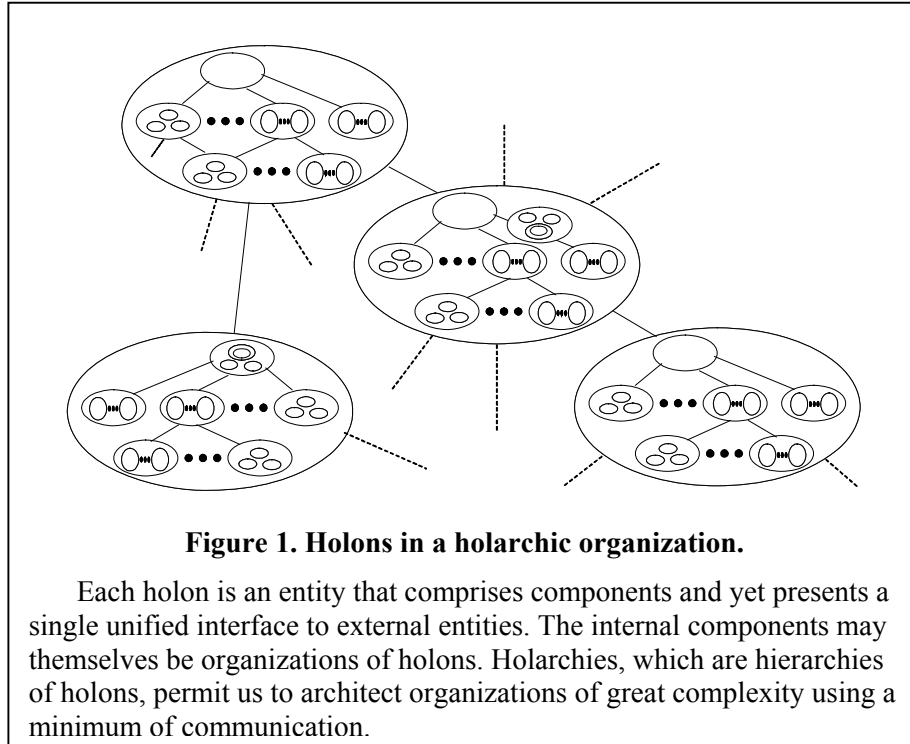
Superior information enables better decisions. Life is full of possibilities, and these usually manifest themselves as choices we must make. Usually, we can opt to “do nothing,” which means not intervening to change the situation, or we can elect to perform one or more actions. Obviously, we want to choose alternatives that give us the best possible outcome, in our own terms. This is usually termed “optimizing the expected outcome.” To optimize, we must act to get the best possible result. This requires that we execute actions that we believe probably will yield better outcomes than any other action we might perform. To do this, we combine our knowledge of “the way things work” with information that tells us “the current state of affairs.”

For example, we may believe that rain in the early afternoon usually means it will rain at 4:30 pm. Thus, if we learn that it is raining at 2 pm, we believe that it will probably rain at 4:30 pm. This inference combines our predictive models with our current situation assessment to produce an expectation of the future situation. If we will be meeting a friend at 4:30 pm, we prudently propose an indoor meeting place in preference to an outside location. We expect that action to keep us from getting unhappily wet. Of

course, the quality of our decision-making depends directly upon the quality of the information we receive. Accurate information about rain in the early afternoon is valuable, because it enables us to employ our somewhat primitive model of how things work. Even better information would be possible, if we or others were able to employ it to infer more accurate predictions. A detailed meteorological simulation of the local area might give much better predictions and, in that case, using that information would enable us to consider more options and perhaps reach a superior decision.

Information-superior organizations prevail. People do most of their work as part of organizations, whether their employers, volunteer organizations, clubs or families. Organizations, like individuals, compete in a world of scarce resources occupied by a population of hungry competitors. Organizations make and implement decisions that determine the organizations' outcomes. Obviously, organizations that get better information and use it more effectively than others have a major competitive advantage. Although a few exceptions might arise, organizations that intelligently employ superior information beat their competitors. As a short-hand, I refer to these as *information-superior* organizations. Information-superior organizations reach better decisions and implement them more effectively than mediocre organizations. They have what business people and military leaders often wish for: *an unfair advantage*. When conditions persist, the information-superior organization surpasses existing competitors, prevails against challengers, and attains supremacy in its dominion. Because organizations control the preponderance of the world's resources and activities, the information-superior organizations reign supreme over our planet. If these were living creatures, we'd surely perceive them as a dominant species.

Organizations comprise mostly hierarchical, information-based, distributed components. We are all familiar with organizations that disperse employees and work sites widely over one or more geographic regions. This dispersion corresponds to *physical* distribution. But organizations also routinely distribute vital functions, such as *decision-making* and *control*. Information collected in various locales finds its way to groups and decision-makers around the globe that need it. Each local entity makes some decisions, passes its plans and results along to other parts of the organization, and higher management integrates, interprets, and assesses these results as part of its own decision-making processes. Decisions, plans, results, and observations flow around the distributed organization.



Arthur Koestler coined the term *holon* to describe a self-contained decision-making entity that both contains suborganizations and participates as a component of a larger or higher-order organization [1]. Holonic organizations are *self-similar* or *fractal*, meaning that their basic compositional structure repeats at every level of aggregation or scale. Within any holonic organization, holons at every level perform identical types of information-processing tasks. A holon receives goals and guidance from its superiors; it assesses the situation so that it can evaluate alternative actions and implement the most desirable ones; and, in turn, it directs its subordinates to do their parts to achieve the intended results. Organizations manifest various important aspects. They construct and populate physical and formal structures. They adopt and follow policies and procedures. They develop and sustain values and cultural norms. But the information that the organization communicates and processes provides its lifeblood. Because the other factors change very slowly, if at all, recent and current information effectively

determines what the organization actually does. Absent current and correct information, the organization acts like a senseless animal.

Distributed intelligent organizations exploiting information superiority become *hyper-beings*. We live in a world where intelligent life forms have broken free of their purely physical, terrestrial legacy. The Internet, as a prime example, has created thousands of virtual “places” and “worlds” where real and virtual characters interact. The World Wide Web has become the world’s biggest and most frequented library, with people looking to the web first to find answers to everyday questions. Intelligent organizations use all of these technologies, and others, to enable themselves to collect better information, to analyze it more thoroughly, to conjecture and evaluate alternative courses of action, to choose and implement their plans, to coordinate and control their agents and resources, and to monitor, feed back, and adapt to experienced outcomes.

From a sufficiently distant vantage point, we might not discern individual agents and resources participating in any such plan. We might only see the observable effects or what social scientists on Earth would term the organization’s “behavior.” We would then perceive how these distributed intelligent organizations exploit their information superiority to affect the world. We would be watching hyper-beings showing off their special talent. We would observe distributed organizations, composed of holons, efficiently and effectively collecting and processing information, dynamically adapting their goals and behaviors to attain and sustain supremacy.

You need to understand and apply some of these fundamental lessons in your own life. The principles that dominant organizations employ matter to you for several reasons. First, you probably participate in a range of organizations that vary in their capability to exploit these new technologies and methods. You can probably help your organizations attain superior results by evolving their processes and methods. You can identify impediments to information superiority and work to eliminate them. You can alter strategies to take account of the new competitive landscape. You can help conceive and implement more appropriate and effective systems to support the distributed intelligent decision-making hyper-beings need. Furthermore, as new products and services come to market, you can employ these to improve outcomes in the organizations you participate in. Learning the basic steps of intelligent decision-making and continually improving the tools you employ to support it will go a long way toward making you more productive and successful.

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Competition is ubiquitous, so rewards go disproportionately to those that prevail. Economists perceive competition as a natural response to scarcity, a chafing constraint in the quantity of goods and services available for consumption. The scarce resource might be housing, beachfront property, new cars, or whatever. The world simply doesn't have as many of these available as the total amount desired by all the people on earth. Thus, people and organizations compete to get more of these goods at lower costs than others can. So everyone has to compete for scarce resources, but some organizations excel at it and obtain better results than others do.

In the biological world, we measure success by population size and reproductive rates. Humans have been doing very well in these terms lately, though the experiences of individual humans vary widely. Affluent citizens of the developed countries are getting more and better valued goods than others do. Similarly, some of the business organizations are earning more profits than others. Furthermore, some military organizations, notably that of the US and members of NATO, have been deriving better outcomes for their efforts than others have. In all of these arenas, rewards accrue disproportionately to those on the top of the heap. In competition, out-thinking and out-implementing others means you take home much more than they do.

Combining technologies for information superiority and distributed intelligence with capabilities for effective action produces supremacy. The computing field is about 60 years old. For the entire period of its development, the field has been racing ahead with new innovations, more powerful capabilities, and better-faster-cheaper computing and communication devices. The rate these technologies have evolved is without precedent in the worlds of engineering or biology. As a result of Moore's Law, we have computing devices that double in capacity every 18 months. As a result of similar improvements in communication, networking, and Internet software techniques, we see an exponential increase in the number of computers, megabytes of stored and processed information, and human-machine interactions.

In spite of all of these accomplishments, we are still early in the history of hyper-beings and their competitive evolution. We can already see that organizations have transformed to exploit opportunities available through information superiority. Enterprises have radically altered their supply chains, manufacturing processes, and distribution systems to cut huge amounts of time and cost from their products. Dell computing and Federal Express

package delivery companies are often cited as stellar examples of these approaches. But most companies have not radically altered the way they do business yet, nor has the military accomplished the significant transformations its leaders seek. In the next decade, we will witness many organizations make the bold moves required to become information-superior hyper-beings. Some of these will fail. Others will prevail, attaining positions of supremacy they should be able to sustain indefinitely.

Many technological and doctrinal trends support the impending transformations. Computing power increases and costs decrease on a regular basis. A single PC today has more computing power than most laboratories and research facilities had 25 years ago. In the next 10 years, individuals will be able to purchase for a few thousand dollars personal supercomputers, capable of computing the most challenging algorithms currently known. Organizations with thousands of computers, will find these interconnected by the Internet or its successor, providing vast bandwidth for real-time collaboration and information sharing. Every organization will be seeking ways to increase its information superiority, and few will find themselves limited by computing or communication resources. Instead, they will be limited by the rate they can adopt and implement the systems and practices required to unleash intelligent hyper-being behavior. Specifically, they will need to understand what structures and processes foster this behavior, how to implement those, and how to adapt them over time to improve. The speed with which they implement these information-superior capabilities and the rate at which they adapt and evolve them will determine the organization's velocity through the competitive terrain. Information-superior hyper-beings will leave unexceptional competitors in the dust. They will accrue advantages that make them seem alien to this world. They will see further, foresee farther, envision more, plan more creatively and effectively, and implement more efficiently than any creature or enterprise our world has ever known.

Hyper-beings constitute the dominant species of the new world order. The physical world and the cyber-world occupy two segments of one true world. In the physical world, we interact with molecules and experience mass. We mine things, fabricate them, ship them, consume them, and ultimately destroy them. This is the only world known to our ancestors. In the cyber-world, a world of information processing, we manipulate bits, words, packets, files, objects and streams. These bits bear information and *mean* something when we interpret them in the context of our beliefs and expectations. We use *models* to understand how the world works. The models are mostly intuitive

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and informal, although in some cases we use formal or computational models, as when we simulate the weather to forecast it or simulate a nuclear weapon explosion to evaluate its performance.

When sensor observations, news reports, business results, and intelligence analyses reach us, we determine the “news” or “information” content by determining whether and how what we are receiving differs from what we already know or believe. No matter how many times someone may tell us something that we already know, the redundant reports have no information value. On the other hand, when information doesn’t accord with our beliefs, that is news, and it’s always an opportunity to learn something new. Further, if our beliefs change, it may be necessary to change on-going behavior or revise plans, because the new information wasn’t available when the plan was chosen as the most desirable alternative.

So information reflects what’s occurring in the world and causes us to change our behavior to re-optimize it in light of our best, most up-to-date models of how the world works. Hyper-beings, possessing the best information collection, modeling, information analysis, planning and control resources, can put more resources to work optimizing and re-optimizing their behaviors. Their size and resources are advantages in this game. Those who master the information processing challenges and apply their improved thing with effective action will dominate. In this new world, where physical and cyber-realities intertwine, hyper-beings become the predominant species.

This book attempts to anticipate and help shape the rise of hyper-beings. In this first part, I describe hyper-beings and their principal characteristics. This provides a big picture of the emerging landscape to make its principal features evident. Readers should comprehend how hyper-beings organize, communicate, coordinate, and behave. They should perceive their comparative advantages. They should feel they understand where this evolutionary line has come from and where it’s headed.

I think it’s no exaggeration to say that our computing and communication technologies are combining to constitute a transformational force on humanity as great as those as fire and the written word. Fire enabled people to vastly extend their habitat, in terms of distance, climate, and daily hours. Fire enabled us to eat more and different things, and ultimately to create fearsome weapons and precision tools. The written word also extended the range and reach of humanity. In this case, writing allowed people to transmit know-how from one place to many others, accelerating the diffusion and advance of

culture. In a similar way, the ability of contemporary organizations to organize at various levels of aggregation, to work at appropriate levels of abstraction, to observe globally, to communicate at the speed of light, to test and evolve models, to plan and control precisely the activities of thousands or millions of distributed cooperating components exponentially expands the scope of human activity and the grasp of organizations. I see no natural limit to the size and scale of this grasp. Rather, as in earlier industrial days, hyper-beings have natural economies of scale: the bigger they get, the more efficient, effective, and naturally dominant they become. Hyper-beings want to include more parties, co-opt others into their systems, and collectively control more of the world. That which they do not control, they cannot optimize.

Are hyper-beings good or bad? Although hackneyed, we ought to judge people, organizations and cyber-beings by what they do rather than what technology they employ. Science and technology repeatedly offer us opportunities to do good or evil. We have organizations today that do good and others that do evil. We have some governments on Earth that do good and others that do evil. There's no doubt that hyper-beings will be the most powerful, intelligent, farthest reaching entities ever known. Their potential can't be overstated. The opportunity for abuse of power is apparent. Undoubtedly, we will need to create new means of checks-and-balances to assure that the enormous power of these new creatures doesn't run amok. At the same time, hyper-beings will attain levels of efficiency and effectiveness that can produce great benefits to their customers, investors, partners and participants. In optimistic pursuit of that positive potential, I invite the reader to step into Chapter 2, where we make evident the radical nature of the changes afoot.

2. “We’re not in Kansas anymore”

Depending on when you grew up, life was simpler in many ways. Just a few generations ago, people grew up without TV and cell phones. Many people now living reached adulthood before they touched a computer or videogame. Today’s teens have grown up with PCs, the Internet, WiFi wireless networks, the web, file sharing, and many other technologies that have disrupted the slow pace of life in the 20th century. Well, in the words of a familiar spokesperson, get ready now for something entirely different.

We have left the world of autonomy, independence, and local business behind, for good. These qualities were valuable when a person’s reach was severely constrained by limited physical resources, limited transportation capabilities, and weak information processing technology. When making money required moving molecules, people had to locate their activities close to resources, distribution centers, and customers. This proximity gave an advantage to local suppliers, and the best local suppliers amplified that advantage by getting close to customers in other ways. Suppliers knew their customers, knew what they wanted, and developed deep personal relationships to keep their customers’ loyalty.

But those days are over. If we can associate the good, simple, local life with small town America, such as those in the heartland, we’re not in Kansas anymore³. Yes, there are still small local businesses, but their proportion of the world’s economy is declining. More importantly, their advantages have evaporated. A global Internet-based firm such as Amazon, or a global information-superior organization such as Marriott Hotels, can provide superior customer service to its customers, wherever they are. Customers want simplified interactions that give superior buying experiences, they want products and services that work at least as well as expected, and they want low prices. These critical elements of value are delivered best by companies that use information technology to remember their customers, offer them additional goods and services they will value, simplify their purchases, expedite delivery and installation, provide quick and effective service, and pass along cost savings resulting from efficient supply-chain management and volume purchasing discounts.

³ For those too young to have seen it, these were Dorothy’s words to her dog Toto when the tornado carried their house out of black-and-white Kansas into the Technicolor realm of Oz, in MGM’s *The Wizard of Oz*.

The world has changed in so many ways over the last few years that the shape of things in the future has little in common with the stable features of the past. In this chapter we are going to discuss many of the big changes that, collectively, radically alter the environment for organizations and people. Taken together, these changes transport us from Kansas to a brave new world, where things never stop, information flows at light speed, the rich get richer, and new forms of intelligent life have the opportunity to dominate.

Networked World

We live in a networked world. Networks allow people to communicate telephonically or digitally, using a wide variety of means. Email and instant messaging are the most common forms of people-to-people digital communication. People also interact asynchronously by sharing files. New forms of digital communication include video teleconferencing and web-hosted conferences (or *webinars*). As communication costs decline, people communicate, collaborate, and cooperate more, because this enables them to make things happen more quickly, more effectively, and across greater distances.

Our machines have many ways to talk to one another as well. The Internet provides a ubiquitous basis for them to exchange messages and files. They can request services of one another or allow others to access their services and accomplish work remotely. They share databases, and these are often distributed among sub-databases and replicated to assure high availability in multiple locations. Other network protocols also exist for allowing our machines to interact. The most prevalent protocols operate on both “wired” networks and wireless ones.

In a matter of just a few years, there will be more devices communicating with one another on Earth than there are people. Why is this? Miniaturization enables us to build incredibly cheap sensors, computers, and transmitters. These provide useful information about the state of affairs in their local environment. Collecting this information enables organizations to track and update their models of the world, thereby giving them better information sooner. Most interesting machines in the future will link themselves up with some global network such as the Internet and immediately begin providing real-time data and receiving tasking orders from their masters.

What do machines say to each other when they talk? The history of information systems shows a steady progression in content from very simple status signals to higher levels of requests, transactions, and semantics. The

Internet solved the problem of allowing any computer to join the community of machines that can easily exchange digital information. The next problem solved was what the format and encoding of information should be. The Internet defines a variety of MIME types that allow different forms of content to be exchanged⁴. Distributed computing standards such as OMG's CORBA⁵ and W3C's Web Services⁶ made it easy for one computer to directly control another or obtain services from it, regardless of where it is. Finally, computers have begun to understand the content of information. They receive helpful hints coded using syntactic and semantic markup techniques, including XML and related domain descriptions given in XML-encoded DTDs⁷. Soon, XML-extending techniques such as the DARPA-W3C semantic markup language OWL⁸ will begin providing machines easily processed semantic information. These technologies allow people to annotate computerized messages to say what types of components they encode and what standard categories they employ. Furthermore, machines using parsing, language understanding, and inference techniques can interpret what the content asserts, what it means, and what actions to take in response. While far from perfect, these techniques are already widely used and getting better all the time.

In short, the world we live in has practically no boundaries that limit who can talk to whom, what can talk to what, what can be said, or who and what can understand and act on information. Once you purchase computers and pay for the electricity to operate them, it costs you nothing extra to accommodate incremental requests for communication. Thus, the marginal cost of communication has become essentially zero. In such a world, talk may be cheap, but it's increasingly ubiquitous, continuous, and material.

⁴ The Internet Engineering Task Force (IETF) sets Internet standards. See www.ietf.org.

⁵ The Object Management Group (OMG) develops standards for distributed computing. See www.omg.org.

⁶ The World Wide Web Consortium (W3C) develops standards for HTML, XML, web services, and other web protocols. See www.w3c.org.

⁷ A Domain Type Definitions (DTD) specifies the attributes and possible values that practitioners in a specific community should employ to annotate their contents. For example, the Dublin Core dictates how to describe library resources.

⁸ The W3C OWL Web Ontology Language effort has recommended a standard. See www.w3.org/TR/owl-features.

Globalization

In Thomas Friedman's book, *The Lexus and the Olive Tree*, the New York Times correspondent described the pressures on countries to participate in globalization as "the golden straightjacket." [2] The potential rewards for joining the global community were so great, they presented opportunities for "gold" and other fortunes to the participants. According to conventional economic theory, each player in the global marketplace could leverage its special advantages to optimize its economic results. China, for example, could exploit low labor costs and high quality workmanship to excel at manufacturing. But know-how and capital would only consider moving to countries that provided them safety. To feel safe they need financial transparency. They also want assurances that thieves won't loot their assets, and this requires a moderate level of sociopolitical maturity. Corrupt and autocratic regimes would chafe under these requirements for open and fair systems. These new rules would feel like a straightjacket on their behavior. Put on this golden straightjacket, make money. Abuse or reject it, and watch know-how and capital flee.

Globalization is a major economic and political trend, aided by international institutions such as the World Trade Organization, GATT, the European Community, and NAFTA. Each of these organizations provides a framework for increasing international trade and dependency, often at the expense of some national sovereignty and autonomy. The companies that participate in this trade act as what Koestler called holons. Each company becomes a component of bigger transnational systems with goals and constraints of their own. At the same time, each company operates as a self-contained entity pursuing its own goals and directing its components and constituents on how best to play along.

Many large companies have built their own multi-national systems to operate effectively across national boundaries, within the constraints of international laws and treaties. In addition, collections of allied and affiliated companies have worked out arrangements to provide mutual aid and support to members of their commercial federations. In Japan, these are called *kereitsu*. In Korea, they are called *chaebol*. These Asian federations of allied companies coordinate their products, their plans, their distribution networks, and their financial systems to out-perform the competing federations. In other countries, dominant manufacturing or retailing companies simply call their own coordinated federations of companies *supply chains*. In the context of

this book, of course, we see these as early and somewhat immature forms of hyper-beings.

Global integration is occurring now because communication costs have fallen dramatically, knowledge and information are mobile, and capital is plentiful. Countries have seen benefits to increasing trade and seek ways to increase employment opportunities for their citizens. Language and cultural barriers are ebbing, in part due to the spread of western, especially American, products and values.

Globalization is likely to continue, albeit it with fits and starts. Many people object to the loss of their local culture or the loss of independence. Others object to the “take-no-prisoners,” “winner-take-all” attitude associated with rampant capitalism and its dominant players. Others object to the concentration of wealth that goes along with market dominance and to concentration of political power that typically accompanies it. Still others object to the loss of diversity associated with predominant products, raising concerns such as reduced innovation, increased vulnerability to disease or disruptions, and loss of local industries and economic base. All of these concerns have *prima facie* validity and are supported by plentiful evidence. Nevertheless, the rewards evidently have more motive power than the risks. Globalization moves inexorably forward.

Move Bits, not Molecules

Most of the economy of the world, at least through the 20th century, was tied to processes that extracted, refined, processed, and shipped physical materials and products. Since people need food, clothes, furnishings, tools and fuel, the importance of these activities isn’t going away any time soon. On the other hand, the most rapid growth in the economy is in the information sector, where people consume bits not molecules. So it’s bits that have the fastest growing value. We need to understand why this is and what it portends.

When Gutenberg invented movable type, it unleashed revolutionary changes throughout Europe. Surely it wasn’t the type itself that had the impact, nor the symbols on the page, nor the pages printed, nor the weight and volume of the books shipped. None of these essentially physical qualities was more than accidentally associated with the revolution. It was, of course, “the word” that created the impact. That is, information was able to get to readers who were edified, informed, and inspired as a result of consuming it. If informing means telling someone something they don’t know, the widespread dissemination of printed materials unleashed an informing torrent. For the

first time, people could learn from others not in their immediate vicinity, experts could reach broad audiences, and everyday people could drink from a fountain of knowledge.

Digital communications, including computers, computer-readable media, the contents of the World Wide Web, and mass media are now spewing forth vastly more information than anyone can consume in a lifetime. The prolific results of scientists, engineers, researchers, and automated observation and analysis stations find their way both to printed pages and on-line digital repositories. Practically everything worth saying is stored digitally and accessible to nearly every person on Earth. Our stockpile of digital content is growing exponentially.

Two very important side effects of this trend have become evident. First, as the media conglomerates have learned, digital content is leaking from their controlled vaults. People get access to a few copies of a valued resource, and they replicate it and disseminate it broadly. This, of course, threatens the established royalty systems that have compensated authors and publishers for the last two centuries. Second, the value chains associated with selling and delivering products and services to customers are being significantly restructured. Customers value the end result they obtain from a purchase, but generally begrudge the time, effort, and expense they incur in actually purchasing the product or service. Furthermore, customers don't perceive their personal copies of standardized information as highly valuable, worthy of high costs. In fact, individuals can obtain most information for free, either from libraries, broadcast media, or file sharing.

As a consequence, two trends combine to squeeze sellers in an economic vise. First, sellers must use digital communications increasingly to give customers more of what they value and reduce the hassle and effort required. Second, customers perceive much of the information sellers provide them as a standardized, low-value commodity. For these reasons, new enterprises employ lean operations that move more bits and fewer molecules, delivering customers a higher ratio of perceived value at reduced cost. Company presence becomes more virtual, the activities more information-centric than physical, and interactions with customers move increasingly into cyberspace. Cyberspace is where we communicate and conduct transactions that require only bits to move. Of course, physical transactions will continue, but economic returns inexorably shift from physical operations to information processes.

Capital is Mobile

Capital is money people invest in businesses. Companies usually expend capital on things such as equipment or facilities, and supplies. Because businesses consume resources to create the things they offer for sale, they expend money to build up inventory and promote their products before they can actually sell them. Eventually, customers purchase the goods and services the company has offered, thereby agreeing to pay the company amounts termed *revenues*. Delays often occur between sales and the inflow of cash resulting from actual payments. The build up of inventory, the delays in cash, and other requirements for short-term expenses combine to make the company seek additional money, termed *working capital*. Thus, companies basically need capital for two reasons, furnishing and operating their business processes.

Capital comes from people who think they can earn a good profit by lending the company money or by purchasing ownership shares in the company. The people who provide capital are termed *investors*. In exchange for providing the money, investors hope to earn interest on loans, dividends on stock shares, or capital gains on stock ultimately sold at prices higher than originally paid.

At several times in history, capital has been scarce. Scarcity results either from investors having no money available or being unwilling to risk it in businesses. Investors generally behave en masse, since every investor lives in the same environment and experiences mostly the same conditions[3]. When several investors find conditions favorable to invest, most investors do. When several investors have a great deal of liquid assets standing at the ready for investment, most investors are also keeping significant assets in liquid form. As a result, aggregate investment waxes and wanes cyclically. With respect to the publicly traded firms whose stock shares trade on stock exchanges, the basic swings are called “bull” and “bear” markets. When people have cash and want to invest, the “bulls” are running. Money flows into companies and their stocks. At other times, as in the period between the end of 2000 and early 2003, the reverse occurs. The “bears” sell their stocks, hold onto their cash, and do not invest.

It used to be difficult for investors to place investments far from home, because they couldn’t get good information about the prospective investment and they couldn’t easily participate in an investment transaction. Those days are long gone. Money flows around the globe, enabled by global investment

banking operations, mutual fund companies, and electronic trading networks. People, institutions, and transactions operate at great distances, at the speed of light, with money moving as a result of electronic transactions that in actuality only change bits in the account records of credits and debits.

There have been times when the total amount of cash available was scarce, because people wanted to hoard it, governments gobbled it up for wars or other nationalistic pursuits, or people reacted to governmental corruption or financial mismanagement by losing confidence in money. Fortunately, we have mostly avoided those problems for the last 50 years.

The net result, and the important one for this section, is that money is plentiful and moves easily. Today, capital is mobile. It moves to where the opportunities are. It doesn't stop at regional, national, or international boundaries. It flows to different regions of the world as the climate changes. There's more money than good investment opportunities. Much of the developed world is sitting on piles of cash that are earning less than 1% per year. These are historically low returns. Almost any good investment opportunity can attract significant capital. Thus, capital has become a relatively weak player, owing to the relative excess of supply compared to demand. This factor amplifies the relative power of distributed intelligent organizations. People with capital, investors, have much reduced influence, and distributed organizations can obtain capital in multiple locales.

Labor is Mobile and Work is Outsourced

The other traditional source of power has been labor. In fact, labor and capital often wrestled over their share of influence, power and control. Organized labor might be cheering the declining power of capital but for one fact: the power of labor has suffered a similar decline. The biggest single factor degrading labor's power is the ability of businesses to transfer operations to low-cost communities. Even if the business as a whole doesn't move its signs, places of sale, and headquarters, it can effectively move most of the value-adding work. So China has become the number one manufacturer in the world. Most American companies continue to transfer core manufacturing operations to China and other developing countries with low wages, such as Mexico, Vietnam and India. So businesses today can transfer work to components that pay workers low wages. This practice is termed *outsourcing*, and it is one of the single fastest growing trends in industry. Traditional blue-collar manufacturing has been moving for decades. White-

collar outsourcing has moved in lock-step with the rise of modern networking and improved information processing capabilities.

Labor itself is increasingly capable of moving to where the work is. Europe is suffering from historically low birth rates, so workers from Turkey and underdeveloped countries of the former Soviet Union travel to take up places in Western European businesses. For decades, Latin Americans have flooded the US to perform vital jobs in agriculture and service industries that kept wages in these occupations below American citizens' official "poverty" levels.

Both means of getting work done at lower labor rates have been accelerating. It's relatively easy in today's world to ship bits to a low-wage locale describing the products and processes that machines and workers need to implement. Even customers who telephone the toll-free service number for their best known national companies are likely to be speaking to people half a world away, all made possible by modern telecommunications and computing. The individual workers in the low-wage locale can be local residents or can get there in a few hours by catching a low-cost airplane flight. Labor, on a global scale, is vastly underutilized. There are many more potential workers than high paying jobs. Supply, again, exceeds demand. Our networks and open borders make labor mobile and put it under great competitive pressure.

A recent news⁹ report extolling significantly improved business results achieved by Cisco after the e-commerce bubble burst, makes the point clearly:

[Cisco management] began playing hardball with suppliers to keep profits up. The CEO of one supplier said Cisco wanted to take 90 days to pay for his products instead of the normal 30. It also wanted the supplier to extend the warranty on its goods to three years from one. When he balked, the CEO got a call from a midlevel manager. "If you don't [agree to our terms], we'll instruct our people not to use your products," he recalls the manager saying. The supplier, like many others in such tough times, couldn't afford to lose Cisco's business and buckled under.

Many others lost out entirely. Cisco's list of key suppliers has fallen from 1,300 to 420. That lowered administrative

⁹ *Business Week*, November 24, 2003.

costs and led to volume discounts worth hundreds of millions of dollars each year. Pong also outsourced more production to lower costs, from 45% in 2000 to over 90% today. At the same time, he spent millions to shift production work from nine contract manufacturers to just four. And smaller resellers complain that Cisco began giving discounts to strategic distribution partners such as IBM and SBC Communications, leaving hundreds of smaller players unable to compete against these behemoths. “Cisco went from being our best partner in good times to our worst enemy in bad times,” says the former CEO of one reseller.

The end result is that the deck is stacked to make it easy for businesses to cut costs continually by moving work to the lowest cost workers. The better organized, the more globally conscious, the more intelligent the distributed operations, the lower the costs, the higher the profits, the greater the natural size and scale of the prevailing enterprises. Conditions are very conducive to the rise of hyper-beings.

Excessive Supply

Michael Hammer, in his book *Agenda*, tried to rally company executives to change their perception from business as usual[4]. He pointed out that we, in the developed world, live in environments of plenty. In fact, there are *too many* suppliers of almost everything. Most customers don’t perceive significant differences among the products offered by competing companies. Moreover, even the CEOs of most companies admit in private discussions that *they* don’t perceive significant differences either. When products are indistinguishable, they are by definition *commodities*. When we have more commodities on the market than customers with money really want, we’ve got a situation of excess supply. That is the world we occupy.

Hammer’s point was that old strategies don’t work for companies in this situation. You can operate your business, if you’re extremely efficient, but you will net minimal profits, if any. To get big profits from customers, you must offer them something they see as different and worth a premium price. The simplest road to profitability is through this kind of differentiation. But if you cannot differentiate your products, you have to differentiate around the customer’s experience. What do most customers want? Better, faster, cheaper products, services, and results, with minimum hassle. When everybody’s making the same things, nobody can differentiate by making better, faster, or cheaper products. Advantages of that sort are short-lived and usually

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insignificant. Unless you invent new types of products, improving the customer's experience may be your only profitable gambit. How do you give a customer a superior experience? You need to: know the customer better; simplify the customer's buying experiences; reduce customer hassles associated with delivery, installation, support and maintenance; and win the customer's continuing loyalty through periodic positive interactions. This is the *agenda* for surviving, thriving, and making profits in commoditized markets with excessive supply.

When products were simple, distance a big obstacle, and customers naïve, every small business serving its local clientele could address this full agenda with a warm, friendly, ongoing relationship. Today's products, however, often have greater complexity, and customers have become increasingly sophisticated. If assistance is required, it cannot be provided by technically ignorant, general-purpose sales personnel or call center attendants. When a customer wants help, not hassle, the company has to link the customer directly to a knowledgeable specialist. That specialist, to be really effective, should know the customer's history, have a model of the customer's product and site configuration, and have unsurpassed knowledge of how to make things work when problems arise. As products increasingly interact on networks with other products and combine software components from multiple sources, the challenge of providing excellent service seems beyond the ken of any company. Moreover the outsourcing trend means that most customers are being supported by low-paid, uninformed, unfamiliar personnel, leaving the customer with the unpleasant experience of having incurred additional injury as a result of seeking assistance.

To reduce a customer's hassle and to exceed the customer's expectation for a positive interaction, companies literally will need to provide super-human service to customers. Their service will remember each customer perfectly, know the customer's history totally, be familiar with the customer's configuration and site, know how these components interact, understand a wide range of service objectives and problems, be capable of diagnosing and repairing problems remotely, and be thoughtful enough to offer the customer additional benefits, savings, promotions, and innovations that the customer considers outstanding. Without these capabilities, all companies, regardless of size, will slip into mediocrity and eventual demise. Only large companies with comprehensive technical capabilities can accomplish this agenda. They will do this by superior use of information about customers, products, configurations, sites, problems, diagnoses, objectives, opportunities, and

support techniques. They will use built-in sensing, networked communication, surveillance and management techniques to reach into customers' premises, watch what's going on, and proactively deliver superior customer experiences. The companies that do this will grow into dominant hyper-beings in the competitive arena. Their customers will be wowed, delighted, and loyal.

Power to the Buyer

Ironically, in a world of giant companies, power is shifting to the buyer. When many companies offer equivalent commodities, the customer can freely choose among suppliers. The suppliers will bid to win the customer's business, and they will inevitably compete by offering lower prices or enhanced packages. Almost every industry today is awash in competitive blood-letting, where prices are falling and companies are starving for customers. Current examples are evident in PCs, computer servers, telephones and wireless services, banking, insurance, jeans, groceries, airlines, hotels, and rental cars. As more services come on line to help customers break through remaining barriers to price information, prices will inevitably fall further. Thus, the Internet accelerates the decline of profits among commodity suppliers.

Sellers have traditionally used many different techniques to lock their customers into their product line and keep them from switching to other suppliers. There have been proprietary operating systems, proprietary hardware, proprietary networks, proprietary adapters, proprietary order entry systems, proprietary distribution and delivery networks, proprietary telephone numbers, proprietary instant messaging systems, etc. All of these were intended mostly to cause the user great difficulty and expense for switching suppliers. These systems are supposed to be very "sticky," being somewhere between "honey" and "fly-paper." Attractive properties are excellent, because they bring in new customers. Lock-in features are excellent, because they prevent existing customers from departing.

Consumer groups and governments often work to break down the lock-in features of proprietary products. Standards, in particular, are used to define how multiple competitors in a market should make their products work together. This increases the "openness" of the market and reduces proprietary lock-in. When all the suppliers in a market offer products that compete and interoperate, customers have maximum power. When a single dominant supplier controls the market, that defines a monopoly. Governments eventually attack monopolies, finding ways to open the market and increase

customer power. Monopolists derive big profits, but eventually governments reduce them.

In our current environment, characterized by a surfeit of undifferentiated products, the customer has more power than the supplier. Customers are getting smarter too, because they have access to more and better information that reveals features, prices, and competitive comparisons. In this world, customers won't pay premium prices to any supplier that provides merely competitive features and prices. There isn't much wiggle room for the mediocre business.

Innovate or Die

Many middle-class and affluent adults have begun to experience the combined effects of globalization, outsourcing, and surplus supply: they're losing their jobs, their total compensation doesn't keep up with the rising costs of a comfortable life, and they have become and feel dispensable. Whole sectors of the economy and even whole nations risk falling down the ladder of economic progress. In bygone days, with protected markets and other barriers to friction-free flow of information, capital, and workers, industrial giants and their governmental allies could maintain supremacy. Now, however, no giant protects its workers in one country from lower-priced workers in another country. No legislature can build a barrier to stop the flows. Operating according to yesterday's strategies won't arrest the slide.

Joseph Schumpeter was the first economist to explain how innovation works to expand the economy and why we need as much of it as we can get to sustain rising standards of living [5-7]. Most modern businesses realize that they must continually create and nurture new products and services. As sales of these new offerings increase, they offset revenue reductions resulting from formerly significant but increasingly stale products. Our employers can afford to achieve innovation and increase productivity by moving jobs to low-cost labor forces. This becomes easy once these labor forces raise their education and innovation skills to levels comparable to those in North America, Europe and Japan. But we, as individuals, can't afford to have them take away and transfer our employment, and we as a nation can't afford to have the national economic advantages deteriorate. No matter what level of analysis you consider—the individual, the company, or the nation—the logic is simple: *innovate or die!* Declines are slow, so even severe disorders might not be obvious, and death isn't immediate. But sliding down the ladder of prosperity hurts enormously.

The message is clear. As individuals, we need to excel at innovative thinking and processes. As suppliers and employees, we need to participate in organizations that out-perform the competition, continually, including over the long-haul. As citizens, we need to assure that political, social, economic and educational policies sustain our advantages in innovation. A few leading CEOs, all of whom lead efforts to shift large amounts of capital, employment, and opportunity out of the US, are at least trying to raise the alarm before more “canaries in the mine” die. The following news item illustrates their alarm:

“OCTOBER 30, 2003 (REUTERS) - IBM CEO Samuel Palmisano said today that the U.S. needs to step up the pace of innovation to help stem the flow of technology jobs overseas.

Palmisano said that he expects 13 million jobs to be created in the next two years around the world, including in rapidly developing countries such as China, India and South Korea.

“We are at a critical moment,” he said. “Because if we’re not careful, the U.S. will fall out of step with the new realities of innovation. If that were to happen, the innovators and risk-takers would go elsewhere. Because today they can.”

Palmisano spoke at the annual meeting of the Council on Competitiveness in Washington, which is creating a National Innovation Initiative to come up with ideas on how to continue to innovate in the face of such competition.

Other countries are becoming more competitive not only in wages but also in education, job skills and network infrastructure, he said. “We believe the United States must again raise the bar — to take the steps necessary to keep the nation at the forefront, to continue to offer the most fertile and attractive environment for innovation in the world.”

His comments come at a time when IBM and other companies are shifting jobs overseas as they try to cut costs.

Last week, Intel Corp. CEO Craig Barrett said that the semiconductor company no longer planned to invest in California and that its investments were following its markets, 70% of which are outside the U.S.

Earlier this month, Intel Corp. co-founder Andrew Grove said that U.S. dominance in key tech sectors was at risk, comparing it to the fate of the U.S. steel industry. “It would be a miracle if it didn’t happen in the software and services industry,” Grove said.

The comments also come about six months after the head of Oracle Corp., technology industry veteran Larry Ellison, stirred up controversy by saying that innovation was all but gone in the U.S. and that Silicon Valley, the home of start-up technology companies, was dead.”

Knowledge is Power

Knowledge is information about how the world works. With knowledge, we can anticipate how one thing affects another, we can predict effects, and we can often control what does or does not occur. Knowledge derives mostly from *science*, where investigators formulate hypotheses, run experiments, and hone theories and explanations that work reliably. People have a great deal of *informal* knowledge, as well, gained as a result of their brains doing pseudo-scientific analyses of their personal experiences. When many people have compatible experiences and interpretations, their informal knowledge becomes generally accepted. Scientific knowledge explains how antibiotics work, how engines produce thrust, how bridges stand and airplanes fly, and how electronics carry information over networks that display messages. Informal knowledge explains why insults engender anger, faithfulness produces trust, speeding causes stress, and why it’s better to seek forgiveness than permission. Regardless of what type of knowledge we possess, knowledge that’s valid enables us to predict and control events in the world. That is why *knowledge is power*.

When engineers speak of *power* they mean the capability to accomplish physical work in some reasonable amount of time. The more power, the faster you can move a heavy weight or the more weight you can throw around. This is a different but analogous meaning of that intended when we speak of the *power* of knowledge. In the current case, we mean that knowledge can enable you to do all kinds of work in improved ways. If you want to move more weight, knowledge can enable you to do that. If you want to move a weighty object faster, knowledge can enable you. If you want to do things better, or faster, or cheaper, the most direct route is through know-how. In short, knowledge amplifies physical power.

From the fossil and archaeological record, we have good evidence that most of human history was marked by an incredibly negligible growth of knowledge. Even in historical times, whole centuries passed with few advances in knowledge. That changed a few hundred years ago starting with the Renaissance, and knowledge has been increasing since then at an accelerating rate

Many of our new technologies directly support the knowledge-producing industries and processes. Recently, for example, the entire human genome was sequenced by robots. Machines implemented the techniques of trained microbiologists, computers processed the data to identify valid hypotheses, and other computer programs automatically documented the results. The same kind of acceleration is happening in most areas of human endeavor. Even when processes are not fully automated, scientists and researchers collaborate via networks, publish their results on Internet-accessible databases or web sites, search for others' relevant results, and analyze and interpret results using powerful networks of computers with sophisticated data processing algorithms. Computers can conjecture hypotheses, design and conduct experiments, analyze and publish results. The whole process of finding truth now operates at light speed.

Through automation and productivity enhancements for human investigators, civilization is producing knowledge at a breakneck pace. In addition, observations and reports are spewing forth from automated collectors, pundits, bloggers, journalists, critics, students, teachers, and columnists. All of this information is digitally encoded, widely indexed, and instantly available. This is a "good news, bad news" situation. On the plus side, we have more information and more knowledge about what it means than we can reasonably hope to exploit. On the negative side, the average individual is awash in digital data and has no hope of finding, let alone benefiting from, more than a tiny fraction of what's available. The game is definitely tilting in favor of teams of people over the individual, especially hyper-beings and other information-superior organizations that have the resources, processes, and incentives to find the best information, exploit it, and surpass their competition.

Because knowledge is accumulating rapidly, new possibilities open. New understanding of how things work makes it possible to invent new products and processes, as well as to improve existing products and processes through more limited innovations. In computing and electronics, we have been

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watching product life-cycles shrink for some time. Most products are succeeded by new versions in about a year, and significant new families of products arise about every 5 to 10 years now. These cycles are about twice as fast as they were 20 years ago and about 10 times faster than they were 100 years ago. The more we learn, the greater the opportunity to change what we offer the customer, to jump ahead of the pack, to extract more money by giving noticeably more value for the same price.

In competitive arenas other than business, knowledge is equally powerful. In intellectual arenas, such as chess, knowledge and the ability to apply it quickly have long been determinative. Only in the last few years have the know-how and proficiency of computers reached the level of the world's best human chess players. In medicine, as another example, computers routinely analyze and interpret medical data, guide surgical interventions, monitor and manage patients.

In military contests, the information-superior organization is able to prevent conflict, shape the battlefield when conflict is inevitable, and win decisively by outthinking and outmaneuvering the opponent. The information-superior organization collects more useful information, interprets it more correctly, exploits it for better plans, and distributes information more usefully, in a more timely way, to enable its distributed components to coordinate their activities more effectively. The end result is that the modern military aspires to harness and leverage the power a hyper-being's superior knowledge provides.

In sum, the production of information is up throughout the world, it moves faster than before, and knowledge about how things work and how to exploit information is increasing exponentially. Knowledge makes innovation and invention possible, and these are the easiest routes to profit. Knowledge of the customer, the customer's business, and the customer's problems provides the means for a business to deliver value, to differentiate its offerings, and to charge premium prices customers gladly pay. In military and non-profit spheres, success also comes to the smart organization that can get better information and employ it effectively across boundaries. Size and reach multiply the power of knowledge, because they create more opportunities to employ it for advantage. Hyper-beings, organizations of great size and reach, possessing superior information processing systems, are uniquely equipped to transform the knowledge explosion into a competitive advantage.

24x7 Competition

What ever happened to “bankers’ hours?” Ah, it must have been nice: working weekdays only 9 am to 3 pm, possibly as late as 6 pm on Fridays. Nice job, if you can get it, eh? Well, as you know, those jobs are gone, along with the slow pace of competition they reflected. Competition today is 24 x 7: 24 hours per day, seven days per week, 365 days per year. Why? Because customers have the power, labor is cheap relative to the fixed costs of big businesses, the information processing infrastructure runs all the time without marginal costs incurred by the hour, and buyers buy more when free to shop on their own timetables. One other factor is increasingly important in this shift, and that is the rise of *virtual stores* or *e-business*. Shoppers no longer care where the sellers are located. Online, they shop when they want and where they want. Many sellers are represented mostly or entirely by computers that present shopping pages and forms, accept purchase orders, and complete the transactions entirely electronically. Ultimately, goods may be transshipped from the manufacturer or distributor directly to the customer, with no molecules ever passing through the hands of the seller.

Only cultural and legal barriers might slow proliferation of the 7x24 model. “Blue laws” used to prevent people from selling alcoholic beverages on Sundays and election days. Similar laws used to prevent retailers from selling on Sundays and other unwholesome times. And in many countries, various restrictions still impede big business invasion of local markets. These constraints, though still in place in some jurisdictions, are vanishing fast. Globalization brings with it requirements for open markets. Foreign companies bring with them desires to serve the customer at all hours of the day, at all places around the globe. In this arena, the sun never sets, for the enterprise is serving customers around the clock and around the globe.

Obviously organizations that work around the clock must be supported by information systems that never sleep. Financial transactions keep coming, order processing goes on continuously, and goods and services are being delivered somewhere every instant. The ability to integrate the far-flung operations of a global enterprise 24 hours a day is a stunning achievement of computer and communications technology augmented by powerful software applications. Organizations that employ this technology effectively and efficiently gain huge advantages. Once in place, organizations can use this technological foundation as a basis for observing, monitoring, coordinating, and managing the entire operations. These organizations attain information superiority by joining its extensive information to its comprehensive abilities

to plan, execute, and control. Operating non-stop with the best systems and the best information sets a pace that few competitors can match.

Asymmetries and Asymmetric Threats

Information superiority has natural economies of scale. The networks, processes, products and behaviors get better, faster and cheaper the more people they serve. In traditional “smoke stack” industries, natural economies of scale occur too, but they usually lead to monopolies that require government regulation. Electric power and telephone were two industries that, for most of their histories, were regulated because of such economies of scale. There is some debate about whether they should have ever been deregulated, but political deals broke these industries into multiple parts under the belief that innovation would increase and consumers would reap benefits from increased competition. Until these recent experiments however, conventional economic wisdom about these industries held that the average cost of serving customers would decrease as the companies expanded. Thus, once a company got ahead, it could progress steadily toward complete monopoly by exploiting its cost advantages to undercut any competitor.

The reason for this discussion is to make the point that *big is better in networks*. The more links, nodes, and users you have, the more customers you can serve and the lower your average costs. If your networks provide some other advantage, such as knowledge or improved decision making, the benefits of scale increase. Big isn’t just better in that case, *big is everything*. An organization that has greater reach, more information, more knowledge, and more intelligent processes needs only capital and labor to fuel its dominant position. It can crush competitors with superior products, services, customer knowledge, and costs. Being Number 1 isn’t everything. It’s the only thing.

I have intentionally stressed the objective advantages of the dominant hyper-beings to drive up your desire to look for weaknesses in the argument. If you are like me, you find one-sided contests and one-sided arguments offensive. Although you and I are engaged here in a purely intellectual exchange, the organizations that are facing competition from hyper-beings experience the reality of this argument as a daily threat to their existence. It’s not a game for them. To operate in a niche where an information-superior hyper-being lives is to look Death in the face. Death in business may mean closing down an operation and the loss of jobs for people who presently earn a living wage. In military contests, however, death means death.

Over the last few years, the asymmetric nature of military competition with the United States has been a topic of intense investigation in the US, among our allies, among other nation states, and among terrorists. It doesn't take long for people to realize that the dumbest thing you can do is to attack or oppose a superior power in ways that let it exploit its superiority against you. Instead, you look for ways to attack it that play to its weaknesses or which nullify the power of its many advantages. This gives rise to asymmetric threats and asymmetric warfare.

The 9/11 terrorist acts illustrate this asymmetry. The terrorists used the US's own commercial assets to attack a non-military target of great symbolic significance. The total destruction of the World Trade Center was emotionally devastating. The suicide of the attackers negated our ability to retaliate or wreak vengeance. This created a sense of powerlessness. Finally, the stateless nature of the Al-Qaeda meant we had nothing we could attack in retaliation. Although we have subsequently toppled governments in Afghanistan and Iraq ostensibly in some way to respond to the 9/11 attack, most people can see how tenuous and strained this logic is. In asymmetric warfare, the smaller opponent doesn't play by your rules. It minimizes or negates your power by nullifying your logic. It seeks ways to have huge negative impacts on the general public rather than military or state targets.

The US and the rest of the developed world have great advantages that are driving the rise and growth of hyper-beings, but we also have sensitive dependencies on vulnerable supporting systems. We cannot make these systems totally secure, and taxpayers consider the costs prohibitive to make these even moderately safe. Food, water, highways, airports, trains, telephones, electric power grids, the Internet, Microsoft PCs, Linux servers, financial networks, credit cards, drivers' licenses, employee databases, social security numbers, etc., etc., are all vulnerable and relatively easy for talented people to attack. We have a society and industrial base that thrived in an environment of low external threat and widespread domestic tranquility. When we built systems for defense, we oriented them toward great military attacks from the East. By the time the Soviet Union collapsed, the defense establishments on both sides of the Atlantic were basically bankrupt.

We do not have now, nor are we likely to have soon, effective means of preventing or countering a wide range of asymmetric threats. In the national security arena, this means we will be scrambling to improve our abilities to detect, prevent, and mitigate a huge diversity of possible attacks on largely

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undefended targets. The opponents of America's hegemony correctly see the hyper-beings that spring from our culture as sprawling dominant organizations. They also understand that these hyper-beings will prevail in peaceful environments governed by familiar rules and values. Their only means of attacking that hegemony is through asymmetries. We should expect a great number of these in the future.

Similarly, in contexts other than military, we should expect a large number of asymmetric challenges to the hegemony of hyper-beings. People and organizations that see their livelihoods challenged and see all advantages going to the other side will do desperate things.

Can anything be done to prevent these nasty scenarios from playing out? Assuming that the hyper-beings will dominate in civilized competitive arenas, we must ask how much inequality between winners and losers will be tolerated. Presumably, by sharing the wealth, winners can create a world of tolerable disparity. That, however, requires a degree of self-serving enlightenment and government involvement that has been rare in human history. We can only hope that the inevitable predominance of hyper-beings is not allowed to run to its natural, monopolistic, asymmetric end. Powerful interests need powerful limiters.

Summary

Much of natural evolution has led to the predominance of the human (*homo sapiens*), the thinking and talking creature who uses tools, reasons symbolically, models the world, and predicts and controls processes to achieve desired outcomes. In the 20th century, engineers created tools and technologies that allow large organizations of people, and collections of organizations, and collections of organizations and computers to combine forces to control more things, more effectively. These emerging hyper-beings know how to get desired results. They can assess their situation, set goals, develop credible plans, anticipate results their plans will produce, implement plans, control execution, observe outcomes, learn from experience, innovate and continually improve. In aggregate, these activities define what I call *efficient thought*. Hyper-beings think more efficiently because they have more and better resources, more knowledge and better information, and better processes.

Hyper-beings extend evolution beyond individuals, beyond organizations, into a new class of distributed, intelligent, multi-level, bio-electronic hybrid life forms. Where in the past advantages might have accrued purely to size,

Rick Hayes-Roth

strength, wealth, or physical skills, the quality of an organization's thinking most determines success in the future. What matters most is the organization's ability to achieve good outcomes in a dynamic environment by correctly understanding how things work, having the ability to formulate, evaluate, and implement good plans, and executing plans faster than agile competitors. All of these capabilities combine to make up efficient thought. The next chapter looks into these key capabilities more deeply.