EXECUTIVE SUMMARY

THE FUTURE IS A PASSAGE THROUGH WORLDS WE'VE YET TO IMAGINE

Human transitions are accomplished through passages—whether culturally sanctioned personal rites of passage or huge migrations that, only in retrospect, can be seen as movements from one way of life to another. These passages are often stormy, frightening, chaotic. They call on previously untapped human abilities, both personal and cultural, to navigate through worlds that appear to be disintegrating, hopefully to put the pieces back together in a new configuration, a new kind of living.

We suspect that, like migrants, we humans are all beginning a long trek through strange territories we have only rumors of. The rumors come in many forms from many sources, some more reliable than others. While science-fiction images of cyborg cultures and long-standing tales of apocalypse seep into our imaginations—and even lead us down particular roads—more measured forecasts help us put together the intelligence we need to make rational, if also unexpectedly innovative, choices at each step.

This year, the *Ten-Year Forecast* presents ten new *Perspectives.* They can help us begin to imagine the worlds we will pass through in the coming decades, as well as the world we will create through that passage. But perhaps more important, we point to some fundamental shifts in the imaginative tools we will need to get there.

ECONOMICS: ECOSCIENCE IN THE MARKETPLACE

In the face of a deteriorating natural environment, how will developments in ecoscience, marketplace innovations, and the political sphere interact over the next decades to change the way we manage the environment and market products and services? **Nine experts** helped us build a map of the next 50 years—and think through the implications of carbon, water, and air quality markets.

—Alex Pang, Kathi Vian, Jamais Cascio & Matt Chwierut

DEMOGRAPHICS: EXTREME LONGEVITY

Even as the global population appears to be tilting strongly toward the aged, will life-extension technologies and new cultural patterns keep people forever young? In a conversation with **Aubrey de Grey** and **Nick Bostrom,** we explore the real potential for longer lifespans and a population that is actually getting younger, not older.

—Jamais Cascio

POLITICS: PARTICIPATORY PANOPTICON

As camera phones, webcams, and other mobile network devices become increasingly commonplace, will privacy and even secrecy become things of the past? **David Brin** adds his perspective on reciprocal accountability to our own forecast about the ways in which so-called life caching—capturing the daily details of one's life electronically—will change the way we age, the way we think, and the way we manage the people who manage us.

—Jamais Cascio

CULTURE: DIGITAL NATIVES, CIVIC SPACES

With the explosion of youth media, what can we expect from a generation of Digital Natives as they enter the civic sphere with new abilities to deconstruct media messages and offer up their own critique? **Henry Jenkins** and **Howard Rheingold** consider the potential for a new civic literacy as we share our own survey results for three new indexes on smart networking, collective behavior, and a literacy of the commons.

—Howard Rheingold

MANUFACTURING: DO-IT-YOURSELF?

As 3D printers become more capable and less expensive, will they expand beyond the realm of design prototyping to transform the practice of manufacturing and perhaps even drive some kinds of production into the home? **Bruce Sterling** and **David Pescovitz** trade viewpoints on do-it-yourself futures as we share our new Do-It-Yourself Index.

—Jamais Cascio & Alex Soojung-Kim Pang

A LONGER VIEW

A longer view is clearly needed as so many slow but huge waves of fundamental change begin to present themselves for our consideration. Climate change, the decline of the carbon fuel economy, the growth of a pervasive culture of urban slums, and the prospects for bioengineering on the scale of an industrial revolution all have their roots in the present and their most disruptive consequences in the very long term. To collectively sift through those consequences and make choices today that will sustain the world through this century and beyond, we will need collaborative tools and cooperative strategies that can engage an entire planet. We will need techniques to filter the massive and growing amounts of present-day data to see the patterns of the future. We will need economies and communities with feedback mechanisms to bring us into alignment with these impending futures. We may even find ourselves bioengineering the very way we think about the future.

AN ECOLOGICAL WAY OF THINKING

If time is one dimension of our imaginative toolkit, complexity is another, and to operate in the complexity of global human society, we will slowly adopt a more ecological way of thinking. Drawing on the last 30 or so years of ecological science and complexity theory, we will begin to see the world through an increasingly multifaceted lens. Our networking intelligence will begin to reveal connections we could not have anticipated, and our growing literacy in networking tools will usher in new processes—intellectual, economic, and civic—for distributed seeing and describing, deciding, and acting. Externalities will slowly disappear from our economic models, and the language of econometrics, from price per gallon to gross domestic product, may become but an embedded function in more compelling ecological models. Those models, in turn, may prove to be emergent frameworks that can be viewed and tuned but not invented by humans.

DÉTENTE WITH DILEMMA

Finally, we will need to reach some kind of détente with dilemma. Well-schooled in solving problems, we will need to re-school ourselves in the art of acting intelligently (and perhaps also compassionately) in situations that have no solution. We will have to find tools and processes for teasing out the first-, second-, and third-order dilemmas in these situations; for reconciling multiple stakeholders; and for designing processes that generate new value out of apparent conflicts of interest. A world with no externalities is a world where dilemma is the name of the game, and how well we learn this lesson will have much to do with our individual and collective success over the next decade.

We hope that, embedded in this year's *Ten-Year Forecast,* you find some of the insights, frameworks, tools, and processes that will help you cultivate and apply these new ways of thinking about the future. At the core of each of these thinking tools is the ability to draw connections. So we not only present a summary of the *Perspectives* here; we also take the first step toward connecting the dots between them and then drawing the implications at the important intersections.

FINANCE: INTANGIBLE REFORMS

Confronted with growing environmental uncertainty and heightened social risk, will the financial community find new kinds of instruments—building on new kinds of measures—to mitigate the risks? **Jed Emerson** shares his views on blended value, as we look at the prospects for a growing sophistication in managing multiple capitals: financial, intellectual, natural, and social.

—Jessica Margolin

ASIA: CHINESE CONSUMER COLLECTIVES

Given a history of collectivism, will the emerging Chinese practice of consumer collectives transform the retail markets of China—and perhaps spread to the West as well? **Sam Flemming** reflects on the use of bulletin board systems (BBS) for consumer coordination in China, as we look at how the Internet is supporting the spread of consumer collectives to all parts of China.

—Lyn Jeffery

COMMUNITIES: CITIZENS OF SUSTAINABILITY

As people increasingly draw the link between their personal health and the well-being of the community, will we move beyond so-called "green consumers" to an emerging class of "sustainability citizens" with a powerful local focus? Wal-Mart's **Monica Mullins** helps us understand how a global company can drive sustainability values and address local needs while we report on our Citizens of Sustainability Index.

—Kathi Vian & Mani Pande

EDUCATION: OPEN ECONOMY MAKEOVER

Facing growing criticism from all sides, will public K–12 education now confront the additional disruption of open-economy practices, and will that disruption eventually pave the way for new strategies to the complex social dilemmas that plague the institution? Our **Open Economy Toolkit** provides a framework for us to think through how network structures, self-organizing groups, and cooperative practices may recast the future of public education.

—Andrea Saveri

SCIENCE: THE NEXT REVOLUTION?

As fundamental uncertainty begins to pervade the world of science, will we find that our technologies have outpaced our ability to understand the kinds of changes they are wreaking? **Jerry Ravetz** explains what he sees as an era of post-normal science as we explore the impacts of evolutionary design, complexity theory, exabytes of information, and the failure of grand theories on the future of science.

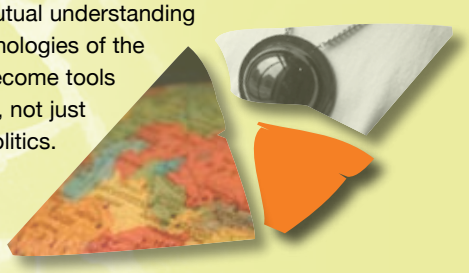
—Alex Soojung-Kim Pang

CONNECTIONS

COLLABORATIVE EVOLUTION

Participatory Panopticon **Extreme Longevity** **Ecoscience**

One key value of networked collaboration is the ability to work closely with people thousands of miles away. One form of this collaboration can be mutual monitoring and evaluation of health and environmental conditions, with members of a network team serving as trusted advisors, offering feedback on choices and results. Local experiences, aggregated across different locations, provide rich data sources, and as collaborators work together for extended periods (increasingly common in an era of radical longevity), mutual understanding and trust deepen. The technologies of the participatory panopticon become tools for collaborative well-being, not just collaborative politics.

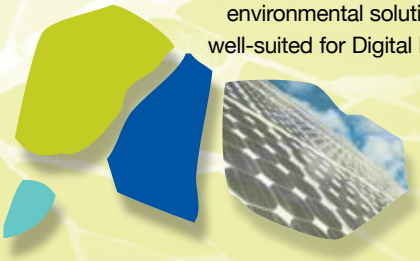


THE GREEN PANOPTICON

Citizens of Sustainability **Ecoscience**

Participatory Panopticon

Broadband wireless networks, cheap and powerful sensors, and a growing public awareness of the need for better and timelier environmental information can combine for ecological sousveillance: an "inconvenient truth" panopticon, using an explosion of personal mobile devices for measuring, monitoring, and understanding a rapidly changing environment. Such tools could be passive, such as sensors that upload data whenever a network-connected device (such as a mobile phone) comes near, or could be active, such as tools that give citizens a means of tagging sources of environmental damage (or examples of environmental solutions). These tools are particularly well-suited for Digital Natives, putting student collaboration at the cutting edge of global ecological research.

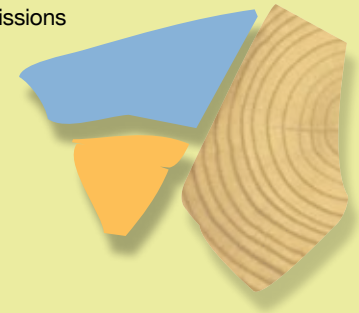


NEW RULES FOR A NEW GENERATION

Participatory Panopticon **Digital Natives**

Citizens of Sustainability

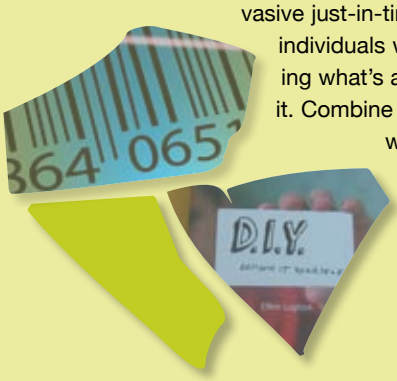
Digital Natives are stepping into a world where distributed, networked tools of communication and awareness are commonplace, and where large-scale environmental challenges have the potential to become the most significant issue of the century. This cohort has a very different attitude toward both of these issues than do most members of earlier generations. As Digital Natives take on greater economic and political responsibility, rules concerning topics such as privacy, anonymity, and participation are likely to change in significant ways. A generation accustomed to casual online visibility and deeply aware of the growing climate threat is likely to embrace public accountability regarding environmental behavior: emissions quotas, carbon footprint records, and other measures that could easily seem like invasions of privacy to earlier generations.



"INSTRUCTABLE" HEALTH

Extreme Longevity **Open Economy Education** **Manufacturing**

The DIY (do it yourself) philosophy—a cornerstone of the emerging manufacturing and design world—is also starting to take root in the arena of health. Today, collaborative Web sites provide real-time dietary advice, the history of individual food items (via barcodes scanned by camera phone), and even information on local biohazards. As these pervasive just-in-time learning systems proliferate, interested individuals will have access to myriad details regarding what's affecting their health, and how to change it. Combine this with open-source DIY biotech, and we have the makings of a revolution in personal health care. Big question: will this be in cooperation with established health institutions, or in opposition?

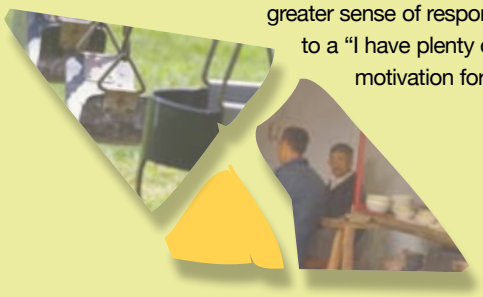


VERY LONG-TERM INVESTMENTS

Extreme Longevity **Intangible Reforms**

Citizens of Sustainability

How much of our view of time horizons is based on how long we have to live? One of the more important initial changes arising out of revolution in biogerontology may be a fundamental shift in how we understand risk. Unlike most of the social and political effects of extreme longevity, which wouldn't see full expression for decades, our appreciation of risk and opportunity could easily start changing almost immediately. We would be more likely to see decisions with costs incurred decades later in more personal terms—and choices with short near-term costs as taking a less significant part of our lives. While in principle this could lead to a greater sense of responsibility, it could also lead to a "I have plenty of time" culture of reduced motivation for action.



VALUES-BASED COLLECTIVE BUYING

Chinese Consumer Collectives **Intangible Reforms**

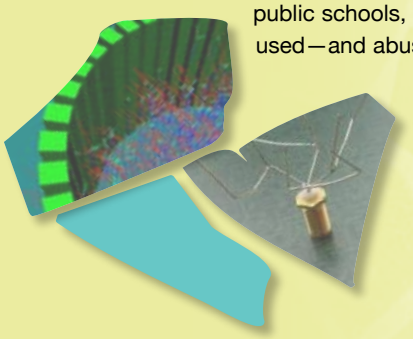
Citizens of Sustainability

The economies of coordination that we noted in last year's *Ten-Year Forecast* will show up in the Internet-enabled consumer collectives of China in all kinds of settings, from rural villages to human resources in big companies. At the same time, U.S. citizens of sustainability are finding their own basis for contributing to their local communities and building new kinds of commons. As consumer collectives spread globally—they almost certainly will—and as people everywhere turn their attention to the escalating risks in the environment and society at large, it is likely that they will begin to form buying coalitions around shared values. Not only could these new coalitions change the face of retail, but they will also almost certainly change the way companies manage their multiple capitals, including natural resources, social networks, and intellectual property. This new literacy of multiple capitals will, in turn, filter down to individuals, reinforcing the values-based buying patterns in a possibly virtuous cycle of wealth generation from new social, environmental, and intellectual practices.

SIMULATION LITERACY

Ecoscience **Open Economy Education** **Science Revolution**

More powerful computers and emerging scientific models have pushed simulation to the forefront of tools for understanding the world. While this is most visible with climate science, simulations have taken on real importance in subjects from epidemiology to industrial design; much of the planning for pandemic outbreaks, for example, now relies on simulations. These tools are increasingly able to deal with complex environments and provide insights into the more subtle workings of emergent systems, including collaborative economies. As powerful simulations move from supercomputers to laptops and from government labs to public schools, awareness of how simulations can be used—and abused—is becoming a critical skill.



WASTE AS AN ASSET

Manufacturing **Ecoscience** **Citizens of Sustainability**

One of the key insights of modern environmentalism is that waste—whether we mean waste material or waste energy—is a sign of inefficiency. One way to reduce that inefficiency is to reduce the amount of waste generated by a process; another way is to use that waste as a component in another process. As we move into a world that embraces both sustainability and new technologies of manufacturing, waste products that once would be shipped off to a landfill will increasingly be looked at as base material for new generations of production. Further, as the cost of raw materials for production rises to account for energy and greenhouse gas footprints, landfills may be re-imagined as a resource commons.

2007 TEN-YEAR FORECAST TOOLKIT

In addition to the ten *Perspectives* in this year's *Ten-Year Forecast,* the following tools are designed to help you leverage the forecasts in your own organizational planning and strategic forecasting efforts.

2007 Map of the Decade

Methodology: The Open Economy Toolkit

Data: 2006 Ten-Year Forecast Signals Survey

Practice: Get There Early

Human–Future Interaction: The 2007 Videos

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With special thanks to
Marina Gorbis, Bob Johansen & Dale Eldredge
for their support.

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ECONOMICS:

ECOSCIENCE IN THE MARKETPLACE

Science and commerce have long been intertwined. From the 17th century, when Isaac Newton was pioneering mathematics and physics while serving as Master of the Mint, to today, when academics-turned-entrepreneurs are familiar figures in high-tech regions, science has been a resource and influence on economies and industry. Conversely, economics has also shaped scientific inquiry into everything from botany to neuropsychology. Over the next decade, efforts to reduce greenhouse gases and preserve essential ecosystems will create a bond between scientific research on climate and ecology, and efforts to build carbon-trading markets, measure the value of ecosystem services, and estimate the economic cost of global warming.

MARKETS AND SERVICES: THE SHAPE OF BUSINESS TO COME

For the next decade, efforts to understand and manage climate change will be at the top of the agenda. More companies and governments (particularly European governments, but also a number of American states) have recognized that they need to act more strenuously to reduce energy consumption and carbon emissions. Markets for personal carbon offsets and conservation are also growing.

These markets are still in their infancy. Many reduction arrangements are bilateral deals between polluters (say, a rental-car fleet) and conservation groups (say, a forest reserve). Other carbon markets are regional or confined to specific companies. To become as global as the problem it proposes to solve and as effective as today's capital markets, trading will need to turn pollution and conservation into commodities, and science will need to provide the measures that set the values of those commodities.

However, the urgency around increasing greenhouse gases obscures what, in the long term, may be an equally important effort to develop economic measures of ecosystem services. Traditionally, economists, businesses, and governments have taken these services for granted. Today, the scale of development and environmental change creates unprecedented threats to industries like agriculture, fishing, and forestry that rely directly on healthy ecosystems. More ominously, they now strain even more fundamental ecological services like water purification, crop pollination, soil stabilization, and flood control.

To more accurately assign the real costs and benefits of economic activity and environmental change, it has become necessary to inventory the services that ecosystems provide and calculate their economic value.

GLOBAL VS. LOCAL: FINDING THE RIGHT FOCUS

Within a few years, these two branches of research—measures of ecosystem offsets and valuation of ecosystem services—are likely to begin to overlap, as climate change models become more granular and ecosystem services models become more comprehensive and larger in scale. Work on greenhouse gas sequestration may eventually become an important subset of the broader field of ecosystem services. What impact this might have on carbon-trading markets is less clear.

Climate change is a global problem with both global and local impacts. There will likely be strong pressure to treat carbon as both a global problem and a commodity, in part to link mitigation efforts in the developed world with conservation efforts in the developing world. Other ecosystem services have more local expressions: flood control benefits a city's residents very directly, but outsiders only benefit indirectly in the form of lower insurance costs. Further, some of the groups most interested in valuation of ecological services are states: eco-service valuation may thus develop into a tool for land-use planning and public policy more than for global trading.

ECONOMIC UNCERTAINTY: KEEPING PACE WITH NEW SCIENCE

Looking beyond 2017, new research will almost certainly create new challenges for both science and business. Models of atmospheric chemistry and climate change could rewrite business plans and policy alike as we gain a deeper understanding of the impacts of greenhouse gases. Whether or not these changes represent radical refinements of widely used models, they'll probably require markets to adjust the ways they value carbon as a commodity; potentially new models could disrupt existing regulatory regimes. Hedging against this scientific uncertainty, while taking advantage of commercial opportunities, will be a key strategic challenge for individuals, companies, and states.

—Alex Soojung-Kim Pang, Kathi Vian, Jamais Cascio & Matt Chwierut

OVER THE NEXT FEW DECADES, ECOSCIENCE WILL HELP MAKE THE BUSINESS CASE FOR SAVING THE PLANET

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THE SCIENCE OF CARBON TRADING: A FOCUS ON GLOBAL VALUES

Climate scientists and ecologists will play a key role in measuring and marketing carbon emissions and sequestration. Just as scientists developed standard weights and measures to smooth the flows of commerce in the 19th century and contributed to the growth of today's real-time, information-intensive economies by developing atomic clocks and determining atomic weights in the 20th, basic research in climatology and ecology will help carbon-trading markets develop and expand.

Some of the advances will come through improvements in the models climatologists use to simulate the consequences of additional greenhouse gases in the atmosphere. Today's climate change models treat the world as a series of large, homogeneous pixels. More granular models that can differentiate between microclimates and adjacent, but very different, ecologies—coastal regions and nearby mountain chains, for example—will let scientists more precisely forecast likely impacts and the value of mitigation.

Another set of advances will come in real-time monitoring of carbon emissions. Environmental sensors that measure the real carbon output of cars, planes, and consumer goods will allow markets to target emissions even more finely and to move toward taxing specific activities —thus more quickly and directly rewarding efforts by individuals and companies to live green. Those sensors, along with ground- and space-based monitoring systems, will more precisely measure emissions reductions generated by forests, soil, and other natural sinks—helping scientists model how long those sinks will operate. Initially, various sensor networks are likely to develop using their own metadata schemes and storage standards, but eventually we'll see standard mechanisms for managing and sharing the vast quantities of data these networks will produce.

The growth of sensor networks and standardization of atmospheric data, in turn, will let markets create a variety of important tools. For example, it's likely that grading standards for different kinds of sequestration will take into account the security of the system, the amount of carbon they can store, and other factors. Thus, a remote Siberian reserve that leaves methane-trapping tundra undisturbed and a fast-growing softwood forest in Malaysia would be rated differently. Sequestration programs could also be more finely differentiated from programs that develop renewable energy infrastructures (which avoid generating carbon in the first place). Tools to mitigate the risk of carbon investments will also emerge: a company might construct a portfolio consisting of forests that have high sequestration capabilities but are also fire-prone; low-capture but stable grasslands; and risky deep ocean or geo-engineering projects. Finally, such differentiation will make it possible to construct portfolios that suit the needs of different industries.

Source: flickr.com/photos/josefstuefer/54676138/

MEASUREMENTS OF ECOSYSTEM SERVICES:

THE MARKET FOR LOCAL VALUES

No one can deny that humans have always drawn value both from Nature's products and from natural services. Despite the fact that these services help sustain life—clean water and air aren't luxuries but the most fundamental of necessities—we've been able to take these services for granted. Today, though, just as human activity is altering the planet's climate, so can large industrial projects, development, and growing populations undermine an ecosystem's ability to provide humans with the services critical for life. Scientists are thus starting to develop tools to measure those services and predict the impact of development and population growth on them.

In a recent article, Stanford ecologist Gretchen Daily and colleagues identified six major ecosystem services:

- **Carbon Storage** Plants and soil remove carbon dioxide (and in some areas, methane and other greenhouse gases) from the atmosphere. Deforestation can release this carbon; so can tillage practices that upset large quantities of soil.
- **Crop Pollination** According to U.C. Berkeley biologist Claire Kremen, 15–30% of food production depends on pollinators; bees and other insects contribute tens of billions of dollars to agricultural sectors each year.
- **Flood Control** Swamps and other wetlands, alluvial plains, and riparian zones absorb excess water from floods and hurricanes, reducing damage to human settlements and habitats.
- **Forage Production** Grasses provide forage for livestock like cattle and sheep.
- **Outdoor Recreation** This is value generated by beaches, parks, and other recreational areas.
- **Water Provision** Regions provide water for human consumption either by capturing and storing rainwater; delivering water through streams, rivers, or aquifers; and cleaning polluted water.

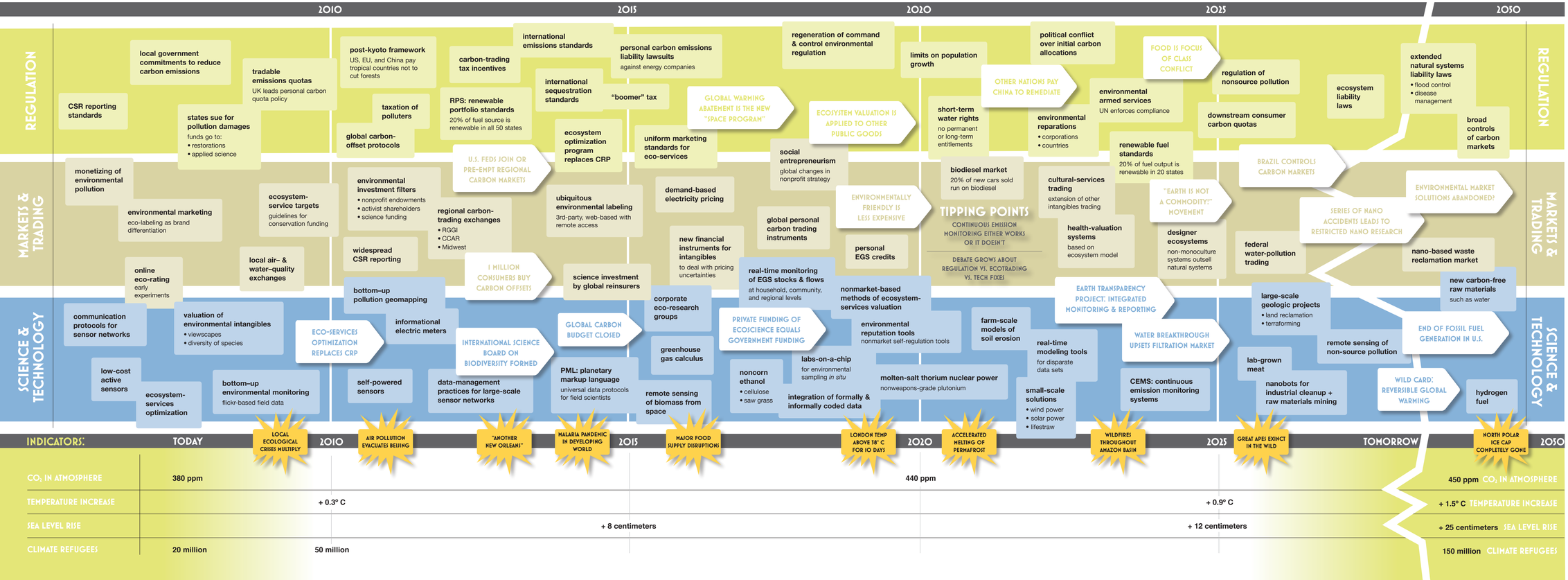
A few entrepreneurs are already building financial tools to preserve ecosystems serving high-value industries. For example, London reinsurer ForestRe is developing a plan to rebuild forests around the Panama Canal. Since destruction of those forests produces runoff that slows traffic and adds to maintenance costs, shipping companies have a clear incentive to replant those forests.

The Panama Canal example is unusual, thanks to the Canal's special place in both Panama's and the global economy. In fact, only a small amount of work on ecosystem services has this global cast, despite the famous 1997 estimate of the value of global ecosystem services ($33 trillion, in case you're interested). Most scientists working on the valuation of services, however, work on services that are produced and consumed locally, or focus on the economic productivity of specific species: for example, the contributions of wild bees to the productivity of pollinating crops in California.

There are certainly efforts to develop more comprehensive valuations of all major ecological services within a region: University of Vermont ecologist Robert Costanza is developing tools to assess the ecological and environmental impact of development plans. Gretchen Daily is leading another group refining tools to assess the value of ecosystem diversity. These efforts may eventually lead to more integrated global trading schemes, but for the next two decades, such science is likely to be focused on local markets and policies.

ECOSCIENCE 2050

STATES | MARKETS | SCIENCE



WHAT THE MAP TELLS US

This map of the intersection of ecoscience and economics over the next several decades tells several stories:

FROM MARKETING STRATEGY TO MARKETING STANDARDS

Over the next decade, much effort will be invested in establishing the carbon footprints of products, services, companies, individuals, cities, regions, and nations. These footprints will form the basis of marketing strategies—small footprint offerings will have greater perceived value in the marketplace. Over time, these ad hoc marketing strategies will coalesce into marketing standards, such as labeling laws.

FROM PERSONAL CARBON CREDITS TO REPARATIONS

Current voluntary efforts to lower the carbon footprints of everyday activity—whether in industry or in the home—will gradually be incentivized by financial tools such as carbon taxes and carbon credits at all levels of global enterprise. Over time, the focus will likely shift from such incentives to legal and regulatory remedies, including the likelihood of lawsuits and reparations. By 2050, these interventions will begin to fade as ecologically sound practices become the norm.

FROM ECOTARGETED INVESTMENT TO NEW FINANCIAL INSTRUMENTS

Forward-thinking investors—both individual and institutional—will bet on the future value of ecologically sound practices, driving the evolution of systems for measuring, valuing, and trading ecosystem services. Given the uncertainty of the science, new financial instruments for trading in these services will evolve to manage the risk inherent in them.

FROM SENSORS TO MODELS TO MARKETS

Technological advances in sensor networks—and the ability to integrate data from them—will lay the foundation for ever finer modeling of ecosystem services and pollution. This data will feed market models and policy alike. These models and markets will, in turn, be applied to a variety of other types of services, such as public health.

FROM CARBON MANAGEMENT TO CARBON REPLACEMENT

In parallel with market and regulatory eco-management, science and technology will accelerate development of a noncarbon economy based on alternative energy and raw material sources, including both large- and small-scale solutions. Nanotechnology is the wild card in this development; solutions could include everything from lab-grown meat to mining of waste streams for raw nano-materials. The outcome is likely to be a distinctly different material economy by 2050.

FROM WEAK CONSENSUS TO STRONG CONFLICTS

Political and economic inequalities in eco-markets and the rules that underlie them are likely to lead to future contests between developed and emerging economies. Together with potential failures of the market to avert catastrophes, these conflicts will undermine markets as a tool for managing complex ecologies, and in fact, the eco-management model may fail altogether.

GLOSSARY

parts per million (PPM): a measure of environmental pollutants. Prior to the Industrial Revolution, atmospheric carbon levels are estimated to have been about 280 ppm; the current level is around 380 ppm.

biomass: the total living biological material in a given area or of a biological community or group. Usually measured by weight, or by dry weight, per square meter or square kilometer.

California Climate Action Registry (CCAR): a nonprofit voluntary registry for greenhouse gas (GHG) emissions that helps businesses, nonprofit organizations, municipalities, state agencies, and other entities establish GHG emissions baselines against which future emission reduction requirements may be applied.

carbon credit trading: the trading of permits to emit carbon dioxide. Pollution markets (also called cap-and-trade markets) helped reduce U.S. SO_2 emissions in the 1990s, and similar systems have been proposed by the Kyoto Protocol and regional climate change schemes.

Conservation Reserve Program (CRP): a voluntary program through which agricultural landowners can receive annual rental payments and cost-share assistance to establish long-term, resource-conserving covers on eligible farmland.

continuous emission monitoring systems (CEMS): systems composed of gas analyzers, gas sampling systems, temperature, and flow and opacity monitors. Usually used to demonstrate regulatory compliance of various industrial sources of air pollutants.

corporate social responsibility (CSR): a movement based on the idea that companies should promote public, environmental, and social interests as well as profits, and in the long term can "do well by doing good."

environmental goods and services (EGS): natural processes and products that contribute to the maintenance of ecosystems and support human activities.

renewables portfolio standard (RPS): a flexible, market-driven policy to ensure that a minimum amount of renewable energy is included in the portfolio of utilities.

renewable fuel standard (RFS): a standard established by the Energy Policy Act of 2005 for fuel companies to include renewable fuels in their output.

Regional Greenhouse Gas Initiative (RGGI): an effort by Northeast and Mid-Atlantic states to reduce power-plant greenhouse gas emissions through a cap-and-trade program.

socially responsible investing (SRI): the application of CSR to investment. Socially responsible investors combine motivations to maximize profits and the social good.

triple bottom line: a method by which companies evaluate their operations not just on the standard "bottom-line" of profit, but also on their impact on the environment and their contribution to the public good.

HOW THIS MAP WAS DRAWN

The Ecoscience 2050 map is the result of an IFTF expert workshop in October 2006. For the workshop, we invited experts in history of science, environmental science, information technology, economics, law, and finance. These experts worked together to create a timeline of innovations at the intersection of ecoscience and economics.

THE EXPERTS:

Tom Arnold, Chief Environmental Officer and Co-Founder of Terrapass

Jamais Cascio, IFTF Research Affiliate

Dorothy Glancy, Santa Clara University, School of Law

W. Michael Hanemann, U.C. Berkeley, Department of Agricultural and Resource Economics

Peter Levin, Columbia University's Barnard College, Department of Sociology

Mike Liebhold, IFTF Senior Researcher

Jessica Margolin, IFTF Research Affiliate

Chad Monfreda, University of Wisconsin, Center for Sustainability and the Global Environment

David Zacks, University of Wisconsin, Center for Sustainability and the Global Environment

The workshop was led by Alex Soojung-Kim Pang and Kathi Vian, with assistance from Matt Chwierut, Mike Love, and Megan Schoendorf.

DEMOGRAPHICS:

EXTREME LONGEVITY

From the Cambridge Interdisciplinary Research Centre on Ageing come the claims of Aubrey de Grey that "the first person to live to 1,000 was probably born by 1945," that the average age of death for most people born in wealthy nations during this century will be over 5,000 years. While controversial, de Grey is not alone in these beliefs. A growing number of scientists are working to uncover the biological clues as to why we age—and what we can do about it. Even if they are off by several generations, it's likely that their work in the coming decade will lead us to radically extended, healthy lives. But as profound as the bioscience may be, the most important transformation over the next decade will have less to do with science than with culture, as the world grapples with a new understanding of what aging means for both individuals and society.

CULTURAL SHIFTS: BOOMERS IN THE DRIVER'S SEAT

In an age of accelerated technological change, it's easy to forget that demographic changes, particularly those related to age and longevity, are *slow*. Longevity-related changes to population growth will be barely perceptible over the next ten years, except to demographers. Even if a biomedical breakthrough were to eliminate cancer as a cause of death tomorrow, the population in the United States would grow by only about 6 million people over the entire decade.

The more significant changes, at least for the next ten years, will be cultural. New perceptions of what it means to age as well as the emerging possibilities for realistic, healthy life-extension will take hold. The underlying driver isn't simply our improved understanding of human biology. The real driver will be the aging U.S. baby boom generation, which will increasingly demand products and medical services to keep themselves healthy and active.

By 2017, the bulk of the boomer generation will be in its late 50s to mid-60s, and the leading edge will be in its early 70s. Demand for health-related services will be at an all-time high, as will funding for research and development of adaptive technologies. Pharmaceutical and biotech companies will compete to roll out products that do more, last longer, have fewer side-effects, and (ultimately) are cheaper to buy and use. For subsequent generations, who sometimes find themselves living in the boomers' shadow, these life- and health-extension treatments will have been beta-tested.

YOUNGER, NOT OLDER: SURFING THE AGE WAVE

It's unlikely that the next decade will see a definitive biomedical breakthrough that radically extends the human lifespan. However, such a breakthrough isn't necessary to enable centuries-long lives. The logic is straightforward: because new discoveries continue, the longer one lives, the more likely it is that discoveries leading to even longer life will occur during one's lifetime. Even if "true" extreme life extension isn't figured out for another century, surfing the waves of discoveries could allow one to be here for it.

In fact, incremental improvements in age are already producing a population that, against the obvious measures, has stopped aging and is growing younger. Demographers have begun to calculate two new measures of age. *Prospective age* is the expected years of life remaining for an age group, and it is steadily growing. *Standardized age* is a combination of chronological age and prospective age, and for many developed nations, it has flattened or is actually declining. In very real terms, the population is getting younger, not older.

BEYOND 2017: SOCIAL ADAPTATION

Although demographic changes are slow, they are relentless and can have a tremendous impact over the long term. A population that regularly lives to be 110 or 120—in robust, active bodies—must confront some fundamental questions about how societies are structured. Economic issues of retirement, financial planning, and social security may be the most obvious, but basic questions about human relationships may be more profound. What does it mean to be married for "as long as you both shall live," when you may be living for another 100 years? What kind of relationship can one have with great-great-*great*-grandchildren or -grandparents? How does it change people's behavior if they know that they could live for a century, or (potentially) centuries? Do they become more conservative? More adventurous? Do they start thinking long term? Does society stagnate, or is the concept of "stagnation" itself an artifact of short-term thinking?

These are the questions we will be asking with greater frequency in the years to come.

—Jamais Cascio

CENTURIES-LONG LIFESPANS MAY BE CLOSER THAN WE THINK—BUT WILL OUR SOCIETIES BE READY?

INSTITUTE FOR THE FUTURE

TEN-YEAR FORECAST
Perspectives 2007
SR-1064
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AUBREY DE GREY
is a researcher and spokesperson for longevity research at the Cambridge Interdisciplinary Research Centre on Ageing.

Aubrey de Grey coined the term "longevity escape velocity" to describe the ongoing pace of incremental improvements in longevity that might allow aging populations, particularly in the West, to surf the age wave and escape aging. He has mapped out the necessary steps in his "strategies for engineered negligible senescence," or SENS, which is an ambitious plan to eliminate the seven leading genetic and proteomic catalysts for aging. But when Jamais Cascio interviewed him, together with Nick Bostrom, who leads an effort at Oxford to understand the future of humanity, both men were moderate in their forecasts for the coming decade.

Q: WHAT KIND OF PROGRESS MIGHT WE EXPECT OVER THE NEXT DECADE IN LIFE EXPECTANCY AND LIFE-EXTENDING THERAPIES?

Nick: If past trends continue, we would have a life expectancy about two years longer in 2017 than it is today.

Aubrey: In the next ten years, it's highly unlikely, in my view, that any new therapies will be developed (let alone FDA-approved) that postpone human aging measurably.

Nick: But even measuring whether a new therapy postpones aging in humans is problematic. One approach is potentially reliable but very slow: observe subjects for many years or decades and check whether age-related illness is significantly postponed.

Another approach is to measure how the therapy affects various health parameters in the short run. This is faster but conclusions drawn from such studies can be unreliable. Does the therapy genuinely postpone aging or does it merely temporarily mask some of the symptoms? For example, administration of human growth hormones may improve some vitality indicators in the short term but may fail to extend—or it may even decrease—lifespan. A better panel of biomarkers for aging in humans would be a major boon for biogerontology.

It is quite possible that without knowing it, we already have some therapy, drug, or supplement that significantly postpones aging. The most likely possibility for slowing the rate of aging with a drug within the next ten years would be a drug that acts on some general regulatory mechanism.

Aubrey: The most likely possibility is a calorie-restriction mimetic, but I predict that any such drug will fail to extend lives of middle-aged or older people by even as much as a year. And even that will probably not be detectable by 2017.

Nick: A successful calorie-restriction mimetic could be such a thing. Another candidate would be what we might term a "social-status mimetic." One large and robust effect is that people with higher social status tend to live longer than those with lower status. Perhaps this effect is mediated by some stress hormone or some other system that regulates an organism's trade-off between investing in long-term maintenance and repair versus short-term readiness and crisis management. If one could intervene in this system and shift the trade-off in favor of long-term health investment (perhaps by lowering chronic stress levels or boosting psychological self-esteem), it is possible that this would have a significant beneficial effect on lifespan.

Q: WILL THERE BE DISCREPANCIES BETWEEN EXPERT OPINION ON THE POTENTIAL FOR LONGEVITY AND THE POPULAR IMAGINATION?

Aubrey: Advances in the laboratory by 2017 may well be impressive enough to convince the majority of leading biogerontologists that it is only a matter of time before therapies that dramatically postpone aging are developed, and indeed that such therapies may arrive within only a few decades. This shift in publicly stated expert opinion is likely to translate almost instantaneously into a corresponding shift in public expectation. Indeed, I think it quite likely that public opinion will "overshoot" into over-optimism about the timeframe for translation of these laboratory results to humans.

Nick: My guess would be that the shift in public opinion would happen more gradually, and that it will also take some time for this shift to be fully reflected in research funding. It is possible that public attitudes have already begun to shift slightly. It would be interesting to have data on this.

To some extent, the reaction would depend on exactly how the mice lifespans were extended—and how likely it appeared that the intervention could be easily translated to human use.

Q: WILL SUCCESSES IN THE LAB TRANSLATE INTO CHANGES IN SOCIETAL EXPECTATIONS AND EVEN PERSONAL BEHAVIOR?

Aubrey: The trigger for such a dramatic shift in public expectations (which are over-pessimistic today, of course) will be that the laboratory results will be on animals that are already in middle age before anything is done to them. The most likely scenario is that two-

NICK BOSTROM

is Director of Oxford's Future of Humanity Institute with an emphasis on ethics, transhumanism, and the human capacity to know.

FOR MANY PEOPLE, THE PROSPECTS OF RADICAL LIFE-EXTENSION WILL BECOME PSYCHOLOGICALLY REAL ONLY WHEN THEY CAN SEE OTHER HUMANS WHO LOOK AND BEHAVE AS THOUGH THEY WERE TEN YEARS YOUNGER THAN THEIR CHRONOLOGICAL AGE. AT THAT POINT, THE DAMS MAY TRULY BREAK.

year-old mice that would normally live to three years old will instead live to at least five years old. That is, their remaining lifespan starting from when the treatments are begun will be trebled from one year to three. This will translate into about 60 years of extra life for people who are already about 60 when the treatment begins, and that may excite people a little, especially since all the extra life will be youthful. In fact, I think it'll probably take at least 15–20 further years (until about 2020 or 2025) to get even 30 years for humans, but that's only the start.

Nick: For many people, the prospects of radical life-extension will become psychologically real only when they can see other humans who look and behave as though they were ten years younger than their chronological age. At that point, the dams may truly break, but this would be after first-generation anti-aging therapy had already been implemented. One may hope that the mere theoretical expectation that lifespan could be extended at some point within the next several decades would be enough to trigger support for a massive investment in biogerontology. But there are already many known ways in which people could extend their lifespan. Quitting smoking. Regular exercise. Eating lots of fruits and vegetables. And public enthusiasm for these is moderate. It is difficult to predict whether the theoretical expectation of vast increases in lifespan would be much more motivating than the expectation of small increases in lifespan that are currently obtainable.

Q: WHEN WE LOOK AT LIFE EXTENSION IN ITS SOCIAL CONTEXT, HOW SIGNIFICANT IS IT? IS IT THE CORNERSTONE OF A NEW SOCIAL OR TECHNOLOGICAL REVOLUTION, OR IS IT ONE INTERESTING PUZZLE PIECE IN THE SLOW EVOLUTION OF HUMANITY?

Aubrey: The fact that all of this is only the start will be the cause of the social upheavals we will see at this point. A very general rule concerning technological progress is that, when not impeded either by lack of public enthusiasm or by the need for a fundamental conceptual breakthrough, it occurs at a rate that makes 30 years of progress equivalent to a fundamental breakthrough, as with the advance from the Wright Brothers to Lindbergh or from the Comet to Concorde. The therapies I've described will be bona fide rejuvenation therapies, repairing molecular and cellular damage that has been accumulating throughout life. The damage present 30 years after a therapy of this kind was first administered will be harder to repair, because it will consist not only of 30 years of recent damage but also an entire lifetime's worth of the types of damage that the therapy was inadequate to repair. But that difference is likely to be outweighed by the improvements in the therapies that will occur over the 30-year interval. This phenomenon, which I call "longevity escape velocity," will allow people who benefit from the earliest therapies to live indefinitely without age-related decline, even though those early therapies may only confer 30 years.

This logic is easy enough to understand that people will appreciate it as soon as the mouse results appear, quite possibly by 2017. Thus, adults alive then will realize that they may never age. This will initiate a restructuring of societal priorities that will dwarf the Industrial Revolution.

Nick: There are some other prospects that may also begin to seem more realistic to larger numbers around 2017, such as superintelligence, uploading, nanomedicine, and cryonics. I am not sure that biogerontology will be occupying center stage of the public's attention at that time or any other time.

Biogerontology deserves to have its funding increased by orders of magnitude. I hope that Aubrey is right, but my expectation is that funding will increase gradually and that it may never be as large as it ought to be.

JAMAIS CASCIO

is a co-founder of WorldChanging, an IFTF Research Affiliate, and guest editor of this year's collection of *Ten-Year Forecast: Perspectives.*

PROSPECTIVE AND STANDARDIZED AGE: NEW WAYS TO MEASURE POPULATIONS

Conventional measures of age count up the years since birth. A nation's average age is, logically, the average total number of years spent alive so far. This common-sense methodology ends up being deceptive in an environment where biomedical technologies and social changes are increasing both life expectancy and expectations about life.

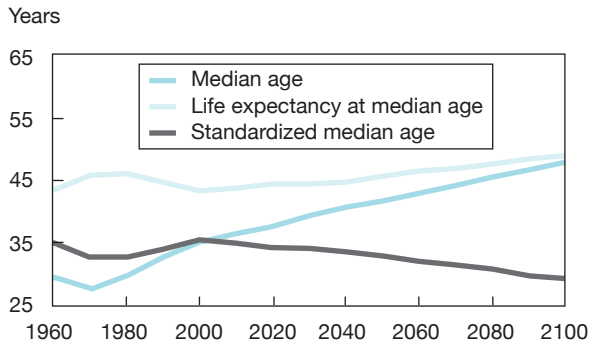
Warren Sanderson and Sergei Scherbov, of the World Population Program at Austria's International Institute for Applied Systems Analysis, have come up with an alternative measure of average age that takes into account not just how long (on average) people have lived, but how long (on average) they have left to live.

Prospective age is the expected number of years remaining for a given age range; as health care and medical technology improve, that prospective age grows. At present, prospective age is still rising at a rate well below chronological age; when prospective age begins to increase *faster* than chronological age, we will have reached de Grey's "longevity escape velocity."

Sanderson and Scherbov combine prospective and chronological age into a *standardized age* model, using 2000 as the reference year. If a 30-year-old in 2000 could expect to live another 50 years, and a 40-year-old in 2025 could expect to live another 50 years, then the future 40-year-old will have a standardized age of 30. If overall life expectancy increases, even as the median chronological age rises, the median standardized age can stay flat or even decline, sometimes dramatically.

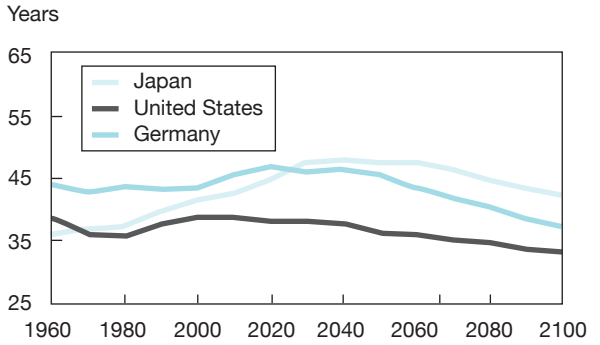
At a practical level, this means that social policies based on estimates of life expectancy—most notably social security and pension plans—have to take into account more than an aging populace: they have to account for the fact that the populace will have more healthy, productive years as well. This model also has the potential to shift the way we think about aging. The current view is subtly backwards-looking, triggering thoughts of what life was like all those years ago, emphasizing deeds already accomplished. Prospective age, conversely, is inherently forward-looking, making people think about what might happen over all those years to come.

1 STANDARDIZED MEDIAN AGE IN THE UNITED STATES WILL CONTINUE TO DECREASE



Source: Sanderson and Scherbov, *Nature*, 2005. http://www.nature.com/nature/journal/v435/n7043/abs/nature03593.html.

2 COMPARISON OF STANDARDIZED AGE IN GERMANY, JAPAN, AND THE UNITED STATES



Source: Sanderson and Scherbov, *Nature*, 2005. http://www.nature.com/nature/journal/v435/n7043/abs/nature03593.html.

YOUTH EXTENSION: THE CULTURE OF LONGEVITY

As tempting as it is to think of longevity and life extension in purely biological or biotechnological terms, over the next ten years the most visible effects of increased longevity will be in the continued cultural shifts surrounding age.

Among these shifts, one that will continue to have a major impact over the next ten years is the realization that, in most nations around the world (even places like Japan and Italy), populations are effectively growing *younger* because of rising life expectancy. The next decade will see a greater recognition that this increased lifespan does not simply mean a lengthening of one's final years, but a combination of biomedical and social changes that might better be described as *youth extension* instead of life extension. Media references to "40 is the new 30" or "60 is the new 40" are more than marketing slogans; for a growing number of people, social and economic opportunities and expectations in these later years are strikingly similar to the opportunities and expectations afforded to younger people in past decades.

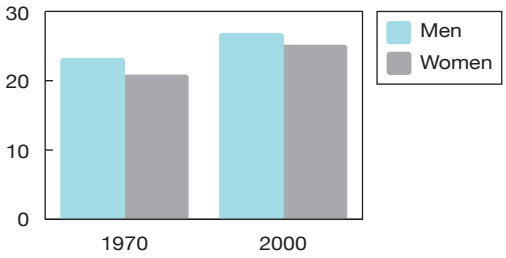
This is particularly visible in the workplace. As lifespans continue to lengthen, the traditional (and government-sanctioned) model of retirement at 65 will make less sense for people expecting to live another 30 or 40 years. Older people may have decreased physical abilities, but mental acuity can remain sharp well past the conventional retirement age, while social skills tend to continue improving as one grows older. Moreover, these two categories—creative thinking and social interaction—are at the heart of the modern economy.

The expansion of economic opportunity for older generations appears to be mirrored by the "extended childhood" effect becoming increasingly visible among people in their 20s and 30s. Younger adults are, on average, getting married later, having children later (if they choose to do so—and a growing percentage chooses not to) and adopting the material symbols of adulthood, such as purchasing homes, at a later point in their lives (in some regions). At the same time, the increased availability of reliable reproductive technologies allows older adults to delay "settling down" far longer than they could in past decades.

Over the next ten years, the clash between traditional expectations and the opportunities available to different ages and generations is likely to intensify in the West as the bulk of the baby boom generation reaches standard retirement age. This clash may be most visible in the workplace, as telecommuting, the business use of virtual environments, and the ongoing emphasis on creativity, information analysis, and social skills for professional growth lead to a greater mixing of generations.

3 GETTING MARRIED LATER

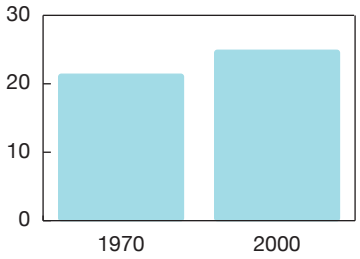
Median age at first marriage



Source: U.S. Census Bureau, *America's Families and Living Arrangements*, 2000.

4 HAVING CHILDREN LATER

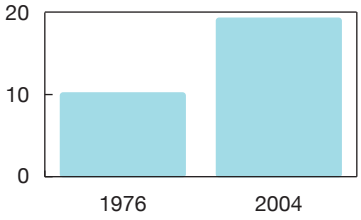
Median age at first birth



Source: CDC, *National Vital Statistics Reports: Mean Age of Mothers,* 2002.

5 INCREASINGLY CHILDLESS

Percent of childless women 40–44



Source: U.S. Census Bureau, *Fertility of American Women,* 2004.

CALORIE RESTRICTION: LAYING THE GROUNDWORK FOR LONGEVITY

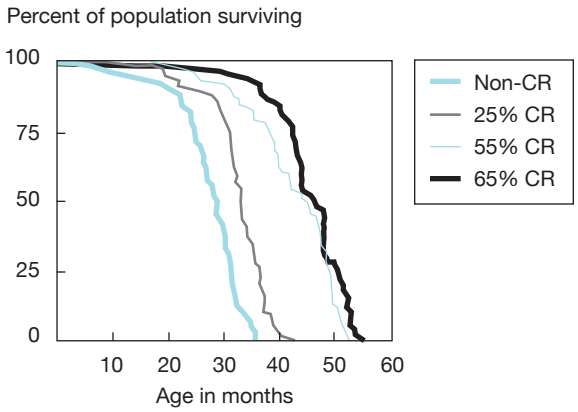
In Bruce Sterling's 1996 science fiction novel *Holy Fire,* people had to demonstrate that they had been taking care of their own health—with exercise, good eating habits, avoiding smoking and other risky activities—before they could buy into the life-extension treatments. After all, biomedical augmentations are less effective if they have to repair old damage, too. While this particular science fiction prediction may not be borne out, it's clear that the likely first step to living a very long time is to engage now in health-extending practices. Most longevity enthusiasts remain focused on the basics of exercise and nutrition, and the avoidance of health-damaging behavior.

Recent years, however, have seen increasing attention given to a new approach to life extension, one with a substantive amount of scientific backing. Calorie restriction (sometimes known as caloric restriction or "CR") posits that reducing caloric intake by 20–40% below normal (along with taking supplements to maintain optimal nutrition) can increase maximum lifespan by a significant, albeit not yet known, amount. Animal tests going back 70 years have shown that reducing the consumption of calories increases the lifespan of a variety of species; mice and rats fed 60% of a normal diet had 50% longer than normal lives, on average. Other health effects noted in mice and rats include decreased inflammatory response, decreased cognitive defects, and delayed reproductive senescence.

Primate tests have yet to reach conclusive results, but so far show notable improvements in a number of health issues. One 2006 study, performed by Washington University in St. Louis, showed that a 20% calorie-restricted diet (with nutritional supplements and exercise) resulted in significantly reduced heart aging, taking approximately 15 years off the age of the heart. A 2004 study in Sweden showed a 50–75% reduction in the incidence of breast cancer among women with reduced dietary calories. Other studies have shown improvements in fasting levels of insulin and measurable reductions in DNA damage.

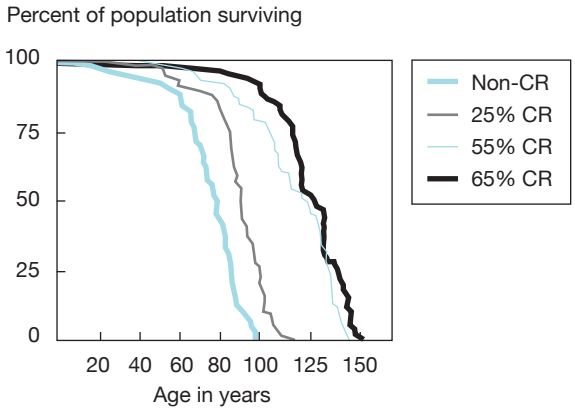
The social aspects of eating, as well as behavioral changes associated with hunger and low blood sugar, make dietary restriction an unlikely path for longevity. The next ten years, however, should see the introduction of so-called "CR-mimetic" drugs, which trick the body into acting as if it has taken in a reduced amount of calories. The leading candidate for CR-mimetic supplement is Resveratrol, a compound found in red grapes (and red wine) and in peanuts. In late 2006, research published in *Nature* showed a 15% improvement in lifespan for obese mice fed Resveratrol supplements at the human-equivalent dosage of 150–200 mg/day. Given that a human would have to consume some 20–30 liters of grape juice or wine every day to get an equivalent dosage, research is now underway to develop a supplement form.

6 LIFESPAN OF CALORIE RESTRICTED MICE VS. NON-RESTRICTED MICE



Source: Ian Goddard, Eat Less Live More, http://iangoddard.net/cr.htm; based on R. Weindruch, et al., *Journal of Nutrition,* April 1986, pp. 641–54.

7 HUMAN EQUIVALENT OF CALORIE-RESTRICTED MICE LIFESPANS, IF RESULTS WERE IDENTICAL



Source: Ian Goddard, Eat Less Live More, http://iangoddard.net/cr.htm; based on R. Weindruch, et al., *Journal of Nutrition,* April 1986, pp. 641–54.

DE GREY'S SENS PROJECT: STRATEGIES FOR ENGINEERED NEGLIGIBLE SENESCENCE

For biologists, "aging" is more accurately referred to as "senescence"—the combination of processes of deterioration that result from the ongoing development of an organism. Organisms don't die simply because they reach a certain age; they die because of an accumulation of damage to the cells. For biogerontologists like Aubrey de Grey, the goal of their research is to reduce as much as possible the process of senescence, with the result being an extended healthy life.

Although many traditional gerontologists remain skeptical about the SENS approach, other bioscientists are following parallel pathways to life extension, attacking individual components of a multi-part problem. UCSF's Cynthia Kenyon, for example, has managed to increase the lifespan of nemotodes by up to 600% through the manipulation of a set of genes regulating insulin and by increasing the capacity of cells to repair damage.

8 SEVEN KEY AGING PROCESSES

Cell depletion:
Some cells in important areas of the body—including the heart and brain—cannot be replaced naturally, or are replaced far more slowly than they are lost.

Cell senescence:
Cellular senescence refers to the phenomenon where a cell can no longer divide, but does not simply die. Senescent cells can secrete harmful proteins.

Mutations/epimutations in the chromosome:
Mutations change the DNA sequence, epimutations change the ways in which DNA is decoded into protein. The forms of mutations/epimutations SENS focuses upon are those leading to cancers.

Mutations in the mitochondria:
Cellular fuel-producing mitochondria have their own separate genetic code, mutations to which can accelerate some aspects of senescence.

Intracellular junk:
Functional cells regularly break down proteins and other molecules that are no longer useful. Those that cannot be properly digested accumulate as "junk" inside cells. Intracellular junk is connected to a variety of neurodegenerative diseases.

Extracellular junk:
"Junk" proteins may have harmful results outside of cells, too, including the amyloid plaque found in the brains of Alzheimer's patients.

Extracellular crosslinks:
Over time, proteins that link cells can develop cross-connections, reducing tissue and cellular elasticity, and causing problems like arteriosclerosis.

9 EMERGING THERAPEUTIC TECHNIQUES

Cell therapy
Uses cells with genomes modified in the lab and then introduced into the body (generally useful for the replacement of lost or dying cells only).

Somatic gene therapy
Is done inside the body, requiring a method to consistently deliver new genes to specific places in a chromosome.

Somatic protein therapy
Also performed *in-vivo*, boosts the production of certain proteins (particularly useful for resolving the intracellular junk problem).

WHAT TO DO

MARKETING:

MASTER THE ART OF "SUBTLE SEGMENTS"

Moving forward, it will become harder to lump consumers into broad categories around age. There won't be just one "senior" market, for example, or even two—such as "active" and "traditional" seniors. Companies will have to master the art of "subtle segments," based on combinations of smaller age ranges, lifestyle and lifestage, work status, health status. Sometimes, "age" won't even be the determining factor in cohort membership: as people resequence their lifestages, lifestage will lose its age-related tags. At the same time, lifestages will become more complex with the new mix of members who have different life experiences—all of which will demand a subtler segmentation.

CULTURE:

PLAN FOR INTERGENERATIONAL DISCORD

There are at least two potential scenarios where generations will be at odds with each other. In the near term, resentment between boomers and echo boomers might escalate to the point of political polarization. In the United States, we could see new alliances as ethnic populations, both young and old, feel the burden of providing, with relatively small rewards, all the services that boomers will be needing. They may well align themselves with a broader contingent of echo boomers to form a majority voting bloc.

Or we might see fragmentation as age becomes a segment like ethnicity and class, in which case boomers will once again dominate by virtue of their sheer size. In the longer term, forms of intergenerational discord could multiply as people work out new lifestages with new needs, incentives, skills, and resources at each stage. The conflict could spill over into every aspect of life from workplace and the home to politics and marketing. In resolving these conflicts, the generations may create new kinds of intergenerational institutions and practices to bridge these gaps.

WORKERS:

RETHINK LINEAR CAREER PATHS, RESEQUENCE CAREER STAGES

While the next decade will see only a slight extension of age, it is very likely to see the extended capacity of people to "live young"—and along with that capacity, new and different expectations as people continue to work into old age. Some of these people will continue their work out of economic necessity, but for many, the workplace will simply continue to be a place of self-expression, learning, and personal growth. Just as people will experiment with resequencing lifestages, they may also want to resequence career stages, take time off for mini-retirements, or periodically try out part-time work. To take advantage of this well-experienced and still vital workforce, organizations will need to rethink the traditional career paths in organizations, creating more diversity and flexibility. Ultimately these new pathways through the organization may create basic institutional change as well.

WHAT TO PONDER

- As families see an increase in the number of member generations, what new kinds of support will they need? Are new or transformed institutions required?
- Could AARP become a major political party—and what might it look like?
- What new social and cultural forms will emerge as people live longer, and how will they change urban, suburban, and rural spaces?

POLITICS:

PARTICIPATORY PANOPTICON

Camera phones, webcams, and other mobile network devices have become increasingly commonplace. While the initial use of these devices may have been to trade messages and humorous or embarrassing images among friends, wireless information and sensory devices have acquired greater social—and political—importance over the last couple years. They are the early manifestation of the participatory panopticon, a world in which we record our lives as well as the lives of those around us. Everything is potentially on the record, often from multiple perspectives; not only is privacy a thing of the past but potentially secrecy as well. Such a world isn't necessarily intentional; instead, it's the emergent result of individually reasonable technological and social choices, choices we're making right now.

TOOLS: LIVING LIFE UNDER A LENS

The participatory panopticon emerges from the intersection of well-established technological and social trends. Digital cameras have gotten smaller, cheaper and easier to use; online storage and wireless networking have become more plentiful and, quite often, free to use; and in much of the world, the dominant information platform isn't the desktop computer but the mobile telephone. Web sites like Flickr and YouTube make it easy for people to share recordings of their lives, and youth-oriented social-networking sites like MySpace are full of casual photos and videos uploaded with little thought.

The next decade will see more people recording just about everything they see—including the activities and words of the people around them. This is more than snapping a photo of an interesting sight, it's the full-time capture of one's surroundings. An already extant early manifestation of this practice, referred to as "life caching," relies on still images from handheld or wearable cameras; as bandwidth and storage continue to get cheaper, life caching will inevitably move to video.

The utility of such tools isn't hard to see. Constant recordings of one's activities, easily accessed through sophisticated indexing and tagging software, would quickly become something akin to a backup memory, augmenting often dubious, error-prone natural memories. Anyone in professional or social positions in which accurate documentation of actions and conversations is important would find these tools of enormous value, as would people suffering from "information overload," a condition in which remembering what's vital and timely amidst the abundant and banal is difficult at best.

USERS: THE GENERATIONS DIVIDE

The particulars of use will likely split along demographic lines. Aging but tech-friendly populations in the United States, Japan, and Europe will be a major audience, as these technologies (if given a sufficiently easy-to-use interface) will be of enormous value to people suffering from age-related memory lapses. Business, military, and civil security use will be commonplace, as well; the U.S. military is already experimenting with early forms of these tools, looking at the recording functions as a way of improving after-action analysis.

By contrast, today's MySpace generation will embrace the networking aspects of the technologies, seeing the life caching tools as a means of sharing their life experiences with peers. Recognizing this emerging trend, a growing number of so-called "mobile network virtual operators" (MNVOs), who repackage and resell bandwidth from major carriers, have launched with an emphasis on data, video, and network connectivity rather than voice. These new operators target younger markets. MNVOs may prove to be a catalyst in the emergence of the participatory panopticon, as they can provide wireless networks with features specific to emerging or niche demands.

POLITICS: SOUSVEILLANCE ON THE RISE

These tools have a well-established political use, as well. Groups like wearcam.org celebrate these technologies as making it easier to "watch the watchmen," and call the bottom–up, distributed network of observation tools *sousveillance*, or "watching from below," in contrast to *surveillance*, or "watching from above." Examples of sousveillance abound. The British press calls on citizens to record and upload media-averse politicians delivering speeches in out-of-the-way locales. A quick-thinking subway rider in New York uses her camera phone to take a surreptitious photo of a man exposing himself to female passengers, leading to his arrest. Such examples will become increasingly common.

Historically, surveillance has been a tool for institutions of authority to maintain control; the advent of a sousveillance culture suggests that citizens will be better able to keep tabs on the activities of those in power. Corrupt or unethical behavior is more likely to be uncovered, and recordings of particularly egregious abuses could be spread almost instantly. At the same time, such a social trend could manifest as vigilantism, particularly if framed as an anti-terrorism or crime-deterrence program.

—Jamais Cascio

IN A WORLD WHERE EVERYTHING WE SEE, SAY, AND DO WILL BE RECORDED, BIG BROTHER WILL YIELD TO THE KID ON THE STREET

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DAVID BRIN
is a scientist and best-selling author whose future-oriented novels include *Earth*, *Startide Rising*, *Uplift War*, and *The Postman*. His non-fiction book, *The Transparent Society*, won the Freedom of Speech Award of the American Library Association.

Jamais Cascio first ran into David Brin in the pages of *Time* magazine 1996, debating the topic of anonymity on the Internet. David posited that it was obsolete and problematic; Jamais argued that it was fundamental and often politically necessary. But now, almost a decade later, he admits that he is more willing to look for ways to use the expansion of mutual transparency for social good. He invited David to join him in this conversation.

Jamais: It's interesting to think about how the last decade has shaped my perception of the subjects of online anonymity, persistent visibility, and the networked world. I'm less strident now, I suppose, and more willing to look for ways to use the inevitable expansion of mutual (as well as unbalanced) transparency for positive social ends. How would you say your thoughts on transparency have evolved since the publication of your 1999 book *The Transparent Society*?

David: I have had a little humility drummed into me over the last few years. I've learned the hard way that my own aphorism—Criticism is the only known antidote to error—works best when you least expect it! You always need to be alert for when some notion needs a reality check.

I've found that transparency is actually a sub-set of something much deeper called "reciprocal accountability." It is a power that only a few generations have had to hold each other—and the mighty—accountable. It's a very recent invention and we all, especially the mighty, squirm like mad to avoid it. But it is responsible for every step we've taken away from feudalism.

Jamais: Can you expand on what you mean by reciprocal accountability? What does that look like, in practice?

David: We have long been bedeviled by one of those "devil's dichotomies"—the standoff between Rousseau and Hobbes. The latter said that men are inherently vile, and thus we need constant repression of our base or predatory tendencies by the harsh rod of authority, either from lords or the state or church. Rousseau held that we are angels in the "state of nature" and only corrupted by all that state and religion stuff.

To any sensible person, these crystallized essences seem the purest hogwash! As John Locke sensibly pointed out, humans are obviously complex mixtures of angelic and devilish traits. Some of us behave well if left unsupervised. Others won't. But clearly both Hobbes and Locke were right to criticize the demeaning effects of each others' prescriptions. Too much supervision, and too little, are both recipes for disaster.

Fortunately, Locke—and Adam Smith and Franklin and other figures from the pragmatic wing of the Enlightenment—noticed something cool. Something that had been discussed by Pericles, briefly, more than two millennia earlier (just before the kings and priests and Platonist philosophers brought the curtain down on a 2,000-year dark age). They noticed that you don't need very much repression from above, in order to curb the nasty tendencies in human nature. By and large, with a little help from a benign state, we can do that job ourselves! If common people are empowered with rights—speech, protest, petition, and recourse to law—they will naturally (and eagerly) pounce upon each others' faults, especially whenever they see someone trying to pull some kind of predatory moves.

In theory, reciprocal accountability is about a benign state helping neighbors to cancel out each others' devils, while the better angels of our nature are free to cooperate or compete joyfully, in markets and other "arenas" of human accomplishment.

Sure, any person reading this will shout and point out a myriad ways in which this process is not working well today! But I must answer in two ways. (1) We got to where we are today precisely because this process has worked pretty well, enough times to change the entire sweep of human existence. (2) Your own rapid objections, seeking to correct my error, are examples of this modern reflex. You help to prove my point.

Ironically, one person used this method to pin me with an apparent exception, an apparent failure of reciprocal accountability and transparency to do the good that I keep yattering about. "What about shy people?" she asked? "Transparency may empower them, like everybody else. But shy people don't want to step forward and skewer others with accountability. They don't want to stop peeping toms and big brothers by 'looking back.' They just want to be left alone."

Try as I might, I cannot come up with a glib answer to that one. Except to say that the world of tomorrow needs to be more than just open and free. It will also, eventually, have to be at least a bit polite.

Jamais: As I've written about the participatory panopticon, it seems to me that the most profound changes that will emerge from the technologies of transparency have to do with relationships—how we interact with each other. Manners matter when we all have this kind of power, whether we want it or not. So does trust. Privacy gets all of the attention, but the most painful

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RECIPROCAL ACCOUNTABILITY IS ABOUT A BENIGN STATE HELPING NEIGHBORS TO CANCEL OUT EACH OTHERS' DEVILS, WHILE THE BETTER ANGELS OF OUR NATURE ARE FREE TO COOPERATE OR COMPETE JOYFULLY.

changes will have more to do with honesty—or, as you put it, "accountability."

It's interesting to watch this all emerge. The clash between the pre-panopticon culture and the reciprocal accountability culture will likely be noisy and not always very pleasant for either side. We can see inklings of this with the dismay many older Americans feel about how much teenagers reveal about themselves on sites like MySpace. Dire warnings about employment prospects rub shoulders with moral panics about photos of young people acting like, well, young people. Meanwhile, the folks using these sites, by and large, can't quite see what all the fuss is about. They've internalized a bit of the panopticon culture. Most people writing about this subject seem to assume that, once these young people grow up, they'll be embarrassed by their past exhibitionism. But what if they are not?

"What do you think are the most important dynamics here? Is this technology drive? Is it a result of a growing desire for accountability by those with social power, such as the placement of cameras in police cars to record traffic stops? Or are we backing into it, not quite realizing the impact of things like camera phones?

David: There are so many levels. One is the tendency of all professionals to defend their turf, which is a phenomenon as old as specialization itself. If allowed to take root and metastasize, this natural human drive will result in a myriad barriers erected, telling amateurs and citizens never to do anything for themselves because they are "not qualified." Certainly this will be applied to the most powerful thing of all, knowledge. And the ability to see. Excuses and rationalizations will abound, for why citizens must not be allowed to see this or that. Eventually, to see anything at all. But, I think it's even better explained at another level. One that I call "the return of the village."

Seriously, all the stuff you carry in your wallet—credit cards, ID, money—these are all credentials that replace something else that used to suffice in human life, your reputation. During 99% of human generations, we lived mostly in villages and clans and small towns where everyone knew everybody else. That's why most people can identify and "know" about 1,000 to 5,000 people, the maximum number that a gregarious person would have had to know in olden times.

In those days, (as attested to vividly in Shakespeare) your reputation was incredibly important. It reflected your status among those few thousand people who mattered. It determined your ability to buy and sell and to derive the benefits of reciprocal respect, to basically make deals with a hand shake. Modern urban pseudo-anonymity is, by comparison, a recent and uncomfortable innovation, only made possible with countless prosthetic devices. Lenses and cameras that extend vision. Books, libraries, and databases that extend memory. And credentials and money that enhance reputation, turning it into a complex fluid with countless nuanced functions. But they all still boil down to the same thing: "Will all my fellow tribesmen let me have and do and become the things that I want?"

Jamais: Historically, we haven't done a very good job at making village communities that allow their members to do and become the things that they want. Overwhelming observation has, by and large, been more often used to suppress outside-the-mainstream behavior than to go after the powerful and corrupt. How do you see this emerging world differing?

David: You and I are examples of the sort of people who were burned at the stake in almost any other culture. Yet, in this one, we are paid well to poke at the boundaries of the "box." I'm pretty grateful for that, and for the millions of others like us, who are allowed and encouraged to bicker and compete and criticize. It is a noisy, noisome civilization and its imperfections may yet kill us all. But is so vastly beats all of the neat and tidy ones that came before.

Now we're entering a new era when the village seems about to return. With our senses and memories enhanced prodigiously by new prostheses, suddenly we can "know" the reputations of millions, soon to be billions, of fellow Earth citizens. A tap of your VR eyeglasses will identify any person, along with profiles and alerts, almost as if you had been gossiping about him and her for years.

It's seriously scary prospect and one that is utterly unavoidable. The cities we grew up in were semi-anonymous only because they were primitive. The village is returning. And with it serious, lifelong worry about that state of our reputations. Kids who do not know this are playing with fire. They had better hope that the village will be a nice one. A village that shrugs a lot, and forgives.

WATCHING ON THE MOVE: FROM HAND-HELD TO WEARABLE

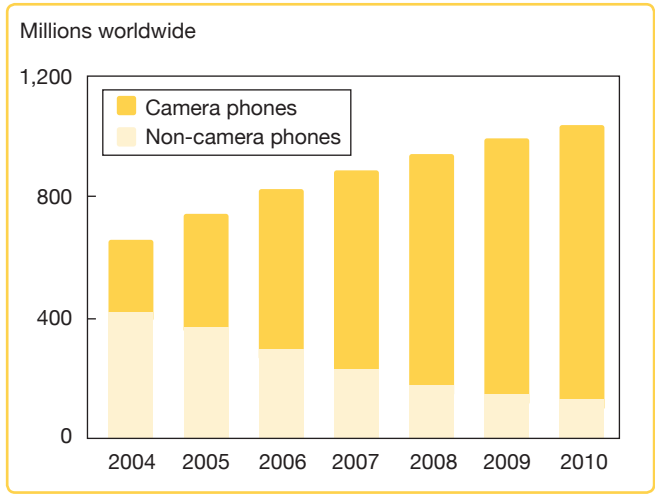
The first commercially available mobile phone with a built-in camera appeared in early 2000, in Japan; and by 2003, camera phones outsold plain digital cameras worldwide. Even if the lenses were small and the image quality most-generously described as "moderate," camera phones held a singular advantage over other kinds of cameras: the ability to snap a picture and send it immediately to other people. While this feature is most often used for casual social interactions, the combination of immediacy and connection has also been used to great effect by emerging citizen media networks, as well as by everyday people finding themselves in remarkable situations (as exemplified by the widely seen images from the London Underground taken by survivors of the July 7, 2005 bombing).

Increasingly, mobile phone use is less about basic voice communication than the integration of data, images, and *continuous partial attention*— a concept from Linda Stone, founder of the Virtual Worlds Group at Microsoft Research. Buddy lists, location information, multiple "checking-in" text messages, and the like allow users to remain connected to and on the periphery of awareness of their friends, family, and colleagues. As the bandwidth for connection among networked individuals increases, so too will the complexity of this information.

The next step in the evolution of these technologies looks to be life caching—using camera phones and similar technologies to document the sights and sounds of one's day, and making the observations available to friends, family, and colleagues. Taking advantage of rapidly increasing storage and network capacity, life caching is less about the conscious recording of particular events than about the passive documentation of one's environment. The vast majority of captured images and sounds will be of little value, but passive acquisition allows a greater chance of catching serendipitous events.

A handheld device is fine for occasional phone calls and quick pictures, but less useful for full-time applications such as life caching. "Wearables" are more promising, and current developers are taking two different approaches: medallions and glasses. Medallions, exemplified by Microsoft's prototype "wearcam" (part of its highly ambitious MyLifeBits project) is worn around the neck, recording images at chest-level. Glasses, such as the commercial DejaView Camwear, put recording systems on a pair of glasses, so the camera follows head direction. In both cases, the devices are—for now—large and obvious, with limited power and storage capacity. Within the decade, however, we will see much smaller versions with far greater capabilities, likely including recording devices small enough to fit invisibly in glasses, earrings, and other accessories.

1 CAMERAS WILL BE IN NEARLY ALL MOBILE PHONES BY 2010



Source: InfoTrends, www.wirelessmoment.com/statistics_camera_phones/index.html

2 WEARCAM MEDALLION CAMERA

This Neclace Dome is a sousveillance device designed to mimic surveillance cameras used in public spaces.

Source: http://wearcam.org/domewear/neclacedome.htm

3 DEJA VIEW'S CAMWEAR HAT AND GLASSES

A small camera mounted to a hat or glasses allows the wearer to capture all of life's moments.

Source: http://stores.skipjack.com/dejaview/Detail.bok?no=27

WATCHING YOUR HEALTH: FROM THE BODY TO THE PANOPTICON

Wireless mobile devices are not limited to cameras as sensory input, and even today it's possible to find mobile phone add-ons to measure inputs as widely varied as UV radiation and bad breath. Add to these a host of on-body sensors that can gather real-time data on on such things as body chemistry and functioning—plus the ability to use network computers for processing and analysis—and a clear forecast emerges.

An aging population and the increasing drive for individuals to be aware of their own (and their family's) health will put handheld and wearable devices on the frontlines of health care. Current mobile health devices require the active participation of users, but passive detection of body temperature, signs of sickness carried in the breath, and even systems trained to listen for coughs and sneezes will make the phone a commonplace if limited medical monitor. Depending upon the affliction, doctors will be able to provide advice or even treatment using phones as mobile telemedical units. In fact, Swiss researchers in 2004 found that dermatological diagnoses made using camera phone images were nearly as accurate as in-person diagnoses.

Beyond continuous monitoring of individuals, mobile health devices and sensors will prove to be powerful tools for large populations during pandemic disease outbreaks or natural or human-made disasters. We have already seen examples in China in late 2002 and early 2003, where information about the locations of SARS outbreaks was passed along via text messaging. The addition of mapping capabilities, GPS, chemical sensors, and better camera hardware to mobile phones will make amateur information gathering and dissemination in a future emergency much more compelling, detailed, and timely.

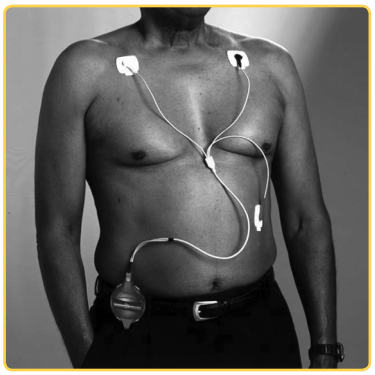
Camera phones and other networked mobile sensors will have a more prosaic benefit as well. Currently, services such as MyFoodPhone offer nutritional advice based on camera phone photos of meals; as recording becomes a passive activity, such services will lurk in the background, ready to offer suggestions as needed. Similarly, experimental use of camera phones as ad hoc barcode scanners while shopping points to a world in which consumers can pull up detailed nutritional data. This ability to keep track of the world around us to safeguard our health—whether in extreme or daily situations—may end up being a major driver of the participatory panopticon.

4 MYFOODPHONE FROM SPRINT

Source: http://www.myfoodphone.com/index.aspx

MyFoodPhone is a camera phone/food journaling service that links individuals with nutrition coaches and advisors. Users can take pictures of meals with their any camera phone and e-mail the pictures to their journal to get feedback from their advisors.

5 CADRIONET AMBULATORY CARDIAC MONITOR



Source: http://www.cardionet.com/media_08.htm

CardioNet provides a cardiac monitoring service with real-time analysis, automatic arrhythmia detection, and wireless ECG transmission. Physicians access the telemetry data from the monitoring center to make diagnoses and treatment decisions.

WATCHING THE WATCHMEN: FROM SURVEILLANCE TO SOUSVEILLANCE

Perhaps the most disruptive aspect of the participatory panopticon will come in the world of politics.

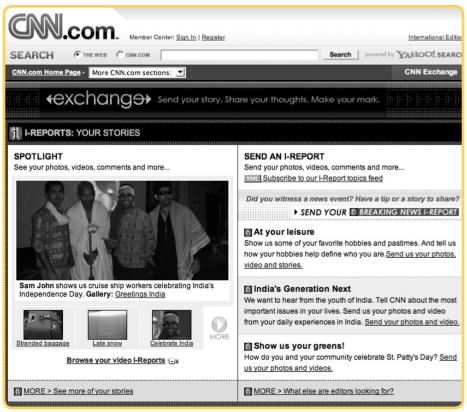
Advocates of sousveillance suggest that nearly ubiquitous mobile networked cameras will give us a powerful tool for "watching the watchmen"—for enforcing accountability of public officials by creating a broadly accessible record of their actions. Nondigital examples of video recordings used to catch official misbehavior, such as with the Rodney King incident, underscore the power this kind of watchfulness can possess. The Rodney King beating was captured on a single camera; the camera phone version of "Rodney King" will likely be captured by dozens, from myriad perspectives. In principle, the millions of people worldwide carrying camera phones that can record and upload video constitute an army of transparency.

Citizens armed with camera phones will fall into a middle ground between activists and journalists. Already, camera phone users have been able to document momentary lapses, mistakes, and corruption on the part of officials, as well as offer first-on-the-scene recordings of events such as plane crashes and terrorist attacks. Such cases will become commonplace as technology improvements make high-quality passive recording easy and social adaptations make constant documentation of one's surroundings a broadly accepted, even expected, behavior.

In parts of the world with corrupt and abusive governments, the participatory panopticon will start to tip the balance to favor aware citizenry. At present, camera-using activists face a dangerous period between making their recordings and passing the tapes to friendly organizations: if the tapes are discovered, the activists face dire consequences. The proliferation of wireless networked cameras, however, allows video recordings to move from camera to friendly organization in a matter of seconds. The best-known video-enabled human rights group, WITNESS, has a Web site specifically designed for uploading video.

The uncertainty for the next decade is how those in power will respond to technologies of mutual transparency, or in David Brin's terms, "reciprocal accountability." In societies with traditions of free speech and politics, the strongest push-back against these technologies may come in the form of intellectual-property controls. Given the abundance of copyrighted material (both audio and visual) that surrounds us in our daily lives, the ability to passively record the world may be stymied by hardware restrictions—already under discussion—that limit or prevent the background recording of copyrighted content. If participatory panopticon systems are built to respect "digital watermarks" or other signifiers of intellectual-property controls, we should expect to see such restrictions abused by corrupt officials, abusive police, and others seeking to carve out an area of secrecy in an otherwise transparent world.

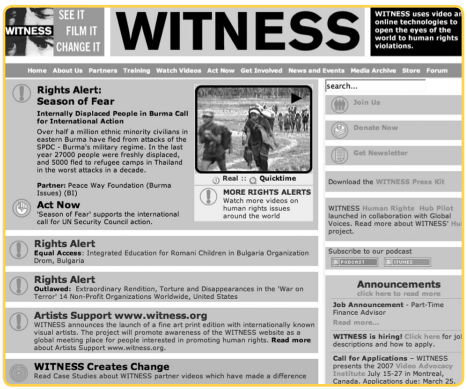
6 CITIZEN REPORTERS: CNN'S I-REPORTS



Source: CNN I-Reports, http://www.cnn.com/exchange/

CNN encourages viewers to send in their photos and videos of breaking news stories.

7 WITNESS: SEE IT, FILM IT, CHANGE IT



Source: WITNESS, http://www.witness.org/

WITNESS uses video and online technologies to open the eyes of the world to human rights violations.

WATCHING YOUR REPUTATION: FROM FRIENDLY ADVICE TO THE WILD WEST

The role of reputation networks will almost certainly become a controversial part of the participatory panopticon as it evolves. Now commonplace online, reputation networks allow users to identify friends, pass along recommendations and warnings, and give ratings to the photos, commentary, or other offerings of peers in the reputation system. Product recommendation software such as Amazon's is another example.

At present, camera phones and similar mobile technologies can serve as tools for a crude reputation network inasmuch as they allow users to send a picture or message to friends asking their opinions of a given product, event, or person. Phone manufacturers or network providers sometimes highlight this aspect of camera phone use in their marketing, illustrating how quickly and easily one can get feedback from friends about a potential date. Arguably, this form of reputation network adds a technological element to otherwise traditional social group activities, augmenting their reach but not providing substantive new capabilities.

The participatory panopticon version of this practice, however, will take advantage of the automated tagging and indexing done by life-caching software. One's personal system will check its recording index, looking for otherwise-forgotten references to a name or face, retrieving useful references or contexts. New faces or names can be similarly checked out by one's broader social network in a semi- or fully automated way, looking in particular for warnings or strong positive recommendations. As with current peer-to-peer cryptographic systems, this reputation network may offer varying levels of trust, restricting how much information about one's contacts to pass along—or even how much to rely on the recommendations of a given peer.

Reputation networks will be the "wild west" of the participatory panopticon, as they'll rely on relatively advanced technology (especially regarding indexing, searching, and potentially facial recognition), and pose many dilemmas around the control of information. Laws concerning libel, privacy, the accuracy of personal information databases—and even ownership of opinions—will need to be re-examined in the light of this technology and its use. Perhaps more importantly, this manifestation of the participatory panopticon will underscore the ways in which social technologies can shake up—for better or for worse—existing relationships and cultural norms.

8 THE JABBERWOCKY APPLICATION FOR MOBILE PHONES

Source: http://www.urban-atmospheres.net/Jabberwocky/info.htm

The Jabberwocky application tracks "familiar strangers"—people you have passed in daily life but have never actually met. Using digital tags and digital scents, it creates a subtle familiarity index for people in your environment.

WHAT TO DO

MARKETING:

BUILD ECONOMIES ON REPUTATION

In a world where individual behavior can be measured and monitored in lots of different ways, reputation will become an increasingly important "currency"—a way of valuing the social capital of an individual, a company, or perhaps even an entire community. Complex sets of reputation data and equally complex reputation analysis tools may well begin to shift the way markets and even entire economies behave. For example, new pricing models may emerge for health products (and insurance), linking them to healthy behaviors—better behavior gets steeper discounts. And as intangibles are increasingly incorporated into accounting schemes for both communities and corporations, reputation tracking will become a key accounting skill. (See "Finance: Intangible ReformS" for more details on alternate capitals.)

TECHNOLOGY:

EXPECT A PANOPLY OF COUNTER-PANOPTICON TOOLS

Even as people embrace a more public and documented life, the demand for counter-surveillance (or sousveillance) tools will likely expand at all levels—from institutions to individuals. The same companies and practices that provide the context-aware environments of the future may find themselves also developing and marketing tools to block some of that context awareness. From surveillance-secure rooms or buildings to tools that can create ad hoc "invisible" spaces, people will turn to technology to address some of the problems that rapidly changing social norms and behaviors cannot. Over time, a complex etiquette of privacy is likely to emerge, not unlike the shifting etiquette of cell phone use.

COMMUNITIES:

EXPLORE EMERGING MEANINGS OF "PUBLIC"

Communities are built around the idea of "public"—public spaces, public goods, public identities. Much of the management of communities involves brokering shared agreements about what is considered public and what is not. As the practical experience of privacy is altered by the participatory panopticon, both the meaning of public and the tools for managing what is considered public will shift. The result will likely extend far beyond questions of privacy to basic assumptions about private ownership.

WHERE TO LOOK

For a look at how "truth" is determined in science, democracy, courts and markets, see Brin's article in the American Bar Association's *Journal on Dispute Resolution*, "Disputation Arenas: Harnessing Conflict and Competition for Society's Benefit" (August 2000).

http://www.davidbrin.com/disputationarticle1.html

WHAT TO PONDER

The implications of the panopticon technologies regarding secrecy and accountability could be dramatic. A world in which someone could be capturing and uploading what you say or do at any time is a world in which it has become much more difficult to get away with lies and misrepresentations. Politicians surrounded by media and citizen cameras at every speech already live in this world; as these tools spread, accountability-by-visibility could begin to apply to people with much lower profiles, including local officials, law enforcement personnel, shopkeepers, business colleagues, and even one's own spouse or partner.

At the same time, the technologies may also be used to lie in new ways—to give video proof of events that never happened or to "Photoshop" the context, for example. Early examples are celebrity porn sites that appear to show x-rated views of celebrities. Many viewers may not even care whether the photos are "real" or not. To say that such a media environment demands a new level of critical thinking skills perhaps understates the problem; what may be needed is an entirely new way of dealing with uncertainty. (For relevant Perspectives, see "Culture: Digital Natives, Civic Spaces" and "Science: The Next Revolution?")

CULTURE:

DIGITAL NATIVES, CIVIC SPACES

A new youth media literacy is emerging. As the authors of cultural products, today's young people are driving a rapid expansion of participative media—as well as a shift in the authority of authors. While this new literacy demands more personal skills in both producing media and evaluating them critically, it is also enabling more collaborative and commons-based forms of civic engagement. Thus, over the next decade, today's emerging media literacy may well evolve into a new civic literacy, as well.

YOUTH MEDIA: THE NEW CULTURAL PRODUCTION PARADIGM

Whatever else might be said of teenage bloggers, dorm-room video producers, or the millions who maintain pages on social-network services like MySpace and Facebook, it cannot be said that they are passive media consumers. They seek, adopt, appropriate, and invent ways to participate in cultural production, from musical mashups to dorm-room videoblogs.

A recent study by the Pew Internet and American Life Project claims that more than 50% of today's teenagers have *created* digital media. Today's "digital natives" exchange SMS messages by the billions, are accustomed to being "always on" and always connected, and participate in peer-to-peer creation and distribution of cultural products from using Napster to YouTube. They do their homework while keeping five chat windows open, talking on the phone, and peeking into their massively multiplayer online games. The conflict between peer-to-peer online file-traders and the recording industry is about more than theft of music; it's about the birth of a whole new mode of production, if Yale professor Yochai Benkler is right. In their production and consumption of culture, their social organization, and their learning practices, digital natives already exhibit cognitive and social styles significantly different from those of previous generations.

DISTRIBUTED TRUST: THE NEW AUTHORIAL AUTHORITY

For digital natives, the availability of wireless Internet access in their classrooms is already dissolving the 1,000-year-old paradigm of the authoritative, broadcast-only "sage on the stage." When the Internet made every PC a potential publishing house, authorial authority shifted from the producer to the consumer of knowledge. Readers of traditional print media trusted publishers, editors, and authors to vouch for accuracy in the Gutenberg era, but the Internet has shifted that responsibility for critical evaluation to the end user. At the same time, digital video cameras, mobile communication devices, wireless broadband Internet connections, and media editing software have put the means of high-quality audiovisual production in the hands of millions of amateurs. With YouTube serving up 100 million videos daily—and more than one-quarter billion images uploaded to Flickr—the rules for responsible media are up for grabs. Search engines do not distinguish between the authentic, accurate, bogus, and spurious. Critical examination of the author's reputation, sources, arguments, and evidence are required. The result? The capacity for independent critical judgment is emerging as a key to success in the networked society.

BEYOND PEER-TO-PEER MEDIA: THE NEW CIVIC SPHERE

This emerging literacy could converge over the next decade with new forms of organization to catalyze transformations in the civic realm. Networked publics, commons-based property regimes, and emergent self-organization could restructure the civic sphere around distributed solutions, increasingly implemented as ad hoc interventions that bypass traditional government and civic institutions—as we've seen with emergent collective response to natural disasters or with youth-organized protests against immigration laws.

This transformation is not a given, however. The counter forces include efforts to limit participatory media production and distribution through the Digital Millennium Copyright Act and technological changes such as the abandonment of net neutrality and the digital rights restrictions built into Microsoft's new operating system. Equally important, however, is the role of education in providing the higher-level skills of advocacy, persuasion, and group formation—the discourses of self-governance that have thus far not kept pace with the growth in media literacy. The future of civic literacy will depend to large extent on how these contradictory forces play out.

—Howard Rheingold

THE RAPIDLY GROWING DIGITAL PARTICIPATION CULTURE IS BEING SHAPED BY THE INTERESTS AND NEEDS OF YOUTH—AND PERHAPS SHAPING HOW WE ALL SEE THE WORLD

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HENRY JENKINS
is Director of the Comparitive Media Studies Program and professor of literature at MIT, currently working on issues surrounding the intersection of old and new media.

Howard Rheingold has been both an observer and champion of participatory media for a long time, but has more recently begun to look at the curriculum for civic literacy through the lens of youth media. Henry Jenkins, across the country at MIT, has been tracking games, media, and cultural change. Jamais Cascio brought both of them together to reflect on the potential for a new kind of civic literacy to emerge from today's media trends.

Q: TO SEED OUR DISCUSSION, LET'S START WITH THE CORE DRIVERS? WHAT IS SHAPING THE EVOLUTION OF THE NEW YOUTH MEDIA CULTURE?

Howard: As always, I'd say it's the intersection of technological and social drivers. Technology is the key enabler, particularly video and gaming. Games offer the ability to participate in what we really only dreamed of ten years ago—virtual reality, immersive environments. And then with the explosive use of do-it-yourself video among young people, clearly we are entering the beginning of a video vernacular for young people. So those are really two strong drivers.

The big social driver is the digital natives, the people for whom having a mobile device on you and having access to all sorts of online services from social-networking services to instant messaging is not something new. For them it's just part of the world, just like flipping a switch when you want the lights to go on. The intersection of this generation of folks who've been growing up with the ability to create as well as consume media, the intersection of that generation with very broad availability of very sophisticated tools—that is, not just for rich kids—those are the drivers that I see.

Henry: I totally agree. But we've seen several decades now of continuous development toward a more participatory culture. As soon as a technology is released into the market, it's being taken up and deployed by these participatory cultures in ways that were totally unimagined by the designers and producers of it. After a while, it doesn't matter whether it's technology that's fueling the change or whether we simply have a culture that is pushing to participate and is going to seize every available tool and resource. We'll do it if it's hard. We'll do it if it's easy. We'll do it if it's legal. We'll do it if it's illegal.

Young people are simply looking for a way to connect with each other socially, looking for a way to express their identity to the world, to participate in larger forms of communities. What makes YouTube really powerful is not just that it's a space where amateurs can post content, but that it's a space where all the different grassroots communities—fan groups, subcultural groups, skateboard communities, Goths, punk rockers—can post their content. It's the cross-fertilization of these grassroots communities, in particular, that I think is accelerating. These things might have gone on in small pockets, isolated from each other, hidden from view. The minute they're brought into public view, they learn from each other very quickly. It's like an enormous burst of energy that comes in and revitalizes a lot of these communities. So it's not just the growth within an individual participatory culture; it's the growth among participatory cultures that is exciting about the present time.

Q: HOW MIGHT THIS CULTURE OF PARTICIPATION PLAY OUT IN THE WORLD OF POLITICS, BOTH IN THE REAL-WORLD CULTURE AND VIRTUAL CULTURE?

Howard: One thing I would want to look at is the degree to which this culture participates in the U.S. 2008 elections. Are they going to deploy the culture and tools in the political sphere? It's a good question, and we'll know more about it in 2008.

Henry: We've already seen some signs in MySpace and other social-network sites that are being used by young people to organize politically. We've already seen protest marches against the Iraq war inside massive multiplayer game worlds. But will we start to see activist use of something like Second Life? Who's going to be the first presidential candidate to create an avatar and go into Second Life to court youth voters? That's going to be a really interesting point, because the kind of politics that emerges in a place like Second Life—which is about broad experiments and alternative realities, alternative identities, and exploring in-depth hypothetical social and political arrangements—is very different from the language that traditional politics has embraced.

The analogy I've drawn to Second Life is Carnivale or Mardi Gras in traditional societies. These were places where you took on a mask and a costume, an identity different from your own. And that allows you to think about social and political possibilities that would otherwise be constrained. We know historically that Carnivale led to many peasant uprisings throughout Europe. It was designed to control and regulate subversive energies, but in fact they overflowed. And because people could think of new possibilities through Carnivale, they acted on them in the real world. Second Life is a fascinating example of Carnivale, except that in the the case of Carnivale, the suspension of normal rules and identities was fairly brief. With Second Life, people are choosing to live in this alternative reality for much more extensive periods of time. The question is: will it have that same ability to

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THE WEB HAS GIVEN A WAY FOR ALL THESE DIFFERENT GRASSROOTS COMMUNITIES TO COME TOGETHER, TO GAIN VISIBILITY TO EACH OTHER, AND THAT CREATES A FUNDAMENTAL CHANGE IN THE QUALITY AND QUANTITY OF PARTICIPATION.

get people to reconceptualize their place in the world and to move them to political action, or does it become more of a safety net for the society, in which all the subversive energy, the alternative culture, just lives in a kind of permanent Burning Man?

Q: HOW WILL THE YOUTH PARTICIPATORY CULTURE EVOLVE OVER THE NEXT DECADE? WILL IT BECOME MAINSTREAM OR WILL THEY OUTGROW IT?

Howard: Well, of course, the 15-year-old automatically becomes a 25-year-old, given ten years. And I foresee worldwide a pretty big change—I don't know exactly what that change is going to be—as these digital natives begin to become citizens and members of the workforce. They're going to bring their attitudes and practices with them.

Henry: We've already seen the generation that grew up playing Super Mario Brothers take on their first roles as teachers, as young professionals, as parents. And we're starting to see the impact of that shift in terms of the serious game movement. Those people are seeking ways to connect their adult identities to a medium that meant a lot to them as they were growing up. I think you can see it in the work that John Beck did in his *Got Game* book, where he looks at the very different attitudes toward competition, risk, personal identity, and collaboration that emerge and in the workplace as a generation of gamers begins to take on their professional careers. People are continuing to play games later and later in life, much later in life than anyone would have expected. It's even spreading upward into senior citizens who are beginning to play games online in greater numbers than I think anyone would have anticipated. Gaming is the real barometer of this stuff spreading outward.

Howard: You know, you cite YouTube. Here's a question: would YouTube be as interesting or as big without the youth component in it? Today, there's something in the media culture that's making a very big splash, and young people have a large responsibility for it being as important as it is.

Henry: Certainly, there's an awful lot of youth content out there, and a lot of the content that's generated the greatest buzz has come from young adults or teenagers. We're seeing amazing work done by teenagers working on their home computers doing special effects and making their own amateur *Star Wars* films, for example, or creating their own music videos. The Lonelygirl15 phenomenon turns out to have been an adult project involving youth, but the fact that it looks so much like other projects that young people were already making suggests the blurring of lines between adult-made and youth-made media.

Howard: There's also a pretty large percentage of the population in Second Life that creates things using its scripting language, which is pretty interesting, because it's not easy to do that. So there seems to be a strong builder culture at work there, beyond the participation culture.

Q: HOW WILL OUR FAMILIAR INSTITUTIONS RESPOND? HOW DO THE FAMILIAR CIVIC ROLES OF EDUCATION AND LAW CHANGE? HOW DO OUR ETHICS CHANGE? IS THIS AN INCREMENTAL CHANGE OR A PARADIGM SHIFT?

Howard: Well, I think Henry and his colleagues made a strong statement in their white paper for the McArthur Foundation regarding the changes that are necessary in education. This is not just shoe-horning another course in the curriculum on media literacy; it's a whole new way of teaching and learning as the availability of these technologies and the changed learning styles of young people begin to collide with the educational establishment. I think that's the site of potential conflict and potential change.

Henry: Education is clearly one of those sectors. What I tried to do in the white paper was identify 11 core social skills and cultural competencies that young people need to acquire and schools need to embrace if we're going to fully prepare every kid in America to be part of the participatory cultures we've been talking about here. And it really does represent a paradigm shift in the way education operates.

I think the other sector of change is going to be the legal culture. We have to rethink our expectations about intellectual property and fair use as we embrace a world where amateur-made content circulates broadly. We can expect that amateurs will respond to the shared cultural content of their time, and much of that cultural content still is going to be the content ➤

THE NEW CIVIC LITERACY: THREE EARLY INDEXES

The 2006 Ten-Year Forecast Signals Survey reveals some emerging patterns of behavior—both online and off—that could be early indicators of a new civic literacy. We have tried to capture these patterns in three indexes:

- A Networking IQ Index that defines an emerging skill set for smart networking.
- A Collective Behavior Index that defines a more specific skill set for sociability and collective action.
- A Literacy of the Commons Index that defines an emerging skill set for maintaining the online commons.

An index is a way to cluster reported behaviors and attitudes into a set of factors that are statistically meaningful. So for example, a set of questions about participation in formal and informal groups of different types may cluster into a factor that suggests a set of behaviors related to social-identity creation. Multiple factors cluster to form an overall profile or index.

Using the index, it is then possible to score everyone who responded to the survey. By examining the scores, we can see how different segments of the population score and how wide-ranging the behaviors are.

When we look at these three indexes, we see an interrelated set of factors—many involving online behavior—that all contribute to a new literacy in organizing social processes, creating group value, and contributing to a commons. Over time, we might expect these indexes to begin to shape new civic processes and even institutions.

NETWORKING IQ—REVISITED ➤

In 2004, we created the first version of our Networking Intelligence Index, based on a survey of 2,014 adults, aged 18–74. In our 2006 survey, we analyzed responses to the same set of questions—as well as some additional questions. A factor analysis of these questions produced five factors that are similar to those in our original survey—group participation, online lifestyle, mobile communication, locative activity, and computer connectivity. In addition, we found a new factor for collective behavior. These results suggest that, although smart networking conforms to a coherent set of behaviors, it is evolving.

FACTOR 1: GROUP PARTICIPATION

Member of an online community

Participate in group activities such as volunteering or playing online games with others

Use the Internet, a mobile phone service or a wireless service to:

- Start or participate in a prayer group
- Build a personal or professional network
- Organize a local political gathering
- Organize a fun event

Monthly participation in groups for:

- Personal development
- Hobby
- Student or alumni organization

FACTOR 2: COLLECTIVE BEHAVIOR

Participate in projects that improve overall health of community

Use public transportation to reduce carbon emissions

Support local farmers

Create media and share it

Make online financial contributions to religious groups

Have a personal blog

Contribute to blogs

Post family or personal pictures online for others to view

Use tagging services like del.icio.us

Subscribe to RSS feeds and blogs

Contribute to a public wiki

Participate in group activities such as volunteering or playing online games with others

Use the Internet, a mobile phone service, or a wireless service to:

- Express opinions about political or religious groups
- Start or participate in a prayer group
- Build a personal or professional network
- Organize a local political gathering
- Organize a neighborhood event
- Organize a fun event

Monthly participation in groups for:

- Personal development
- Hobby
- Student or alumni organization
- Political or religious beliefs
- Physical exercise or sports
- Profession or industry

FACTOR 3: ONLINE LIFESTYLE

Play massively multiplayer online games

Have a personal blog

Contribute to blogs

Maintain a personal, household, or family Web site

Post family or personal pictures online for others to view

Create media and share it

Contribute to open-source programming

Make online financial contributions to political and religious groups

Use tagging services like del.icio.us

Subscribe to RSS feeds and blogs

Contribute to a public wiki

Have a computer that has wireless, IM, and webcam

Get news from news Web sites and blogs

Use the Internet, a mobile phone service, or a wireless service to:

- Meet someone new in your own town or city
- Meet people with similar political or religious views
- Meet people with similar hobbies
- Find a support group
- Express own political or religious opinion
- Start or participate in a prayer group
- Organize a local political gathering
- Organize a neighborhood event

FACTOR 4: MOBILE COMMUNICATION

Use public wireless hotspots

Talk on a cell phone

Use services like IM, SMS, GPS, Internet, Bluetooth, and music or video on a mobile device

Use mobile, IM, and SMS to stay connected

Go online from nontraditional locations

FACTOR 5: LOCATIVE ACTIVITY

Use location-based services

Use GPS

FACTOR 6: COMPUTER CONNECTIVITY

Have high-speed Internet connection, LAN, or wireless router at home

Leave computer connected to Internet

Leave e-mail or IM on

Have a computer with wireless, VOIP, IM, or Bluetooth

Stay connected using IM, e-mail, and computer-enabled phone

COLLECTIVE BEHAVIOR AND SOCIABILITY

Ultimately, civic literacy is about collective behavior. It's about the way we organize ourselves into groups, networks, organizations, and ultimately institutions. If we take a closer look at collective behavior, we can identify a set of behaviors that cluster into two key factors defining something we might call "sociability."

The first factor—social-network development—captures the various ways that people explicitly build their networks. In this index, it reflects the use of both online tools and conventional group forums for building group identity around interests, vocation, and politics.

The second factor—social-identity creation—expresses the personal side of collective behavior. It's more focused on personal development, personal beliefs, and personal expression.

Note that cooperative theories generally suggest that linking personal identity to group membership is a key to promoting collective behavior.

FACTOR 1: SOCIAL-NETWORK DEVELOPMENT

Use the Internet, a mobile phone service, or a wireless service to:

- Meet someone new in own town or city
- Meet people with similar political or religious views
- Meet people with similar hobbies
- Find a support group
- Build a personal or professional network
- Organize a local political gathering
- Organize a fun event
- Organize a neighborhood event

Monthly participation in groups for:

- Profession or industry
- Student or alumni organization

FACTOR 2: SOCIAL-IDENTITY CREATION

Monthly participation in groups for:

- Personal development
- Shared political and religious beliefs
- Physical exercise or sport
- Hobbies or shared interests
- Profession or industry
- Student or alumni organization

LITERACY OF THE COMMONS

The civic sphere is a commons and the Internet is the newest commons—offering new cooperative strategies as well as a training ground for developing a new literacy of the commons. We took a deeper look at some of our smart-networking and collective-behavior variables to try to understand the key components of the emerging literacy of the commons online. Two key factors emerged.

The first is a set of behaviors can be seen as maintaining and engaging in the commons. It captures the extent to which people make contributions to online Web sites, blogs, tools, and even political groups, as well as availing themselves of those same resources.

The second factor, while sharing some of the same behaviors as the first, skews toward the personal. While the first factor focuses on contributions, this factor can be seen as focusing more on personal expression.

FACTOR 1: MAINTAINING THE COMMONS

- Maintain a personal, household, or family Web site
- Create media and share it
- Contribute to open-source programming
- Make online financial contributions to political groups
- Use tagging services like del.icio.us
- Subscribe to RSS feeds and blogs
- Contribute to a public wiki

FACTOR 2: PERSONAL EXPRESSION

- Maintain a personal, household, or family Web site
- Have a personal blog
- Contribute to blogs
- Post family or personal pictures online for others to view
- Subscribe to RSS feeds and blogs

YOUTH: THE LEADING EDGE

When we look across all three indexes, we see that young people are more likely to score well on these indexes than their elders. We also see, in each case, that the majority of the population scores low on these indexes, while a small percentage scores very high.

One way to interpret these scores is to view young people as a class of early adopters of the technologies and behaviors seen here. As these young people mature and enter the workforce and the civic sphere over the next decades, these skills are likely to diffuse throughout our institutions. As with other diffusion-of-innovation phenomena, we might expect to see a strong inflection point in these skills within the next ten years.

1 CORRELATIONS

Age

Smart networking is moderately correlated with youth (-.256)

Collective behavior is weakly correlated with youth (-.096)

Literacy of the commons is moderately correlated with youth (-.248)

Gender

Men score higher on the smart networking index than women, 56% to 44%

Men score higher on the collective behavior index than women, 54% to 46%

There is no correlation between literacy of the commons and gender

Education

Smart networking is weakly correlated with education (.08)

Collective behavior is weakly correlated with education (.127)

There is no correlation between literacy of the commons and education

Political Affiliation

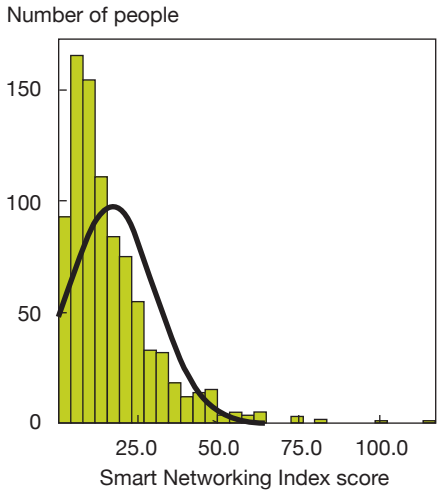
Smart networking is weakly correlated with liberal political affiliation (.102)

There is no correlation between political affiliation and collective behavior or literacy of the commons

Income

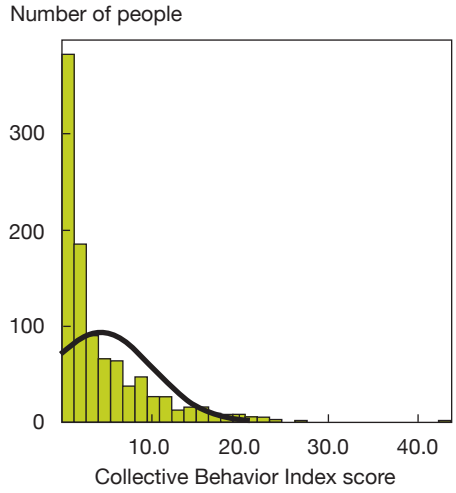
There is no relationship between any of the indexes and income

2 DISTRIBUTION OF SMART NETWORKING INDEX SCORES



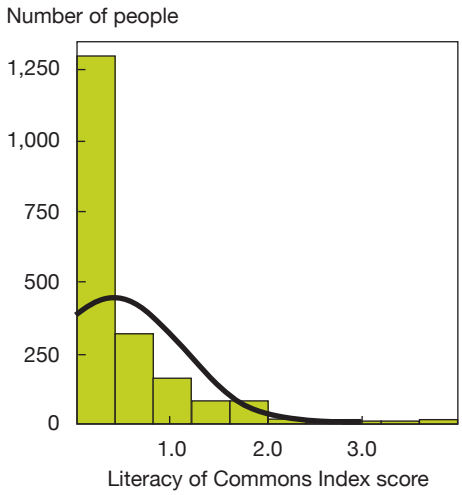
Source: 2006 Ten-Year Forecast Signals Survey

3 DISTRIBUTION OF COLLECTIVE BEHAVIOR INDEX SCORES



Source: 2006 Ten-Year Forecast Signals Survey

4 DISTRIBUTION OF LITERACY OF THE COMMONS INDEX SCORES



Source: 2006 Ten-Year Forecast Signals Survey

of mass culture. So there's a lot of sorting out that has to take place as companies re-imagine their relationship to consumers, as legal scholars rethink what it means to extend the full protection of the First Amendment to include the rights of amateurs who, for the first time, have access to printing presses and can communicate on a large scale.

Howard: And I think implicit in what Henry's saying is a big change in entertainment, both as culture and as industry; the do-it-yourself media that is generating this conflict and need for change in the legal structure is also restructuring the way people spend their entertainment time and the kind of entertainment you're seeing.

Q: HOW DOES THE PARTICIPATORY CULTURE, THEN, REALLY CHANGE THE NATURE OF CIVIC LITERACY AND CIVIC CULTURE? WHAT IS THE ESSENCE OF THE PARADIGM SHIFT?

Howard: What we have is a very strong, positive feedback loop. Yochai Benkler put it well, saying that citizens who are only the passive target of media that are conceived by others and broadcast to them, think of themselves and their role in society very differently from citizens who, because of access to these same media, think of themselves as potentially people who can broadcast themselves, who can participate, and who can advocate. I think just that notion of growing up knowing that you are a participant, rather than just a consumer creates a way of seeing the world that is very different. And I think that when you have that way of seeing the world, as Henry mentioned, whenever a new technology or a new medium or a new social phenomenon becomes available, it spreads very quickly and people are very quick to adopt and to play with it.

Henry: The key thing to keep in mind is that young people have always been early adopters and adapters of technologies. Young people were using toy printing presses to create a zine-like culture in the mid-19th century that involved national amateur press associations. Young people were early in on radio. What's different today is that participatory culture is more visible because the Web has given a way for all these different grassroots communities to come together, to gain visibility to each other, and that creates a fundamental change in the quality and quantity of participation.

Jamais Cascio is a co-founder of WorldChanging, an IFTF Research Affiliate, and guest editor of this year's collection of *Ten-Year Forecast: Perspectives*.

WHAT TO DO

WORKERS:

TAP PEER-TO-PEER DESIGN FOR REORGANIZATION

Organizations that ask digital natives to shed their unique media practices as they enter the workplace—in order to fit into standard organizational procedures or cultures—miss the opportunity to innovate work processes and gain a competitive edge in the emerging open media world. One strategy is to give digital natives the assignment to reinvent existing processes, in small experimental settings, to take advantage of skills that will ultimately prove valuable as new media diffuse more deeply into a variety of institutions. Pushing IT innovation to the edge of the organization in this way not only allows surprisingly inventive solutions; it also gives young workers the kind of experience and practice they need to develop into future leaders.

COMMUNITIES:

BUILD A BOTTOM-UP CIVIC ACCOUNTING PLATFORM FOR YOUTH

As in the case of young workers, young citizens have the potential to reinvent the civic sphere, addressing pressing issues of environmental stress and building a new transparency in civic culture. For example, as new tools for measuring and monitoring the environment emerge, young people can be expected to merge them with new media tools to create new ways of representing environmental measures—and civic accounting of natural, social, and intellectual capital more broadly. Just as organizations can experiment with youth "skunk works" to reinvent their work processes, communities might also create platforms for youth to experiment with new media and monitoring tools to reinvent local processes.

MARKETING:

LOOK BEYOND CO-OPTING AS A STRATEGY

As marketing organizations try to reach the new digital natives through their own media, many will try to co-opt the peer production culture, either by trying to adapt their media to traditional mass marketing approaches or, worse, by using stealth campaigns. While such strategies may be produce some visibility, the backlash almost always makes them unsuccessful overall. Media-savvy digital natives are able to deconstruct propaganda from most sources, and the costs to brand and reputation could be high. In addition, in a mash-up culture, marketing messages are easily distorted. A better practice is to try to understand the real drivers of digital natives, both online and off, and develop authentic channels that speak to those needs. In the longer time, expect the new media literacy to demand higher standards of truth in all kinds of messaging.

MANUFACTURING:

DO IT YOURSELF?

Rapid fabrication technologies allow 3D objects to be created from a computerized design nearly as easily as a DVD burner makes playable disks. Until recently, these objects were limited to a single constituent material, often a fragile wax or imprecise resin. But today, 3D printers can use manufacturing-grade materials to make a limited variety of industrial and commercial objects. On the near horizon are fabricators that will be able to produce electronic gadgetry, toys, and even industrial-grade equipment. And further out is the potential development of molecular manufacturing. As these devices improve, they'll trigger a manufacturing transformation in traditional factories; quite possibly, they'll also end up in homes and offices, reshaping our concept of the consumer economy.

BEYOND DESIGN EXPERIMENTS: FROM PROTOTYPING TO MANUFACTURING

Present-day rapid prototyping allows engineers to make precise working models of objects from CAD files. Two methods for rapid prototyping have become especially important in the last decade. Both are additive processes, which build up objects one layer at a time; neither requires any tooling, which virtually eliminates the set-up times and costs of conventional manufacturing processes. In inkjet manufacturing, an inkjet printer sprays fine beads of plastic or resin instead of ink, eventually building a free-standing structure. In laser sintering, a laser draws the shape of an object in a layer of powder. The laser fuses the powder into a solid; the object is then covered with more layers of powder.

Such rapid prototyping has already had a significant impact on product design. Designers work faster. Users test and comment on early prototypes. And engineers catch problems before they reach production. However, rapid prototyping is now starting to morph into rapid, high-end manufacturing. Hearing-aid manufacturers Siemens and Phonak are laser sintering silicone earbuds. Aerospace companies use rapid prototyping to make small runs of highly complex aircraft parts. And early versions of machines that can fabricate electronics and displays alongside mechanical structures will be more widely available by the end of the decade.

MICRONICHE PRODUCTION: MANUFACTURING FOR THE LONG TAIL

In the near term, rapid manufacturing technologies will continue to allow lower costs for experimentation and small-scale production. But just as the general-purpose computer allowed for innovations in software and information system design, these general-purpose manufacturing devices have the potential to unleash a tremendous wave of design innovation. Moreover, just as the Internet has enabled small producers and even smaller, distributed markets to interact and thrive—what *Wired's* Chris Anderson has termed the "long tail"—fabbing will trigger the rise of microniche production, aimed at diverse, idiosyncratic communities previously ignored by mass producers, but connected over the Internet.

Microniche production is more than simply mass customization; it's a world where unique designs can find a small market foothold because the costs of both small-run manufacturing and targeted marketing have dropped dramatically. In addition, as 3D fabrication systems become more widespread, there's the potential for niche manufacturing to become peer-to-peer design, making it possible to share objects online as easily as music or videos are now shared. In such a world, the rapid rise of "open-source" product design is inevitable.

SMALL WORK: FABBING A NEW INDUSTRIAL REVOLUTION

The technologies could, in fact, bring about an Industrial Revolution in reverse. In this scenario, rapid fabrication (or molecular manufacturing) will turn every home into a personal, flexible factory. Companies and users will sell or share designs that can be manufactured at the point of use: instead of container ships carrying processed goods, the Internet will circulate blueprints and CAD files. With increasingly "smart" materials, we will begin to interact with the world of atoms as if it were the world of bits. Under the unbearable lightness of a billion "spimes" enabling infinite customization and just-in-time local manufacturing, the global economy will deconstruct itself.

This vision is elegant, compelling, and most likely wrong. Design and manufacturing are complex enterprises, and the same technologies that might enable home manufacturing could make factories more nimble and market-savvy. But the two visions—highly flexible factory systems versus home production systems—define a continuum along which we will almost certainly find ourselves disrupting the current producer–consumer models in many different ways.

—Jamais Cascio & Alex Soojung-Kim Pang

SOPHISTICATED 3D PRINTERS WILL NO LONGER BE USED JUST TO MAKE DESIGNER PROTOTYPES—BUT WILL THEY END UP ON THE SHOP FLOOR OR ON YOUR DESK?

INSTITUTE FOR THE FUTURE

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BRUCE STERLING
is a science and science-fiction writer, best known for his novels and his seminal work on the *Mirrorshades* anthology, which defined the cyberpunk genre.

Visions of the future often come from science fiction, and those visions might be all the more compelling if the sci-fi writer also happens to be a science and technology writer like Bruce Sterling. To explore—and perhaps also explode—some of the sci-fi visions of desktop fabbing, Jamais Cascio invited Bruce and IFTF's own science writer and DIY expert David Pescovitz to think together about the potential of 3D printing over the next decade or so.

Q: IS DESKTOP FABBING A PRACTICAL REALITY? WILL IT TURN OUT THAT EVERYONE IS A FACTORY?

David: At the far end of the decade, you see several trends in engineering intersecting and converging to potentially give us a rough version of the *Star Trek* replicator. What we're talking about are 3D printers that spit out goop, layer by layer, until they make a physical object. We're talking about printable electronics. We're also talking about electro-active polymers—materials to which you apply voltage. They flex. You press on them, and a little bit of voltage change occurs.

Those can be used for actuators or sensors—for buttons or the basis of a motor. You load up the 3D printer on your desktop with plans for a new coffeemaker or a new remote control to replace the one that's lost. It will basically squirt out some working approximation of the device. We have a ways to go, but the idea of enabling everyone to be a factory has a lot of pretty profound implications.

Bruce: I've also found that extremely appealing because I also have an "MIT-Media Lab-MAKE Magazine-GNU/Linux-distributed-everything" take on matters. But even though I find that extremely appealing, both politically and literarily, I'm not sure that's actually the way it's going to blow. I would love to have a little desktop fab myself. I'm not sure it would last any longer than my Treo lasted. It reminds me very much of the sort of classic American technological sublime in the early 1980s when writers like myself first got word processors. We immediately concluded that we were going to disintermediate and distribute the publishing industry.

What really happened with electronic text had very little to do with publishing, per se. Most of the text that is on the net is *net*-texted. It would have been hard to say at the time, say if you were doing Boing Boing Magazine and you suddenly got a laser printer, that the upshot of this would be boingboing.net.

David: What I think is interesting is that industrial design—the actual form of working objects—is historically difficult for the nonprofessional or the amateur to be involved with. It is difficult actually making the physical thing, an object with electronics, which competes aesthetically with what can be mass produced. It harkens back to days of fine woodworking and machining and things like that. Maybe these technologies would democratize industrial design somewhat. I'd like to see more beautiful objects more often.

It reminds me also of when Photoshop first came out. Most of the people who had access to it were techies and not artists. It had this cheesy *Dungeons & Dragons* feel to it. It wasn't until the technology was actually really cheap enough for "real artists" to start using it that you saw some real Photoshop beauty coming out.

Bruce: I don't think it will democratize design exactly, but I think it will digg.com and reddit.com it. In other words, in these peer-to-peer methods of distribution of plans, you don't actually get everybody going out, running the recipe, and making one of their own. You get power-law distributions with someone who was formerly an amateur. They discover how to put the Mentos into the Coke bottle and have a massive viral hit.

Q: WHAT'S REALLY THE UNEXPECTED, THE UNANTICIPATED FUTURE OF 3D PRINTING? WHAT ARE PEOPLE DOING THAT MIGHT BE THE SOURCE OF SOME VERY BIG INNOVATION?

Bruce: I was just at an electronic-printing conference, being done by printers, who are aware of the fabricator thing. A guy was talking about organic semiconductors and how they are printed out on these gigantic plotting machines. They are two meters across. They're like giant newsprint rolls.

I said, "It's a circuit, right?" He said, "Yeah." I said, "Is it spaced as neatly as a core duo circuit?" He said, "No, we can't do ten nanometers, but we can do 100 nanometers." So, it's ten times as big a circuit and is two meters across. How long can it be? He said, "As long as you want." So I said, "You're telling me you just invented a macro chip? You're going to print out a single integrated chip, which is ten times looser than a top-end silica microchip, but not that loose. You can make it basically infinitely long and 2 meters across?" He said, "Yes." I said, "What kind of industrial application would there be for a chip like that?" He had no idea. The thought had never even crossed his mind. He didn't know anything about the limits of chips, the size

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I ACTUALLY THINK THERE IS A COMPUTATIONAL BEHAVIOR IN AN ELECTRONIC OBJECT THAT SIZE THAT WE DON'T REALLY KNOW ANYTHING ABOUT. I THINK IT IS AN ENTIRELY NEW KIND OF ELECTRONIC BEAST.

of chips, or propagation of electrical signals through a chip that size. I don't think anybody knows. I haven't found anyone that would say how a chip would behave if it were 100 meters long.

David: It's a roll-to-roll printing process. You can imagine printing out massive displays that way or wallpaper that is also your computer. I think about what Vivek Subramanian, who is a pioneer in printable electronics at U.C. Berkeley, says when people ask, "Well, is it as fast as a regular transistor now?" Subramanian isn't necessarily aiming for that. The aim is to just make it good enough. Good enough for whatever application. Good enough for a cheap display screen that rolls up. Good enough for an electronic bar code printed on your can of Coke.

Bruce: I actually think there is computational behavior in an electronic object that size that we don't really know anything about. I think it is an entirely new kind of electronic beast. We don't even know what to call a macro chip or have any understanding of what a macro chip would be. They do seem to be pretty easy to print out. They were talking routinely about printing electronics, just fabbing electronics, on top of cardboard: things like fabbed electronics on baseball cards so that the card has a live display. It would be some kind of Phillip K. Dick nightmare. It would be like a cereal box which was full of dancing, leaping, antic figures. They're looking at it from the point of view of printing packages because that's what they are by trade.

Q: WHAT ARE THE IMPLICATIONS OF DESKTOP PRINTING FOR THE ENVIRONMENT, FOR GREENING OUR MANUFACTURING PROCESSES? ARE WE LOOKING AT A GREEN-GOO SCENARIO?

Bruce: I'm wondering about that. What's the substance that is being fabbed? To date, it's been polymers and some pretty sophisticated material that usually has a high cost per cubic centimeter. They literally sell it to you like printer's ink. It's pricier than champagne.

The ideal thing would be some kind of semi-unstable miracle goop that could sit in an oil drum for 50 years without ever curing. You could pour it in there and fire a laser or electron beam so it would stiffen up. You could obtain any quality you want: elastic, modules, transparency, all this cool industrial-designer stuff. At the end of the day, you could throw it back into the hopper and unkink its Van der Waals forces, and it would turn right back into the original goo—straight out of the William McDonough's *Cradle to Cradle* handbook. That stuff does not exist.

On the other hand, we haven't ever had a reason to look hard for something with those properties. I just wrote a science fiction story that is coming out in a couple of months. It has a device that does exactly this. It uses carbon nanotubes, which are the magic sci-fi gizmo of choice for 2006. This guy gets this tub of carbon nanotubes, and it's just yellow dust. You pour it through some kind of spark gap device, and it turns into a super-hard black ceramic. If you put the ceramic back in and zap it again, it magically unkinks the nanotubes, and they turn back into nanodust, and everything is hunky-dory.

Is that realistic? I don't know. Would it surprise me if it happened? Not particularly. Materials processing is unbelievably advanced these days. It is incredible what they can do with plastics and the rest of it. It strikes me as being one of the few things we can do from a green perspective that actually does disintermediate practically everything we have done in the last 200 years. I think it could get some traction. So much of the industrial base is being shipped off to China, not just from the United States but from all over the place. There actually is a vacuum that fabs could fill.

David: Maybe what we need along with the desktop fabricator is the desktop biodegrader where you put in some programmed organisms coming out of synthetic biology that can degrade the 50 blenders that you've made that aren't quite right until you get the one that actually works.

JAMAIS CASCIO
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THE IFTF DO-IT-YOURSELF INDEX: A SELF-ORGANIZING ALTERNATIVE ECONOMY

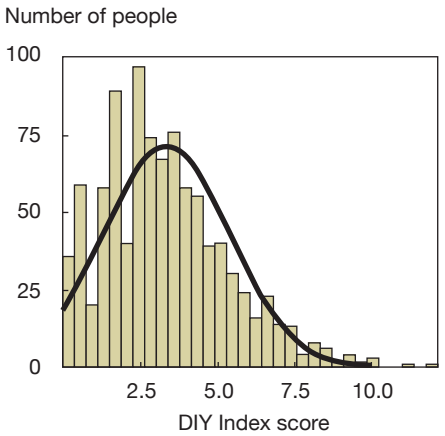
The growth of a do-it-yourself (DIY) movement in the past decade has led to a boom in the home improvement industry, in home-made media, and in customizable products. It has even supported new publications like *MAKE:* magazine, which caters to the DIY crowd.

The 2006 Ten-Year Forecast Signals Survey suggests that a self-motivating, self-educating, and self-organizing sector of society is emerging that may define an alternative economy. This sector tends to seek out customized or alternative goods, services, and entertainment—preferring to have a more active hand in shaping their own goods, environments, and experiences in conjunction with relatively small groups of like-minded people.

While these do-it-yourselfers could be seen as having other-than-corporate values, they are willing to use corporate institutions to create their own innovative and alternative social structures and activities. They also tend to exploit the new online world and its tools for social connectivity, taking some of their self-organizing habits from the physical world and translating them into the virtual world—and vice versa.

Those with the self-organizing DIY profile are still a minority in the population. However, as manufacturing technologies and online sharing of technique grow, they may turn out to be lead users in the way Eric von Hippel defines them: those who are early adopters of products and practices that will eventually be taken up by the larger population.

DISTRIBUTION OF DO-IT-YOURSELF INDEX SCORES



Source: 2006 Ten-Year Forecast Signals Survey

WHAT DEFINES A SELF-ORGANIZING DO-IT-YOURSELFER?

Self-Organized Lifestyle

- Transactions in alternative market spaces

  For example: eBay, garage sales, farmer's markets, and craft fairs

- Home work

  For example: kitchen, gardening, major or minor home renovations, and home-organization projects

- Self-expression

  For example: drawing, painting, photography, music, dance, amateur theater, reading and writing poetry and stories, collecting valuable items, playing sports in organized or informal groups, volunteering locally, playing online games

- Skill-based sharing

  For example: exchanging job contacts with fellow hobbyists, exchanging resources with fellow hobbyists

Online Sociability

- Self as online source

  For example: maintaining personal, household, or family Web site, creating media, blogging

- Self as online contributor

  For example: regularly contributing comments or pictures to a blog, posting family or personal pictures online for others to see, using tagging services like del.icio.us, contributing to a public wiki such as Wikipedia

WHO ARE DO-IT-YOURSELFERS?

- Those who score high on the IFTF DIY Index are likely to be young and married: nearly one-third of married people scored high.
- Self-employed people are more likely to score high: 41% scored high compared to 23% of others.
- DIY high-scorers are actively engaged in their health, showing positive correlations with seeking health information, engaging with health-based communities, and looking for health benefits in products and services.
- High scores also are more likely to go to people who use digital tools for collaboration in teams, who seek learning activities, and who make religious and political contributions.
- Do-it-yourselfers are more likely to score high on IFTF's Sustainability Index (see "Community: Citizens of Sustainability").
- There are no correlations between high scores on the DIY Index and gender, race, religion, native U.S. citizenship, or political views. There is a weak positive correlation with income.

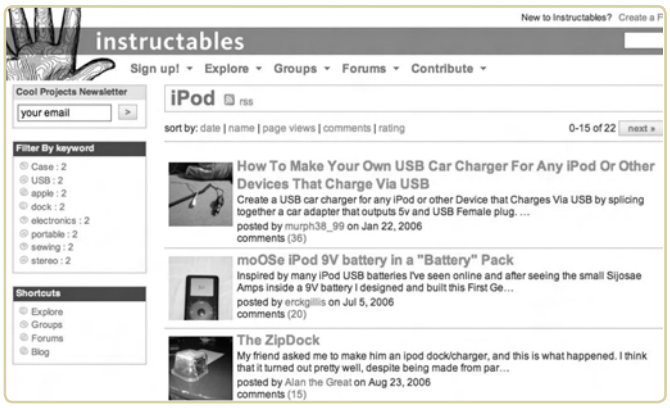
FABBING ON THE DESKTOP

The big question surrounding the rise of rapid fabrication systems is whether or not they move to the desktop. Some experts argue that 3D printers are more like book-binding systems than laser printers—specialized tools that might be found at a neighborhood service center but are of little use in the home. Others see fabbers as being more akin to CD burners: when combined with design software and easy, inexpensive distribution, they blur the distinction between hobbyist and professional.

One highly-visible driver of a desktop fabrication future will be the DIY culture represented by IFTF's self-organizing do-it-yourselfers. Today, this growing movement of hackers and hobbyists trade schematics and plans for a staggering array of devices, mixing an open-source aesthetic with a design school sense of cool. They will be among the first to acquire fabbing systems and figure out how to use them in ways that the producers never imagined. This sub-culture personifies William Gibson's observation that "the street finds its own uses for things."

2 IPOD INNOVATIONS AT INSTRUCTABLES.COM

The Web site instructables.com bills itself as "step-by-step collaboration" for sharing what you make and how others can make it.



Source: http://www.instructables.com/tag/keyword:iPod/

3 MAKE: MAGAZINE

As the "first magazine devoted entirely to DIY technology projects," *MAKE:* "unites, inspires, and informs a growing community of resourceful people who undertake amazing projects in their backyards, basements, and garages."

Source: *MAKE:*

4 A DORKBOT CHAPTER WEB SITE

Organized by the Web site dorkbot.org, groups of art and design communities meet worldwide to support bottom–up design.

Source: http://dorkbot.org/

REINVENTING THE FACTORY

Regardless of the trajectory for desktop fabrication, the factory model of production will still be commonplace. Even if some consumer goods can be manufactured at home, there will still be a need for commercial and industrial products: the days of printing a suspension bridge or jet engine are still far off. Yet rapid prototyping technologies will have an important role here, for one very big reason: they require virtually no set-up time compared to more conventional manufacturing methods, so these new flexible factories can potentially shift product lines in just a few hours.

This will make for a very new kind of factory space: open and reconfigurable. Just as the office of yesteryear, with its vast rows of desks or cubicle farms, was a giant information-processing machine organized to produce standardized information products and services, so too is the traditional factory designed to maximize the efficiency of well-established, stable processes. But companies that need innovation and creativity have driven the movement to create offices that are more flexible, open, and customizable, and spaces that gently encourage serendipity, support collaboration, and facilitate discovery. This change is about to hit the factory floor.

Rapid fabrication systems could turn the factory floor into a center for a new kind of knowledge work, and make manufacturing more flexible, responsive, and information-intensive. These flexible factories won't be organized around production, but around demand. The ease and speed with which they respond to inputs, reconfigure to demand, even move to where they're needed will reshape our concept of the factory.

The flexible factory will consume physical resources more efficiently than ever before, but its most important raw material will be up-to-date information: from designers (about how users are reacting to both the company's latest products and still-under-NDA prototypes); from market-watching software agents, blogs, and discussion boards; and, perhaps most importantly, from prototypes, active and recycled units themselves, uploading data about their histories, uses, and problems to the factory. The combined effects of cascades of information and pressure for constant innovation will turn the factory floor into a space in which production and innovation blend together, and designers, industrial engineers, and machinists work together to update products. By incorporating these insights into a readily-reconfigured production process, the flexible factory itself may become a constantly iterated, evolving design.

The flexible factory will demand a smarter approach to people. Traditional assembly lines needed workers who were as reliable as machines, while managers wanted workers who were interchangeable, and labor unions advocated and enforced strict rules governing what employees could and couldn't do. The shift from mass production or rapid manufacturing will create a demand for workers who are entrepreneurial, highly skilled, and able to collaborate with others—and a shop floor flexible enough to let that happen. Fortunately, through games, a generation of kids are acquiring design and manufacturing skills that can move straight from the living room to the factory floor. Countries with the most advanced game cultures today may have an advantage in the world of rapid manufacturing tomorrow.

5 FACTORY SPACE WILL BE OPEN AND RECONFIGURABLE

Source: http://flickr.com/photos/confusedvision/96390866/

	Desktop Manufacturing	Flexible Factories
Raw materials	• The equivalent of printer cartridges for semiconductors, plastics, insulators, dyes, etc. • Must be low or no toxicity • Recyclable and reusable	• Proprietary high-performance materials • Efficiency-driven choices and uses
Information	• Open-source designs • Peer-to-peer instruction sets • Materials safety and handling	• Design feeds • Early user feedback • Data from market-watching software agents, blogs, and discussion boards • Data from instrumented prototypes, active, and recycled units
Innovation	• A focus on simple devices that users can customize: toys, office equipment, family heirlooms, prosthetics • Device-centered innovation, e.g., iPod extensions	• Continuous updating and reinvention of products • Continuous reinvention or reconfiguration of production processes • Blurring of innovation, design, and production on factory floor
Costs	• Opportunity costs of cheaper factory-produced goods • Relatively high price of complex 3D printers	• Collaboration and coordination costs • New kinds of factory spaces
Labor	• Self-employed • Semi-retired boomers • Youth • Hobbyists • Stay-at-home moms • Gamers	• Entrepreneurial • Highly skilled • Collaborative • Gamers • “Emergent” managers

Source: Institute for the Future

WHAT TO DO

PRODUCT DESIGN:

TAP THE "HOME HACKING" MARKET FOR EARLY INNOVATION

Design and manufacturing are complex tasks, and many people may never have the skills or interest to turn their homes into factories. However, our DIY research suggests that there's a strong community of people with latent design skills, a DIY or hacker mentality, and a passion for particular kinds of products—and these are likely to be the first people to embrace home manufacturing. While they may think of themselves as hackers in an alternative economy, they could actually be enlisted as open-source designers and fabbers, creating a pool of product innovations for more wide-scale manufacturing and distribution by those with large-scale systems in place, following the model of open-source pharma perhaps. A key here will be setting up the incentives and licensing so that everyone wins.

HEALTH AND SAFETY:

CONSIDER NEW CHAINS OF LIABILITY

The expanding pool of potential manufacturers will bring new risks. For products where outsourcing design and production makes sense—whether it's to local micro-manufacturers or consumers—safety and quality control will raise new issues. Corporations with brands to protect should pick products and partners carefully. Now is also the time to begin thinking about chains of liability. While outsourcing production is not a new idea, outsourcing down to the level of consumers is. What happens when a consumer makes a defective product from your design or material? What happens if they "melt down" your product and make a new defective product from the resulting material? Thinking through the issues now will set the stage for taking advantage of new fabrication opportunities a decade from now.

SUPPLY CHAIN:

BRING YOUR SUPPLY CHAIN IN-HOUSE?

Rapid fabrication techniques will make the biggest impact inside businesses in the next ten years. While these new manufacturing techniques will transform in-house design—with prototyping becoming cheaper, faster, and better—some of the most surprising impacts could be in the way companies supply their own parts and materials. While some will take advantage of a growth of micro-manufacturers—at both ends of the fabrication process—one of the opportunities will be to rethink what is outsourced and what is produced in house. As design drives manufacturing from more generic materials and machines, the existing division of labor in many plants may shift, and supply chains could be scrambled.

WHAT TO PONDER

FABBING SMART STUFF

It could happen. Not only will people make lots of things that suit their particular needs. They may make those things smart enough to sense, remember, and communicate with other things—and with people who know how to communicate with things.

For YouTube videos of a "blogject" workshop, go to: www.youtube.com/?v=D8jDXhmy288

Soon flexible and printable electronics and displays will let us embed electronics in fabric, building supplies, packaging, and even paint. As more physical goods contain cheap processors and network connections, however, we see a new kind of world emerge, one that isn't necessarily comforting. Adam Greenfield describes in *Everyware* a world in which user behavior is monitored by objects and the environment. UCLA's Julian Bleecker describes objects that connect to the Internet to tell their own stories about their use, history, and conditions, calling them "blogjects." As cheap rapid fabrication tools become more widely available, smart goods (or even smart add-ons for previously "dumb" objects, something that designer Eric Townsend calls "proto-spimes") will proliferate faster than many of us might expect or be prepared for. "Guaranteed dumb" versions of fabricated objects may end up being a popular category.

FINANCE:

INTANGIBLE REFORMS

During the next decade and beyond, natural and social crises will create volatility in the financial economy. Because awareness of some issues will be sudden, even rational investments may feel like bubbles. As the financial community struggles to deal with these uncertainties, systems for measuring the generation, accumulation, and preservation of many different kinds of capital will begin to gain widespread support. The result? The next ten years will be a transformative period characterized by rapid learning, volatility, and proliferation of financial methods and tools for measuring capital—as well as a profound evolution of financial and other institutions engaged in the generation and protection of assets.

ECOLOGIES OF CAPITAL: THE INTERPLAY OF VALUE

A confluence of forces has led to a revaluation of how financial capital is related to social, intellectual, and natural capitals—and the roles that these might play in risk mitigation. Economists have begun incorporating actual human irrationalities into economic thought rather than relying on an idealized "rational" human. Many influential investors, seeking improved ways of detecting undervalued companies, have identified intangible assets as the ultimate creators of future value.

Meanwhile, new tools have also emerged for quantifying these alternate capitals, as accounting expands its purview. Firms, particularly international firms that must meet the needs of the most forward-thinking markets, have begun incorporating corporate social responsibility (CSR) metrics into their public communications. At the same time, the labor force is relating to firms in ways that transcend the financial. For several decades now, young workers have been drawn to jobs with socially entrepreneurial missions and credos.

Finally, environmental upheavals—or projections of upheavals—may become sufficiently dire that the only possible route for avoiding widespread chaos is an all-hands-on-deck engagement in finding solutions. The more dramatic the natural and social catastrophes, the more social and political will is likely to be generated to prevent future occurrences. Harnessing that drive will reform the institutional landscape to better manage alternative capitals—preserving natural capital via learning (intellectual capital) and organization (social capital).

RISK AND UNCERTAINTY: THE TRANSPARENCY OF CAPITAL FLOWS

Whereas risk can be more effectively managed in controlled or "closed" communication, uncertainty is better managed by fluid or "open" information management. During the transition to new capital-based institutions, financial volatility will increase and new ideas about risk mitigation will proliferate. Just as the Internet followed a path from obscurity to hype to bubble and crash and then toward integration and true institutional innovation, so will the new risk-management products and services. The confusion will look familiar: Where are the standards? Who are the real thought leaders? And how can their insights be tactically implemented for return on investment?

However, managing the risk is only half the battle. Mitigating uncertainty is an exercise in lessening the likelihood of being caught off-guard. The path through this transition will be an increasing transparency of capital flows, whether traditional financial capitals or alternative capitals—or a blend of both. Communities will become more scrutable, reporting multiple dimensions of value creation to provide financial support for local needs and to increase the cohesiveness, flexibility, and resilience of the community as a whole. Aggregation of community-based data, in turn, will enable a more explicit view of the externalized effects of corporations and other players, whether public or private.

New measurement tools and new ways of signaling value will emerge. A guiding metaphor here is the musical concept of "voicing"—the way that the same chord progression can be organized in different ways, yielding different experiences for the listener. If multiple capitals represent the notes in a chord, asset management will require facility in combining and recombining those capitals into different configurations.

Ultimately, at the level of the individual, this increasing transparency of value creation and risk will shift awareness from narrow concepts of financial planning to a more complete picture of one's "personal capital ecology." As people engage with such diverse instruments as personal carbon credits and social-reputation accounts, personal investing will take on entirely new meanings and new forms—and in turn, spawn new institutions to support it.

—Jessica Margolin

COMPLEX ECOLOGIES OF RISK WILL DRIVE EXPERIMENTATION WITH NEW WAYS TO VALUE INTANGIBLE ASSETS AND ALTERNATIVE CAPITALS

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SR-1064

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Jed Emerson is the author of the "Blended Value Proposition," which states that all organizations, whether for-profit or not, create value that consists of economic, social, and environmental value components—and that investors (whether market-rate, charitable, or some mix of the two) simultaneously generate all three forms of value through providing capital to organizations. Jessica Margolin asked him about the evolution of this concept and how it is playing out in investment and philanthropic circles today.

Q: HOW DID THE IDEA OF BLENDED VALUE FIRST OCCUR TO YOU?

I started in 1989 at the Roberts Fund in San Francisco, looking at how to take philanthropic capital and structure it so it can be used for nonprofits that are running market-based businesses employing formerly homeless people. So right from the beginning we were grappling, not with the tension of the double bottom line, but the reality of what I've come to think of as blended value.

We took very seriously the concept of social returns; we wanted to create a formal methodology to track "social return on investment." I'd heard a lot of people use that phrase, but most folks, I think, use it in the sense that they assume some broad social good is coming from their activities. I found that a lot of social investing—certainly the social investing that was leading the pack ten or twenty years ago—was more a question of understanding what you were *not* doing as opposed to the positive value that you were creating. That leads to the "screened funds" concept, where you don't invest in tobacco or firearms or alcohol; but there's very little that speaks to the idea of positive valuation and how the overall value proposition is enhanced by virtue of considering social and environmental factors. It's not that the previous practices are necessarily wrong, but there's an expanded way to think about this work.

Q: WHAT YOU'RE TALKING ABOUT BRIDGES ACROSS THE BUSINESS AND PHILANTHROPIC SECTORS. DID YOU FIND THERE WAS A FUNDAMENTAL DISCONNECT BETWEEN THESE GROUPS?

Yes. For example, in foundations, a lot of organizations really have no formal capital-allocation strategy. The reason that one nonprofit gets more than another has more to do with politics and perception and persuasion than it does with the actual value they're creating in a community or in a given neighborhood.

In my own case, I started in nonprofit work when I was a kid as a peer tutor in Spanish Harlem. I was 13. By the time I hit 30, I had run an entire career track in nonprofit management and social work. On the nonprofit side, if we got good media exposure with the mayor, people would send us money because they assumed that we were doing good work. But the capital was not connected to the value creation that we were engaged with in the street.

For a lot of business people, there's a certain level of social drive. But at the end of the day, a lot of these folks are looking for a more effective way to manage their philanthropy and their work with the nonprofit community. They're not saying necessarily that it's broken, but they're saying, "Gosh, couldn't we do this more effectively and with greater impact?"

We need to think of philanthropy as a form of capital investing. We need to challenge foundations to manage not just the 5% payout that is their grantmaking budget, but the 95% that is their financial investing that actually is often invested in the very companies that are contributing to the problems that their institution and their grantmaking are trying to address.

Q: YOU'VE SPOKEN ABOUT BLENDED VALUE FROM THE PERSPECTIVE OF SOCIAL ENTREPRENEURSHIPS—THAT IS, SOCIALLY MOTIVATED FOR-PROFIT ENTERPRISES. HOW DOES BLENDED VALUE INFORM ETHICAL OR SOCIALLY RESPONSIBLE INVESTMENT IN THESE KINDS OF ENTERPRISES?

I think of ethical and social investing as a subset of a larger conversation about how to maximize value and how we understand the potential to maximize the value of the assets that we have under our management. So I'm talking about not simply about doing screening funds—although that could be one part of the answer—but also doing a whole host of concessionary-rate investing. In essence, we're saying we will take some discount to market-rate risk-adjusted return in exchange for an added increase in the social and environmental value we think can be generated from our assets.

For example, the microfinance industry started with philanthropic capital and as it became more of a proven business model, you now see a whole range of securitizations being offered where you can buy bonds that in essence are helping refinance microfinance institutions across the world.

JESSICA MARGOLIN

is a social entrepreneur and consultant, as well as an IFTF Research Affiliate investigating issues relating to uncertainty, risk, valuation, and wealth.

IF ALL YOU DO IS MARKET-RATE INVESTING, YOU'RE NOT GOING TO SEE HOW SOCIAL AND ENVIRONMENTAL ASPECTS OF YOUR PORTFOLIO AFFECT YOUR FINANCIAL RETURNS OVER TIME ... THE INTERESTING EVOLUTION OF THIS CONVERSATION IS WHAT YOU MIGHT CALL "SUSTAINABLE FINANCE."

It's a question of pulling a variety of tools from a toolkit, and social and ethical investing is one of those tools. But all of these tools should be used to answer: how do we maximize the total impact and value of the assets under management?

The converse of that is, if all you do is market-rate investing, you're not going to see how social and environmental aspects of your portfolio will affect your financial returns over time. So I do think the interesting evolution of this conversation is what you might call "sustainable finance."

Q: DO YOU SEE SPECIFIC AREAS OF INNOVATION IN TERMS OF THE CREATION OF NEW FINANCIAL INSTRUMENTS?

Well, one of the papers that I wrote with Josh Spitzer was called "Blended Value Investing." It was published by the World Economic Forum this last year. We looked at ten different examples of how people are taking foundation assets and using them to leverage economic and social value. It's just fascinating to watch the creativity that some of the Wall Street bond folks have when it comes to figuring out how you "wrap assets" in order to decrease risk and then take those assets out and sell them to third-party investors who don't care about the social or environmental aspect but view it as simply another way to diversify their portfolios.

Q: HOW DO YOU SEE GOVERNMENTS AND INDEX MAKERS OR STANDARDS PANELS EVOLVING—WHETHER SHARI'A PANELS, INDEXES, STANDARDS COMMITTEES, OR COMMUNITY STANDARDS?

Again, it's an interesting enterprise; in order for markets to work most effectively, you have to have a level of trust and confidence in those markets. You have to be able to have confidence that the numbers that you're looking at are the numbers that the next person is looking at—that you can trust the valuations that are placed on these. So in the absence of these outside entities, whether they're governmental or NGO or third parties that are set up by industry groups to create more effective market functioning, you need to have these other actors out there because they provide that third eye, if you will, that's observing and commenting and calling attention to inefficiencies in markets that are functioning on bases that are not going to be sustainable in the long term.

Q: DO YOU HAVE A SENSE OF HOW THIS IS GOING IN THE UNITED STATES VIS-À-VIS OTHER PARTS OF THE WORLD AND WHETHER THERE ARE REGULATORY EVENTS THAT WOULD BE INTERESTING TO WATCH GOING FORWARD?

Well, I think that people and forces are working despite the lack of national leadership in the United States on some of these issues. We see a lot of activity at the state or regional level—whether it's California or a coalition of Eastern pension funds. But you see a whole set of actors who are basically saying, "You know, even if the mainstream doesn't get this, we understand that these issues will affect the long-term performance of the funds that we have responsibility for and we're going to manage those dollars on that basis." So it's almost despite itself that the United States is beginning to see the evolution of some of these practices in a very significant way.

The other thing that I think is kind of funny is that when I go to Europe and I talk with people about what's happening there, I've actually had some folks say, "Gosh, there's so much initiative and entrepreneurship taking place in the United States on these things," and they almost bemoan the fact that the government has been such a big part of the process there. And when I'm in the States, I hear a lot of people say, "Gosh, the Europeans have it made because they've got a governmental sector that is moving these policies and practices forward."

I think that when you step back from the entire conversation you can't help but be impressed by the degree of innovation and change that's taking place at a speed that we have not seen for a long time. And it really does give me hope and make me proud to be a part of this whole community.

INSTANTIATING CAPITAL: A SPECTRUM OF TANGIBILITY

Four main types of capital—financial, intellectual, natural, and social—each have aspects of tangibility. Over time, as people experiment with methods to measure and monitor these capitals, new forms of tangibility may emerge for each.

FINANCIAL CAPITAL

Financial capital involves money and securities as well as property, plants, and equipment. It encompasses the wealth that is accounted for in the gross domestic product (GDP), namely the sum of goods and services consumed. If it's paid for with money, owned with money, or if it's a risk-management instrument that involves the protection of money, it's financial capital. Some aspects of financial capital can be intangible, but most are sufficiently defined by their relationship to tangible assets to be considered well-defined.

INTELLECTUAL CAPITAL

Intellectual capital has been incorporated in the financial world as intellectual property. However, intellectual capital also includes concepts before they've been written up, contractualized, and submitted for protection; ideation, artistic expression, and other articulated but intangible items are all assets. Intellectual capital has existing mechanisms that give value to the output of these assets. Intellectual capital also has the ability to "price" the assets themselves through the provision of wages, for example, though the market for people is notoriously uneven, volatile, and contentious.

NATURAL CAPITAL

Natural capital is often expressed as a service. For example, trees provide carbon binding as well as air-cleaning services (tangible) and a sense of beauty and peacefulness (intangible); they also provide habitat to other species (both intangible and tangible components). Ameliorating risks to natural capital has encouraged the development of "market-based" or financial exchanges as a means of environmental management, such as carbon- and water-trading markets. However, a considerable amount of detailed information about how natural services are performed will be necessary to accurately value these stocks.

SOCIAL CAPITAL

Though the term "social capital" has existed for decades, Robert Putnam popularized it in the 1990s. Generally definitions of social capital are founded on typical characteristics of social networks, trust, and social norms, but since these aren't readily measurable, they are often proxied by indicators like "number of close friends." In his paper *The Empirics of Social Capital and Economic Development: A Critical Perspective*, Fabio Sabatini points out that social capital is more of a code word than a concept. Information about social capital is not only imperfectly transmitted but actually varies from group to group. Further, it can be perceived as deleterious as well as beneficial: nepotism is an exercise of social capital that is generally disapproved. An enormous amount of social capital is entirely unaccounted for in economics: that which accrues in the household, during school, and in volunteer communications ranging from ad hoc to formal. Social indicators have been introduced by communities to begin to address this gap; however, the effectiveness of "social entrepreneurism" depends in part on gauging outcomes from within this informational void. A prominent subtype of social capital is political capital.

POST-FINANCE: TOWARD AN EXCHANGE SYSTEM OF MULTIPLE CAPITALS

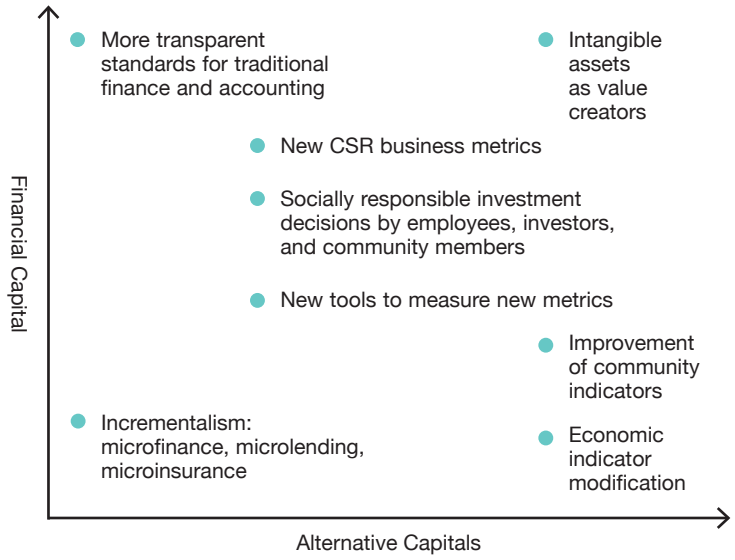
Though accounting, in a highly primitive form, has been around since before the Renaissance, modern cost accounting techniques weren't adopted until 1923 (by General Motors), and regulation didn't ensue until the SEC was formed in 1933 and GAAP was developed in 1936–1938 (and finally codified in 1953). The GDP was developed as a mechanism in the late-1930s to track the goods needed specifically for wartime production but was embraced afterward as a method to show the size of an economy, and thereby its robustness.

Since then, technological advances have increased the ability to analyze tremendous amounts of data, leading to refined and sophisticated mechanisms to support this framework. But beginning in the 1990s, reformers from many disciplines began to experiment with the idea that value doesn't begin in the tangible assets—raw material and physical labor—that are needed for production, but that the tangible assets themselves are the result of some earlier step. Further thought yielded the realization that value is originally created by assets that are intangible; it is created by having smart, knowledgeable people who can work well together in an effective company that has visibly shown itself to its market to be respectable and relevant.

Yet intelligence, knowledge, relationships, processes, reputation, and brand are almost entirely unaccounted for. Why? Because it's not an easy thing to do. In *Intangible Assets*, Baruch Lev points out that these assets are desirable in that they are prone to high returns due to network effects, but they are also only partially excludable: what if you train people and then they go work for your rival? Also since they're not tangible, such assets are illiquid at best and indefinable at worst.

Nevertheless, combining investors' desire for transparency, stakeholders' demands for social and environmental accountability, and a regulatory push on the largest firms to be aggressive rather than "safe" in representing their true value, a host of corporate social responsibility metric systems, indices, and standards committees have emerged over the last few years. Taken together, these efforts suggest the emergence of a system of capitals with increasingly clear relationships—and thus an increasingly sophisticated understanding of the ways that capitals interact.

1 AN EVOLVING SYSTEM OF CAPITALS



Source: Institute for the Future

NEW RISK-MANAGEMENT METHODS: CROSS-FERTILIZATION OF CAPITALS

Financial risks are often managed using financial instruments such as insurance. But financial risks have always also been moderated using alternative assets. Windbreaks minimize farm crop losses. Employing knowledgeable workers minimizes the chance of making bad business decisions or producing bad products. And of course, the practice of leveraging social standing or even fame for monetary gains is well acknowledged (if occasionally distasteful).

If we see different types of assets as worthy of protection, we can see that this type of risk management is already familiar. For the next decade, these mechanisms will be explored—as well as exploited—in much more systematic ways, leading to much more sophisticated strategies for managing risks in one capital domain by harnessing assets in another.

2 MANAGING RISKS IN ONE DOMAIN BY HARNESSING ASSETS IN OTHERS

	FINANCIAL ASSETS	NATURAL ASSETS	INTELLECTUAL ASSETS	SOCIAL ASSETS
FINANCIAL RISKS	**Financial assets mitigate financial risks:** Trading options allows investors to limit their losses if a security loses value.	Services provided by natural assets protect financial investments: Coral reefs protect hotels from storm damage.	Open learning economies leverage knowledge: Research consortia and technology-transfer groups are formed among several large corporations.	Personal reputation serves as a form of credit score: Social reliability lowers risk for microfinancial vehicles; activist investing ties desired social behavior to financial gain.
NATURAL CAPITAL RISKS	Financial value creation for natural capital supports demand and increases liquidity: Eco-economics, such as carbon and water trading, create smoother allocation of scarce resources.	**Natural asset services protect against natural capital risks:** Hillside vegetation limits erosion.	R&D creates alternatives that avoid natural capital degradation: Alternative energy and transportation reduces CO_2 consumption emissions; filters and sensors enable data collection and remediation.	Access to social networks increases resources for natural capital restoration: Clean Mobs provide data for research and facilitate rehabilitation of natural ecosystems.
INTELLECTUAL CAPITAL RISKS	Financial investment in education creates a virtuous cycle: Extracurricular programs reduce drop-out risk; teacher mentoring and continuing education improves student outcomes.	Physical health impacts the ability to concentrate: Nutrient replacement and clean environments support good mental function.	**Intellectual assets mitigate intellectual capital risks:** Documentation of organizational processes protects organizational knowledge when employees leave.	Social networks support the development of relevant educational materials: Online experts and peer-to-peer production expand the learning economy.
SOCIAL CAPITAL RISKS	Investment in cooperative processes and conflict resolution improves civil cohesiveness: Community indicators measure participation and improvements; transparency improves financial support.	Balanced natural ecologies enhance social resilience: Community gardens enhance interpersonal interactions and solidify relationships.	New tools enhance social connection and create new methods for resolving social dilemmas: Cooperation Commons aggregates an understanding of cooperative sciences; WiserEarth creates a platform for collaboration.	**Social capital protects against social risks:** Reputation built when undertaking projects for the public good counterbalances potential future negative publicity.

Source: Institute for the Future

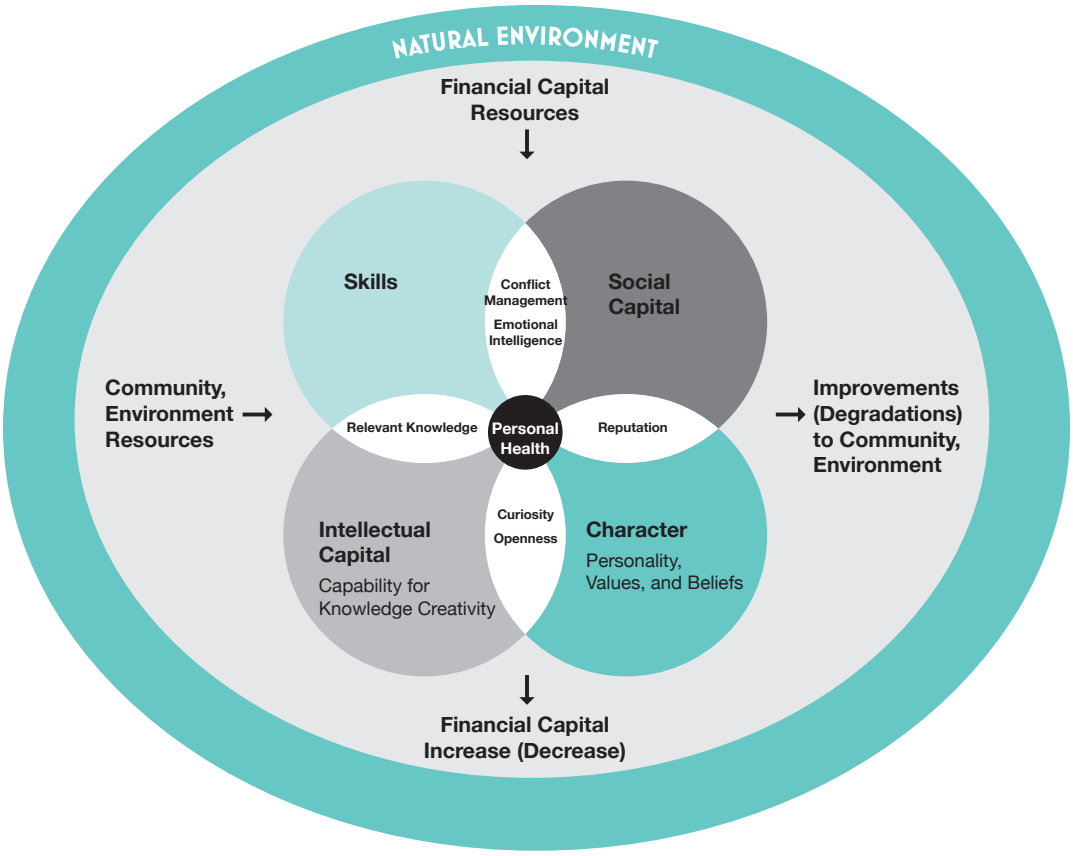
PERSONAL CAPITAL ECOLOGIES: BEYOND FINANCIAL PLANNING

While a lot of the discussion about financial reform and intangibles has focused on macro-level changes in society or new corporate behaviors, it also touches the daily lives of individuals.

In the same way that multiple capitals are increasingly seen as ways to manage corporate or community risks, individuals will become more engaged in managing their own personal risk through a combination of capital strategies. They will become more aware of their personal capital ecologies: the ways their skills, assets, and choices translate into capital flows that either increase or decrease the value of the larger community and ultimately of the natural environment, which in turn, flows back into their own ecologies to increase (or decrease) their personal security and well-being. In short, they will be able to draw more explicit links between their individual "wealth" and the "wealth" of the larger community.

This growing awareness will create a broader and more flexible framework for people to manage their economic well-being—and indeed their social and physical well-being as well. In addition to new instruments, such as personal carbon credits, they will draw on new tools for tracking these personal flows and assets and new, more diverse strategies for managing them over time. These broader strategies will be particularly welcome for boomers, the majority of whom are about to enter retirement with what appears, by traditional measures, to be less-than-adequate financial resources and a failing government safety net. In addition, the tools for defining, tracking, and managing personal capital ecologies can suggest innovative strategies for other capital-poor populations, such as the growing urban slum population or people with disabilities.

3 A FRAMEWORK FOR MAPPING PERSONAL CAPITAL ECOLOGIES



Source: Margolin Consulting, 2005.

WHAT TO DO

STRATEGIC ACCOUNTING:

EXPLORE ALTERNATE FRAMEWORKS FOR BLENDED VALUE

Creating new frameworks for thinking about blended value will be one way to bring new capital strategies into the organization. Consider a program of scenario development for different accounting frameworks, with the goal of seeing how the organization fares under each scheme. Key points to focus on include mitigation of uncertainty as well as risk exposure and management. When developing scenarios, it will also be important to think broadly about new kinds of capital—from longevity and education to online reputation and children's health futures.

WORKERS:

TRAIN WORKERS FOR NEW ACCOUNTING FRAMEWORKS AND TOOLS

In the future, accounting may well become the hot, new eco-frontier—and moreover, accounting won't just be for accountants anymore. Everyone in an organization will need to be trained to think in new ways, integrating new ways of budgeting with outcome measures for intellectual, social, and natural capital. And as new methods for data vizualization and interaction—including simulation—are developed, more employees will be required to learn how to use these new tools. In the short term, start with an experimental group to develop internal processes that incorporate new tools and ways of thinking.

MARKETING:

TARGET PERSONAL CAPITAL ECOLOGIES

As people become increasingly aware of their personal capital ecologies—and look for ways to manage them more effectively—marketing strategies for all kinds of products will have to speak to these needs, whether through environmental labeling or leveraging social networks for product and service users. Understanding the diversity of personal capital ecologies, region by region, will be an important first step.

WHAT YOU MIGHT WANT TO KNOW

activist investor: an investor who participates in governance decision making

asset: something that a firm or a person owns or controls

behavioral economics: a branch of economics that endeavors to more accurately characterize actual human behavior compared to the so-called "rational economic actor"

blended value: a method of uniting financial, social, and natural capital to evaluate investment and philanthropic activities within one framework (developed and articulated by Jed Emerson)

capital: accrued assets, particularly those that can create more assets

community indicators: measures that communities use to evaluate the effects of their programs as and those from externalities of firms and other institutions located in their jurisdictions; these may include number of volunteer hours or air and water quality, for example

corporate social responsibility (CSR): the idea that corporations have a responsibility to measure and monitor the value and impact of their operations beyond what has traditionally been considered relevant to financial operations

ethical investment: investment choices that meet the investor's social responsibility criteria

expense/outflow: assets flowing out of a firm or from a person

externality: those impacts that have traditionally been considered external to the firm; emissions and effluent would create the externalities of dirty air and water

financial risk management: the use of financial instruments to manage changes in price

gross domestic product (GDP): a mechanism developed in conjunction with World War II munitions production to track the resources of the country available for production, and considered one factor that enabled the Allies to win the war; since then, considered a measure of overall "growth" of a country but recently under dispute as an inadequate metric

liability: something that a person or firm owes to someone else; an obligation for a future expense

liquidity: a measure of how easily an asset can be exchanged; a bank account is liquid while a house is not

revenue stream/inflow: assets flowing into a firm or a person

socially responsible investment (SRI): investment choices that meet the investor's social responsibility criteria

volatility: in finance, the statistical standard deviation of a set of prices; for example, if 1,000 trades of a security yield an average trade price of $5, the volatility will describe whether those trades ranged widely from $2 to $8 or narrowly from $4.85 to $5.15

ASIA:

CHINESE CONSUMER COLLECTIVES

The emergence of the Chinese middle-class is changing the world, from shifting global supplies of concrete and copper to build housing for first-time Chinese homeowners, to providing a platform for Chinese innovation in consumer goods. But the next ten years will also see the growing impact of a distinctly Chinese form of consumer culture—new kinds of urban buying collectives, rooted in China's socialist legacy and enabled by communications technologies. Serving these new consumer collectives will require distinctly new strategies in product development, marketing, the retail experience, and customer service.

CHINESE CONSUMER ECONOMY: COLLECTIVISM STILL MAKES SENSE

Any Chinese person older than 25 can remember when life was organized differently. Until the last two decades, urban Chinese life was structured through the "work unit," or *danwei,* that provided people with employment, health care, housing, and leisure activities. Since the 1990s, the role of the *danwei* has been sharply reduced; and for those who work for themselves, in private enterprises, joint ventures, or multinational companies, it has been eliminated. Today housing, employment, and health care are privatizing, and people are responsible for creating their own paths. But given the relatively recent transition away from the *danwei*, it is no wonder that Chinese consumers are organizing into buying teams that leverage the power of the group.

TUANGOU 团购: LEADING-EDGE CONSUMERS

Tuangou, pronounced "twahn-go," refers to teams of buyers who negotiate with retailers and manufacturers for lower prices. This practice has swept across Chinese cities over the last few years and will become more sophisticated over the next decade. To date, it has been driven by young, wealthy, and upper-middle-class urban families faced with new consumer experiences: buying and decorating their first privately owned homes and purchasing automobiles. These are the trendsetters who shape consumer tastes and will define consumer-retailer relationships for the foreseeable future.

Tuangou groups began in Internet chat rooms, where first-time homeowners tried to figure out how to turn the concrete shell of a new Chinese apartment into a finished home. These chats chronicled the sagas of do-it-yourself interior designers in search of the highest quality wood flooring or the most reliable air conditioner installer at the lowest price. Today, the early *tuangou* groups have been transformed into a range of practices for collective buying.

TUANGOU 团购: ONLINE BROKERS AND BUSINESS MODELS

Tuangou are organized online and their activities range from ad hoc to highly planned. BBS forums on commercial sites, such as Taobao, provide ready-made communities where any individual can suggest a *tuangou* trip for an item. These ad hoc groups are not always successful; they tend to have trouble controlling the negotiating positions of individual members, and retailers don't always welcome them. But a host of new Web platforms such as 51tuangou and china.wzcn create a safe and trusted process for organizing strangers and negotiating with retailers. In return for organizing buyers into orderly groups, arranging for special treatment from retailers, and negotiating after-purchase service, these Web sites make a profit from advertising and commissions.

The rise of *tuangou* teams has been embraced by some Chinese businesses and shunned by others. Some retail chains have staff responsible for hosting *tuangou* groups and treat them well. Local merchants are either refusing to host the teams altogether or training their staff to provide special treatment. Meanwhile, *tuangou* products and services are expanding: it's now popular to find expensive wedding packages—including food, photos, and the honeymoon trip—done by *tuangou*. The result? Interior remodeling and wedding industries in Shanghai are influenced by *tuangou* Web sites and demands.

Over the next decade, *tuangou* consumerism will expand to a wider range of institutions, such as enterprises and even gated residential communities. If these *tuangou* practices persist, and companies find ways to service them, the growing Chinese middle class will be the most empowered to date, able to leverage economies of scale, collective behaviors, and rapid information exchange in a way that transforms the relationship between the individual consumer and the retailer. Ultimately, it may reshape retail in the West as well.

—Lyn Jeffery

CHINESE CONSUMER CULTURE WILL LEVERAGE THE BUYING POWER OF COLLECTIVES TO RESHAPE RETAIL PRACTICES

INSTITUTE FOR THE FUTURE

TEN-YEAR FORECAST
Perspectives 2007
SR-1064
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SAM FLEMMING
is founder and CEO of CIC Data, a China-based Internet word-of-mouth and competitive intelligence research company.

Sam Flemming is from Alabama, but has spent the last decade in China, where he runs a social media company, monitoring trends and trying to decipher the real meaning of online conversations that freely and frequently adapt familiar terms to new meanings. Lyn Jeffery, IFTF research director and leading China expert, met with Sam to probe some of the differences between Chinese and Western Internet users—especially the differences in collective versus individual behaviors.

Q: IN THE UNITED STATES AND EUROPE, WE HARDLY USE BULLETIN BOARD SERVICES (BBS) AT ALL, WHILE IN CHINA, THEY ARE AT THE HEART OF ONLINE ACTIVITY. YOUR BUSINESS, CIC DATA, TRACKS PRODUCT AND SERVICE "BUZZ" ON BOTH BBS AND BLOGS. HOW DO THOSE TWO DIFFER?

One is about the individual, the other is about the group. A blog is a very personal site, all about me, my opinions, and my ideas. Sometimes it even has my name in the URL. You are welcome to join in, but it's "me" who is directing the conversation. I am much more accountable. A BBS, first of all, is more group-oriented; it's more of a discussion, a forum. People can pop up and start a topic on just about anything that's relevant to the subject matter. And second, it's anonymous. Of course, blogs can be anonymous, too, but because BBS is inherently anonymous it gives people a little more perceived freedom to express what they really believe, or maybe to express a more extreme side of themselves.

When you look at the Chinese culture—this may sound simplistic, but it's what I've found in my experience—it's the individual versus the group. People enjoy chatting in a conversation more than they enjoy standing on a soapbox. In China, blogs are more personal. The kind of A-list professional blogs that we see in the United States and Europe are an exception. Most blogs are personal diaries shared with a circle of friends.

And finally, the vast majority of conversations that mention companies or products are happening on BBS. So for our focus, there's more to talk about on the BBS.

Q: WHAT DOES THE PROMINENCE OF THE BBS TELL US ABOUT HOW ONLINE CHINA DIFFERS FROM ONLINE AMERICA?

BBS is a new medium in China, and very much part of the online social fabric. Aside from politics, people are comfortable talking about anything and everything else. And from my reading of what's going on in the United States, this kind of group BBS discussion is more mainstream in China. About 43% of Internet users use BBS on a regular basis. So in terms of consumer-generated media making an impact, in China it's happening to an even greater extent than in the United States.

I keep thinking back to 1999 and the last Internet boom. I was going to conference after conference where it was pounded into my head: There are "three Cs" for successful Web sites: content, community, and commerce. In China, the community aspect is very, very strong.

We've been looking at our data recently, and found that about 10% of people who write posts on BBS will contribute 80–90% of the content, so it is a relatively small group that's driving the conversations. That's pretty interesting for companies. If you want to influence a particular community, you should try to reach this small percentage of people and have a strong impact. How to reach out to those people and how to influence them is a whole other question.

Another difference is that there is a commercial aspect to some of the BBS forums. China's largest online auction platform, Taobao, has a very popular BBS forum, and we think that one of the reasons for its success is that it promotes a whole culture around the site. Ebay has very active forums, too, but it's more focused on professional sellers, issues about the services, complaints, and so on. But Taobao has very broad forums like sports and fashion. I mentioned that there are not many opinion-leader blogs in China, but if you look on Taobao BBS, you will find opinion leaders on topics like sports. You will also see that these opinion leaders have a shop on Taobao. In a weird way, these are the opinion-leader blogs that are trying to lead to new business. If you establish yourself as an opinion-leader on the sports BBS on Taobao, you can drive business to your shop.

Q: YOU'VE BEEN WATCHING THE EXPLOSION OF THE CHINESE BLOGOSPHERE OVER THE LAST FEW YEARS. WHAT ARE SOME OF THE FACTORS THAT ARE DRIVING THE RISE IN BLOGGING, AND HOW WILL IT IMPACT THE BBS? WHAT DOES IT LOOK LIKE FROM CHINA?

Keeping in mind that the population of Internet users is skewed and does not represent the general population—and I'm really talking about Internet users in first-and second-tier cities—people are finding an outlet, a way to find and share information. The Internet

LYN JEFFERY
is a Research Director and leads IFTF's work on the Chinese Internet and the new BRIC Ten-Year Forecast.

CHINESE PEOPLE ARE VERY COMFORTABLE WITH ONLINE COMMUNITIES AND ARE AMAZINGLY GOOD AT ORGANIZING THEMSELVES ONLINE TO DO THINGS OFFLINE.

generation, people in their 20s, exposed to a lot more information, more media, and more options for life, both in their careers and in products and services. They are able to find an individual voice much more easily. They're not as directed as their parents were. You name it, the world is open to them.

Q: OVER THE LAST TWO YEARS, WHAT KIND OF CHANGES HAVE YOU SEEN IN QUANTITY OR QUALITY IN CONTENT IN BBS AND BLOGS?

It's hard to say because we've been getting better at our analysis. But you can look at the China Internet Network Information Center (CNNIC) studies and see that between 2004 and 2005, BBS use doubled from a little over 20% to a little over 40%. Social media (including blogs but especially BBS) are an increasingly important part of offline life as well. A lot of news stories on TV or newspapers will get ideas from blogs or BBS, and they will reference them. On the Chinese search engine Baidu, four or five of the top-ten searches are for Internet stars who have become offline stars. So the quantity has been increasing. And looking at the impact of BBS and blogs on mainstream pop culture, you could say that its impact is getting stronger as well.

We also see more active consumers, people talking about their experiences with companies, products, brands, and services, and I think you will see that growing even more. Within the next year, I would expect a major consumer crisis caused by online conversation—something like what we saw in the United States with the YouTube video of the Comcast technician falling.

Chinese people are very comfortable with online communities and are amazingly good at organizing themselves online to do things offline. If you look on Xcar.com.cn or the other Chinese auto Web sites, the big thing to do is to get 200 people who own a Volkswagen Polo and drive out to a big field and spell "POLO" with their cars, and take a picture of it. We have 20 or 30 pictures of fan clubs that have done that.

It's a tribute both to the development of car culture and also to the way online community extends to offline communities, which will surely continue.

Q: WHAT WILL BUSINESSES LIKE CIC DATA AND OTHERS HAVE TO DO TO KEEP UP?

I think we have a couple of main challenges. First is the ability to collect a lot of data, and conversations, and to collect the right data and right conversations for our clients. It's a volume issue and probably the most relevant issue. Second, our data-mining software helps us understand what is being said in the messages, all based on reading text and developing algorithms that can read and categorize text—but the fluidity of Internet language and slang is always a challenge. So for instance, if we're trying to track Bluetooth, we need to understand all the different ways people are saying "Bluetooth." The online slang and technical slang is constantly evolving and changing and you have to always be paying attention. We never have it figured out. We're constantly surprised.

Q: DOES THE MOBILE ASPECT OF DATA HAVE ANY BEARING ON WHAT YOU'LL HAVE TO BE DOING IN THE NEXT FIVE YEARS?

We can't do anything with SMS—that's private communication. We won't touch that. We've been watching mobile blogging, but it's still very, very small. In terms of Chinese consumers expressing themselves, I still think the computer will have the richest source of data. On the other hand, the impact of taking pictures and uploading them or taking videos and uploading them, will be bigger and bigger. That's going to be a larger component, camera phones and phones with video capability, as network speed increases. That can be good and bad for companies.

SCENARIO 1:

A NEW JOB MANAGING AN EMPLOYEE TUANGOU

Wang Bin, 23, is fresh out of Beijing University, China's most prestigious university. She just landed a job at networking and telecommunications equipment giant Huawei. "I was lucky to get this job," she says. "I couldn't even reach the Huawei booth at the Beijing University job fair, it was ten rows deep in applicants! But one of my professors has several former students who are pretty high up in the company, so they helped me circulate my resumé."

Wang, like many of her classmates, majored in Web organizational development and was hoping to get a job designing or managing an online community. She couldn't have asked for a better starting position—Web assistant for Huawei *tuangou*, the team-buying arm of the company. With 100,000 employees worldwide, Huawei is a major presence in the Chinese consumer market, brokering deals on behalf of employees on everything from toilet paper to apartment blocks through the *tuangou* department.

Wang's job is to make sure the Web site is in top shape, 24 hours a day, and to monitor the product requests flooding in from various regions. Her team mines the requests for emerging *tuangou* possibilities in various regions across the world. Most recently, for instance, the heat wave in southeast Asia meant that a rising number of employees in that region was interested in buying small backyard pools. Once the algorithm determines a demand has coalesced, Wang bumps it up the ladder to her manager, who starts making the rounds of their suppliers.

"Huawei *tuangou* is key to our success," Wang's manager tells her. "Lenovo and the telecoms can't offer their top talent the kind of long term discounts that we can, over the lifetime of their career with us." Of course, as Wang is learning, Huawei is not only in it for employee benefit. The company earns commissions from its role as broker and collects fees from employees who want to be *tuangou* members. There are very few who do not.

Tuangou has even become part of the Huawei brand. Huawei senior executives are known for buying trendy, expensive items on the cheap, like the time 400 executives decided they all wanted Lexus SC 16 luxury coupe convertibles—in purple. Lexus made a special deal with Huawei, and both companies got huge media coverage.

Source: http://www.51tuangou.com/article/article_show.php?article_id=1195

SCENARIO 2:

INTERIOR DECORATING, TUANGOU-STYLE

Li, 38, is looking forward to moving into to an upscale apartment in a gated community outside of Shanghai with her husband and 12-year-old son. Her husband has been promoted to a senior position at company headquarters in the city, and they'll be relocating from their home in Shandong province. Li will have to quit her job as an art teacher in a state school, which is still one of the more stable, if low-paying, jobs in the country. But she's ready for her next big project: designing the interior of their Shanghai apartment.

The apartment consists of eight rooms with bare concrete walls and hanging wires. She's heard from her husband's colleagues that their new residential community, Shanghai Palm Heaven, has one of the best *tuangou* organizations in the city. And they had better; for the price they paid for the apartment, they will need all the discounts they can get.

The family is being put up in a company apartment while Li scours the Shanghai Palm Heaven intranet for information on where to get the best bamboo flooring, Danish lighting fixtures, and Japanese toilets. She loves walking through the housing materials markets, where she can calculate the difference between the regular and *tuangou* price on most of the items using her cell phone.

Li's first experience with the Shanghai Palms *tuangou* was a team shop at Gome, one of the major electronics retailers in the city. Li bought the wall-sized screens she wanted for displaying TV and computer images in all the rooms, as well as two-thirds of her kitchen appliances, all for 10–30% off the regular price. After four hours of VIP treatment by the Gome *tuangou* manager in the *tuangou* VIP room, after the gift bags had been distributed and the prizes had been won, Li and the rest of the Shanghai Palm Heaven team left the store, having purchased over $250,000 in products.

Li knows that living so far outside the city means eventually she'll have to learn how to drive, and luckily, she can purchase driving lessons and even a car for herself through Shanghai Palm Heaven *tuangou*, as well. She's particularly fond of the Chery QQ 88 ever since she and her son saw the Shanghai Palm Heaven Chery QQ 88 fan club assembling one Saturday morning on a group drive to Suzhou. They watched as dozens of car owners gathered with their families, snapping pictures and laughing loudly. "That looks like fun!" said her son.

SCENARIO 3:

RURAL TUANGOU TROUBLES

Old Wu, 62, is not doing well. His new water pump is defective—a fake, from the looks of it. He's out thousands of yuan, and his ankle is sprained from where someone trampled it during the violent visit to Supervisor Gu's house. The whole *tuangou* experience had turned out disastrously, just as his wife had predicted.

Old Wu had heard about *tuangou* years before. The newspapers were full of the stories about regular citizens getting a good discount on expensive things that they bought together, as a group, each one making his own purchase. It made sense. But Old Wu was not going to learn to use a computer or the Internet; he'd decided that long ago. It just wasn't for people like him. He barely used his cell phone.

Still, when his nephew's wife told him about the *tuangou* program she was part of, he was interested. He and his wife needed a new water pump for the well, and if they could save 5%, that was almost a month's cash expenditures. The *tuangou* team was being organized by Supervisor Gu in a village about three miles away, and they were taking applicants from miles around. Old Wu attended the next *tuangou* team meeting, along with his nephew, his nephew's wife, and five other villagers. "This is the buying method of the future," said Supervisor Gu, and told them about the great deals he'd gotten on a motorcycle, a tractor, and a diesel generator. Old Wu was skeptical about paying the fee up front—he'd been burned before in pyramid schemes—but as Supervisor Gu pointed out, he'd be recouping the membership fee and still get a discount with the price of the pump. Plus, Huajing was a reputable store. Wu decided to buy in.

The day of the *tuangou* visit, about 100 villagers gathered in the county seat on bicycles, motorcycles, carts, and tractors, ready to make their way to the Huajing agricultural department store. About 45 of them would be buying pumps, which would assure them at least a 15% discount according to Supervisor Gu. They waited for hours outside Huajing. Supervisor Gu emerged from the store periodically to boast about the "negotiations" he was arranging on their behalf. Three hours, four hours. When they finally got their goods, the discount was less than what they'd expected—nothing to be done about it, said Supervisor Gu—but they could make up for it by buying extra fertilizer, which was being offered to them at a special 20% discount.

There was some grumbling on the spot, but after the hours of waiting, everyone just wanted to get home and install their new equipment. It wasn't until a few weeks later that the stories started to circulate. The generators died. The pumps were defective. Even the fertilizer was discovered to be mixed with ordinary soil. Old Wu was among the group who went to discuss the situation with Supervisor Gu, but Gu was outraged at the suggestion of returning villagers' membership fees. In the end, tempers flared, words and blows were exchanged, and Old Wu was left with a sprained ankle and his defective pump.

Source: http://www.wzcn.cn/face2face/Face2FaceHistory.aspx?Code=061126DZ

SCENARIO 4:

BEYOND SALES—THE TUANGOU ACCOUNT MANAGER

Mr. Bu, 45, is a *tuangou* account manager at a Xi'an branch of Home Way, one of China's largest home improvement stores. The store stocks 90,000 square feet of everything from tools to paint and bedroom sets. It has 15 *tuangou* account managers on staff, and competition among them is fierce. Mr. Bu is good at what he does; he makes enough commission every month to afford yearly vacations to Thailand or Indonesia, and next year, he'll take the family to France. His own apartment has been remodeled and furnished from top to bottom with Home Way products, all purchased at a high discount, of course.

It's taken Mr. Bu over five years to move up the *tuangou* client ladder. He started with the relatively stable municipal *tuangou* clients, who are almost like the old *danwei* that his parents belonged to when he was a child. With their relatively low salaries paid by the state and no immediate prospects of making more money, civil officials' *tuangou* teams tend to buy the cheap everyday items—nails, white paint, trashbags—in bulk rather than the high-priced items with higher margins.

But today, Mr. Bu deals with the much more demanding—and much more lucrative—*tuangou* Web site teams. Gregarious and always ready to perform in front of a crowd, Mr. Bu is especially good at hosting the *tuangou* teams, running the prize contests, working the crowd as they sip their drinks, showcasing the latest items and making the clients feel special. He has learned how to handle both of his client groups: the *tuangou* consumer representatives and the Web site organizers.

Source: http://www.wzcn.cn/face2face/Face2FaceHistory.aspx?Code=061126DZ

The *tuangou* reps have honed their good-cop, bad-cop negotiating skills to a razor's edge. They are super-consumers, many of them with years of experience negotiating on behalf of a *tuangou* team. But in the end, they come and go. Unlike Mr. Bu and the Web organizers, they are not in the business of *tuangou*.

The Web organizers run the technical platform and make all the logistical plans for the team visits; they are the ones that Mr. Bu tries to build long-term relationships with. They expect sharp discounts on their own personal products, as well as those for their VIP consumer clients. They also expect access to top-line repairmen and after-purchase services. And if they aren't treated very, very well, they can move their massive *tuangou* teams to another retailer, who will be happy to have the promotional opportunity of direct contact with consumers who are ready to buy. Home Way has an exclusive relationship with two out of four of the top national *tuangou* Web sites, and Mr. Bu knows that keeping his job rests on his ability to make sure they expand their *tuangou* business in the future.

WHAT TO DO

PRODUCT DESIGN:

LEVERAGE TUANGOU-LIKE GROUPS AS DESIGN PARTNERS

As *tuangou* and similar groups of consumers band together to shop in China and eventually other countries, they are also likely to collectively discover what is lacking in existing products and services. Companies can leverage such groups as design partners, getting their input as to how existing offerings can be improved and what new ones make sense. Tapping user groups is already occurring in some markets around the world—technology and autos, for example—where manufacturers get ideas from their most passionate users. But *tuangou* groups exist for a much broader range of products and industries, meaning even more companies will have new partners for design and innovation.

COMMUNITIES:

LINK COLLECTIVE BUYING STRATEGIES TO COMMUNITY ASSET BUILDING

With time, it won't just be about shopping. Once *tuangou* participants understand their collective power, they are likely to want to use it in other areas. For example, once young urban Chinese couples get their weddings and new homes settled using *tuangou*, they could transfer their newfound skills and power to make improvements to areas such as health, education, and the environment. But again, such community action won't be limited to China. As trends like collective shopping spread, so will the broader idea of community building as a means of influence to affect change in all areas.

MARKETING:

MARKET TO COLLECTIVES AS A LONG-TAIL STRATEGY

Lower network-coordination costs are making it cost-effective to meet the needs of "long-tail" or niche markets in industries like digital media and entertainment, and technologies like rapid fabrication (see "Manufacturing: Do It Yourself?") will continue to bring customization costs down for other products. The next step, finding consumers in the long-tail markets, will also become less costly in the future. *Tuangou* and similar groups are natural niche markets. Each self-identified group has its own unique needs and they have interests in a wide range of products. Marketing to these groups is a natural step in working the long-tail.

WHAT TO PONDER

HAND IN HAND

Song from the tuangou Web site Wangqun

You, an individual, meet a stranger, through me

Countless yous, mes, and thems join together

Browsing, consulting, choosing, bargaining …

Everyone helping one another

We are shy no longer

We shop for the best bargains

We buy with flair

We are jumbo consumers

The fanciest stores meet us on equal terms …

…Tuangou is power, netcrowds are the bridge!

WHERE TO LOOK

Team Power Buy
www.teampowerbuy.com

An American *tuangou* Web site. Tuangou or team power buying, as it is called in the United States, is a method in which consumers gather and demand great deals on products and services. Teampowerbuy.com groups consumers to facilitate discounted purchases.

WuYo/51Tuangou
www.51tuangou.com/index

WuYo/51tuangou is one of the more popular Chinese *tuangou* sites. WuYo acts as a broker for ad hoc buying teams, organizing visits to retailers and arranging 2–5% discounts on specific products.

COMMUNITIES:

CITIZENS OF SUSTAINABILITY

For years, advocates of sustainable corporate practices have focused on green marketing. They have documented a growing segment of consumers with so-called green values and have created high-value products that appeal to these consumers. This strategy has catapulted Whole Foods into a leadership role in retail food and has perhaps inspired Wal-Mart to follow its lead. Over the next decade, though, these green consumers are likely to turn into "sustainable citizens," as do-it-yourself attitudes, smart-networking skills, and a focus on personal and community health converge.

SUSTAINABILITY ATTITUDES: PERSONAL HEALTH, COMMUNITY STRENGTH

The underlying dilemma of sustainability is the tragedy of the commons: what seems rational for individuals adds up to a situation where everyone is worse off. A fundamental principle of cooperative strategy suggests a way to escape this dilemma: link personal self-interest to the good of the larger community.

In fact, personal health is emerging as that critical link. The 2006 Ten-Year Forecast Signals Survey points to a new "sustainable citizen" who sees local civic actions—as well as green consumerism—as part of a healthy lifestyle. Supporting local farmers, buying locally made products, and engaging in projects to improve the health of the community are all healthy living strategies for this person. For the sustainable citizen, working on personal health contributes to the overall health of the community.

How many sustainable citizens are out there? It appears that about half of all adults in the United States, across all income and ethnic groups, already qualify.

GLOBAL SUSTAINABILITY: VARIATIONS ON A THEME

Often thought of as a rich nation's issue, sustainability is increasingly linked to personal health concerns—and local community practices—in some of the poorest and most environmentally troubling places on the planet. Over the coming decade, this connection will drive a wide range of community strategies, from local knowledge networks to so-called regenerative commerce that links spending to personal values and concerns.

In China, India, and Russia, IFTF ethnographic research suggests that, as a result of the Internet and other media, families are more aware than ever of the effects of environmental change on their health. In Russia, some affluent families try to grow all their own food to avoid environmental contaminants. A Chinese blog post on "poisonous street foods" drew over 670,000 viewers in just a few days, while China is already the third-largest source of organic foods worldwide.

Meanwhile, the slums of the world's emerging megacities are becoming a hot bed of local commercial innovation, using distributed lightweight infrastructures and cooperative strategies to build sustainable local economic development as a basic survival strategy.

SUSTAINABILITY SKILLS: A NEW CIVIC LITERACY

Indeed, lightweight infrastructures and cooperative strategies are forging a new sustainability toolkit for communities worldwide. In the United States, sustainable citizens are already beginning to adopt new skills in smart networking and collective behavior, according to our survey. They are also likely to be do-it-yourselfers: self-motivated, self-educated, and self-organizing. And this combination of skills—invoked in a renewed commitment to sustainable local communities and motivated by personal health concerns—will begin to define a new civic literacy over the next decade.

—Kathi Vian & Mani Pande

OVER THE NEXT DECADE THE "GREEN CONSUMER" WILL EVOLVE INTO A "CITIZEN OF SUSTAINABILITY" AS PERSONAL HEALTH LINKS SUSTAINABILITY TO COMMUNITY HEALTH

INSTITUTE FOR THE FUTURE

TEN-YEAR FORECAST
Perspectives 2007
SR-1064
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MONICA MULLINS
has a background in social services and workplace safety and is now Vice President of Asset Production, Safety and Compliance for Wal-Mart's Logistics Division.

In 2006, Wal-Mart announced a major initiative to pursue a sustainable business strategy, asking all its suppliers to align themselves with the effort. Monica Mullins serves as the spokesperson for its business sustainability initiatives. IFTF's Bob Johansen talked to Monica about the changes she's seeing at Wal-Mart as it adapts to a global sustainability effort.

Q: WHAT INSPIRED WAL-MART TO UNDERTAKE ITS NEW SUSTAINABILITY EFFORT? AS I UNDERSTAND IT, YOU LOOKED 20 YEARS AHEAD AND BASICALLY DIDN'T LIKE WHAT YOU SAW AND ENDED UP CHANGING YOUR STRATEGY.

I think there were several things going on a few years ago. Rob Walton, who's our Chairman of the Board, had a personal relationship Peter Seligmann. Peter was the co-founder and CEO of Conservation International. In the course of traveling together, Peter said to Rob, "You know, there's really a lot that your company could do to positively impact the environment." He was suggesting to Rob that Wal-Mart really could be a driver of great change.

So Rob introduced our CEO, Lee Scott, to Peter and others from Conservation International, and they all sat down together to share the impact of various industries on the environment. And it was obvious that, with the size of our company and the size of our supply chain—66,000-plus vendors over 4,000 locations across the United States and abroad—we are positioned in a unique way to really have an impact on this thing called "environmental sustainability."

After Hurricane Katrina, Lee Scott once again recognized our ability to change Americans lives for the better. We worked with government agencies and local communities to provide help and relief to those affected by the hurricane. Lee helped us transfer this line of thinking into our daily business practices. We set out to use our resources and size to make this world a better place for our associates, customers, and future generations.

At the same time, we have seen that there are business benefits to doing things in a more environmentally friendly way. There are certainly benefits to the consumer, which is what Wal-Mart's all about. It quickly became apparent that Lee was very serious, that this was not going to be a flavor of the day.

Q: DO YOU SENSE A SHIFT IN THE VALUES OF YOUR SHOPPERS? ARE WE REACHING A KIND OF TIPPING POINT WHERE CONSUMERS WILL EXPECT COMPANIES TO ACT IN WAYS THAT ARE RESPECTFUL OF THE ENVIRONMENT?

Our organic offering continues to grow. The shelf space is definitely expanding. But something that's different about our approach is that we haven't sacrificed the everyday low price. We really are trying to lead what we call the democratization of sustainability. You don't need to be wealthy or elite to buy sustainable products. And that's what we're trying to do—to afford all customers, regardless of their economic status, the ability to take advantage of products that keep the environment in mind. They're affordable, and oh, by the way, they're good for the environment. Wal-Mart has the power, with the partnerships with our suppliers, to make things like that affordable to everyday Americans. And not just Americans. We can do it for people around the world.

I also think consumers are concerned about the environment. And in today's corporate environment, I think there are greater expectations of companies—not only that we operate our businesses ethically and with integrity but also that we're good environmental stewards in the process.

Q: IN THE SIGNALS SURVEY, WE FOUND THAT THERE ARE TWO FACTORS THAT COME TOGETHER TO DEFINE A SUSTAINABLE CITIZEN INDEX. THE FIRST FACTOR IS AROUND PERSONAL CARE AND CONCERN ABOUT HEALTH. THE SECOND FACTOR IS RELATED TO IMPACTS ON LOCAL COMMUNITIES—BEHAVIORS LIKE SUPPORTING LOCAL FARMERS AND RECYCLING AND THINGS LIKE THAT. IS PART OF YOUR SUSTAINABILITY EFFORT FOCUSED ON COMMUNITIES?

You're probably familiar with our "store of the community" initiatives, where we really try to make the store fit the neighborhood, not only externally in the building—the way the building looks—but also the product selection. We try to make sure it really fits the demographics of the local community, whether it's economic or a certain ethnic group. And we do encourage the purchase of produce and other products from local vendors.

So your index marries really nicely with our "store of the community" efforts. It's really a goal of Wal-Mart to have every store in the company reflect the community it's in, whether that's buying from the local farmers or

BOB JOHANSEN
has been a forecaster for more than 30 years. He is a social scientist, an IFTF Distinguished Fellow, and author of the forthcoming book, *Get There Early*.

WHAT WE REALLY ARE TRYING TO LEAD IS THE DEMOCRATIZATION OF SUSTAINABILITY.

YOU DON'T NEED TO BE WEALTHY OR ELITE TO BUY SUSTAINABLE PRODUCTS.

the local organic farmer or a local vendor. But we do have some sustainability standards now as we work with our vendors. We really encourage vendors of any size to look at the way they manage their business and ask: is there something they could do differently from an environmental-sustainability or business-sustainability perspective that would contribute to our efforts as a company?

Q: I KNOW YOUR RELATIONSHIP WITH COMMUNITIES HAS BEEN A SORE SPOT IN THE PAST. AND I'VE HEARD THE TERM "GREEN-WASHING" USED TO DESCRIBE YOUR EFFORT. ARE PEOPLE REALLY TAKING YOU SERIOUSLY YET?

I think it's something that we have to address. But there are a lot of things we do for communities, not the least of which is the number of jobs that we bring to the communities. We're not afraid to go into the metro areas where businesses have left. I think Chicago is a great example, where a factory had been there once and it's very economically depressed and a number of other businesses now have come into this area of Chicago. We pay a very competitive wage. We have very good benefits.

And it's very, very important to us to have a good relationship with the community. We really do want to do well by the community and bring jobs and offer men and women opportunities that they may not have had otherwise. I mean, my own personal story is a good example. When I came to the company, I would never have guessed that I would have the opportunities that I have. I started in February 1998 as a field manager. I was in the company's risk-control department. After about six months, I came into Bentonville and was promoted through the department over the course of a few years. Then I was promoted last December to Vice President. So, I mean, I've just had a wonderful career with this company. And it's a really exciting time to be here.

Q: YOU'RE VICE PRESIDENT OF THE GLOBAL LOGISTICS NETWORK. HOW HAVE YOUR ROLE AND THAT NETWORK EVOLVED AS A RESULT OF THE SUSTAINABILITY INITIATIVE?

The logistics network has grown over the last couple years beyond our fleet and beyond our domestic U.S. distribution centers to include the supply chain, to put more emphasis on the operations of our buildings, the construction of our buildings, and on the cargo initiatives. Our organizational goals and the goals of our network had to be much broader because we have these huge distribution centers that we're building, just as the stores division has the green stores. And the important question was: How do we build the green distribution center? We needed the knowledge of a lot of people, so many of the folks in the logistics network are involved in other networks as well. They might be involved in the waste reduction network. They may be involved in the packaging network. They may be involved in the China network. That's the beauty of the network.

Q: SO YOU ACTUALLY CALL THOSE NETWORKS RATHER THAN ORGANIZATIONS?

Right. That was the whole goal of introducing the sustainable value networks. They were developed to represent not only people from a certain part of Wal-Mart but also people from other areas of the company as well as NGOs, the academic community, suppliers, and so on.

Q: JUST THE LANGUAGE YOU'RE USING SUGGESTS A VERY DIFFERENT APPROACH. IT'S NETWORK LANGUAGE AS COMPARED TO HIERARCHICAL LANGUAGE. ARE YOU INCREASINGLY FUNCTIONING LIKE A NETWORK? THERE IS STILL A HIERARCHY, I SUSPECT, BUT IT SOUNDS LIKE IT'S A MORE FLEXIBLE HIERARCHY.

I don't want to give false impressions. In a company our size, there are going to be silos. But it's much, much easier to penetrate those silos or to partner with people in other organizations. You know, if sustainability has taught us anything, it's that we need to work together. And that's the only way that we will be successful not only amongst ourselves and between other departments and other divisions within the company, but outside as well. We need to welcome feedback and suggestions and criticism from our supplier partners, our NGOs, the government, academics, all of them. ➤

THE IFTF SUSTAINABLE CITIZEN INDEX

The IFTF Sustainable Citizen Index was created using data gathered in our 2006 Ten-Year Forecast Signals Survey, sampling sustainability behaviors of 2,002 respondents, age 18–74. It identifies a key set of sustainability behaviors and measures how widespread these behaviors are in the survey population—and by extension, in American society.

We were particularly interested to see if there is a relationship between personal health and well-being practices, on one hand, and community and environmental practices, on the other. In short, are so-called health-economy consumers also candidates for sustainable citizenship? Are they perhaps even the lead indicators of a renewed civic democracy?

When we did a factor analysis to identify the key components of what we were calling "sustainable citizenry," these two factors did, in fact, emerge as the defining factors. Both reveal a broad definition of health, and both show links between health and environment. But one is much more focused on local community, with a more public or civic face, while the other reveals a more personal face. We call these two factors Healthy Communities and Personal Care.

THE FACTORS THAT DEFINE THE SUSTAINABLE CITIZEN

FACTOR 1: HEALTHY COMMUNITIES	FACTOR 2: PERSONAL CARE
• Use public transportation to reduce carbon emissions • Buy locally made products to reduce long-distance transport impacts • Participate in projects to improve overall health of the local community • Support local farmers • Recycle and buy recycled goods as part of a healthy lifestyle • Buy products that promise lower environmental impact as part of a healthy lifestyle • Buy products that have not been tested on animals as part of a healthy lifestyle • Consider health benefits when buying food, clothing, cleaning products, beauty products, electronic devices, household appliances, cars, vacations, and home furnishings • Eat organic food	• Buy products to improve skin, create a healthy environment at home, improve physical fitness, filter air and water • Include homeopathy, complementary or alternative medicine, dieting or other weight-loss strategy, massages in "healthy lifestyle" • Recycle and buy recycled products as part of a healthy lifestyle • Buy products that promise lower environmental impact as part of a healthy lifestyle • Buy products that are not tested on animals as part of a healthy lifestyle • Consider health benefits when buying food, clothing, cleaning products, beauty products, electronic devices, household appliances, cars, vacations, and home furnishings **But don't:** • Buy locally made products to reduce transport impacts • Use public transportation to reduce carbon emissions
FACTOR 1 is a measure of the extent to which taking care of the local community and environment is part of a healthy lifestyle. This factor reflects a broad definition of health and a distinctly civic-minded orientation.	**FACTOR 2** is a measure of the extent to which personal care choices are part of a healthy lifestyle. Note that even for this personally focused factor, environmental concerns figure strongly into the definition of healthy practices.

WHAT WE KNOW ABOUT SUSTAINABLE CITIZENS

Sustainable citizens cross all age groups, all income levels, and all education levels. But they are almost twice as likely to be women as men.

In addition, sustainable citizens are more likely to have other distinctive profiles. For example, they are more likely to be do-it-yourselfers, to have smart networking skills, to engage in online collective behavior, and to have what we call X-People values: an interest in extending the capacity of the human body and mind beyond current limits.

Finally, sustainable citizens may be more likely to put their money where there mouth is through online political and religious contributions.

WHAT THE CORRELATIONS MEAN

Correlation coefficients measure the linear relationship between two variables. The correlation coefficient may be any value between plus and minus one.

Correlations may be positive or negative. A positive correlation means that, as one variable increases or decreases, so does the other—for example, the more you eat, the more weight you gain. A negative correlation coefficient indicates that as one variable increases, the other decreases.

2 THE CORRELATION PROFILE FOR SUSTAINABLE CITIZENS

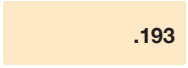
Do-It-Yourself
Sustainable citizens are likely to be do-it-yourselfers: people who are self-motivated, self-educating, and self-organizing—and who tend to seek out customized goods, services, and entertainment. (See "Manufacturing: Do It Yourself?")

Smart Networking
Sustainable citizens are moderately likely to be smart networkers, defined by their group participation, referral behavior, online lifestyle, mobile communication, locative activity, and computer connectivity. (See "Culture: Digital Natives, Civic Spaces.")

Personal Augmentation
Sustainable citizens are also moderately likely to fit an X-People profile that includes an emphasis on the body as a laboratory for innovation, experimentation, and personal expression as well as a belief in transhumanist values of extending and evolving human capability.

Online Collective Behavior
Sustainable citizens are moderately likely to fit a profile of collective behavior that includes an emphasis on online social networking, face-to-face social identity, online contributions, and online personal expression.

Political and Religious Contributions
There is a weak but statistically significant correlation between high scores on the Sustainable Citizen Index and online contributions to political and religious organizations.



Source: 2006 Ten-Year Forecast Signals Survey

3 KEY TO CORRELATIONS

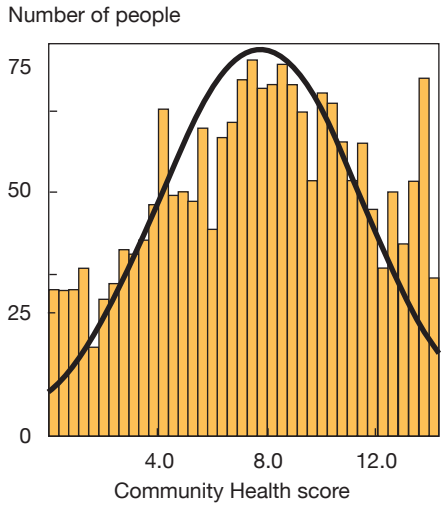
Greater than ±.4	a strong correlation
±.2 to ±.4	a moderate correlation
Less than ±.2	a weak correlation
0	no correlation

CITIZENS OF SUSTAINABILITY ARE MAINSTREAM IN THE UNITED STATES

Using the Sustainable Citizen Index, we scored all the participants in the survey. The scores give us a picture of the distribution of sustainable citizens in the overall population. If we look at this picture, we see a nearly bell-shaped curve, which statisticians call "normal." This means that today, in the United States, sustainable citizens are already nearly mainstream.

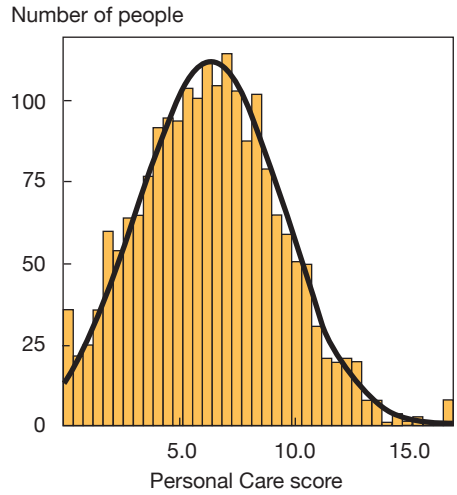
As the population ages and health becomes a growing concern, the link between personal health and community health is likely to grow, pushing more people to the high-scoring side of the distribution. And as the environment deteriorates in the face of increased urbanization, global health threats, and potentially rapid climate change, the link between personal health and local environmental concerns is likely to grow as well. End result? More sustainable citizens in the future.

4 DISTRIBUTION OF COMMUNITY HEALTH SCORES



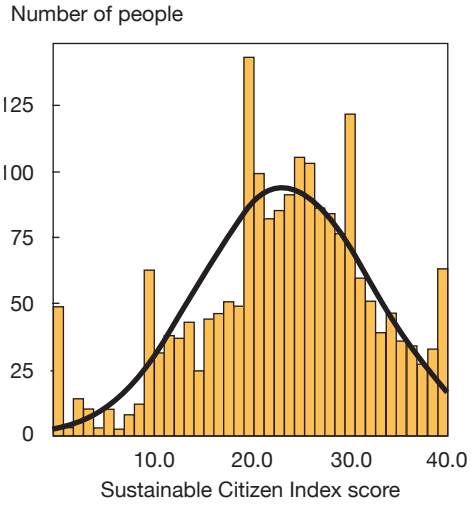
Source: 2006 Ten-Year Forecast Signals Survey

5 DISTRIBUTION OF PERSONAL CARE SCORES



Source: 2006 Ten-Year Forecast Signals Survey

6 DISTRIBUTION OF SUSTAINABLE CITIZENS



Source: 2006 Ten-Year Forecast Signals Survey

GLOBAL VIEWPOINTS: SUSTAINABILITY AROUND THE WORLD

Global development and environmental sustainability are often seen at odds—and with good reason. If householders in India and China, for example, were to reach economic parity with U.S. householders—and spend their incomes in roughly the same way—their demand for everything from automobiles and fuel to food and even paper products would far out-distance today's total world production of these goods. And the impact on the environment would be staggering.

Furthermore, the rapid urbanization of the entire developing world is producing a surge in slums. Already 1 billion people around the world are slum dwellers; by 2050, the number is likely to reach one-third of the world's population. As Mike Davis, author of *Planet of Slums* points out, we have created "a global social class of at least 1 billion urban dwellers, radically and permanently disconnected from the formal world economy."

Yet precisely because they are disconnected, these same urban dwellers are engaged in some of the boldest experiments in sustainability—economic, environmental, and personal. These experiments all share a common theme: the reliance on distributed systems of ad hoc infrastructures and bottom–up economic innovations that may well disrupt the traditional economies and middle-class growth around them while giving birth to radically new forms of civic organization.

DO-IT-YOURSELF RECYCLING ECONOMIES

The 13th Compound of the Dharavi slum has been well documented as a "free economic zone" where the waste of Mumbai is recycled into goods worth a half billion dollars or more per year. The work of remaking tin, plastic, and even soap into new goods certainly creates its own environmental effluent; yet the self-organizing economic community, completely outside Indian law, demonstrates how a do-it-yourself spirit can be part of a larger cultural shift from non-renewable to renewable resources.

REGENERATIVE COMMERCE FOR ECOLOGICALLY SUSTAINABLE GOODS

"Regenerative commerce" is a term coined by Jon Ramer for values-based commerce that integrates social networks with transactional networks to retain and grow local wealth. It is playing out in a variety of development venues, from the *favelas* (shantytowns) of Rio de Janeiro to the rural communities of small-scale producers. For example in Oaxaca, Mexico, an organization known as Bioplaneta builds social and technical network connections between small-scale producers and NGOs who provide technical assistance in meeting the goals of the Eco-Solidarity distributor network.

OPEN KNOWLEDGE NETWORKS FOR ENVIRONMENTAL INFORMATION

In ten villages surrounding Pondicherry, in South India, the Open Knowledge Network (OKN) has emerged as a source of environmental information to support the health and safety of the local population. With online access points in each of the villages, the network of volunteers collects local information about water, energy, health, agriculture, biodiversity, and the environment, as well as traditional practices and local events. Because most of the population doesn't routinely use the access points, the information is also distributed by a small local newspaper and low-power radio network. It isn't the same style of smart networking one sees in the United States, but it includes the same collective behavior, increased connectivity, and focus on network building that characterize the leading edge of smart networking in the industrialized world.

Q: GIVEN IT'S SIZE, WAL-MART CAN ACTUALLY FUNCTION AS A REGULATOR. AND I REALIZE YOU WOULDN'T WANT TO SAY THIS OFFICIALLY, BUT YOU MAY BE THE CLOSEST THING WE'RE GOING TO GET TO AN EXTREME ENVIRONMENTAL REGULATORY BODY IN THE UNITED STATES. WE'RE NOT GOING TO GET REGULATION IN THE SAME WAY AS GERMANY, FOR EXAMPLE.

I think you're touching on one of our goals here. We have the capacity as a company to build very positive relationships with the regulatory agencies and invite them in and build partnerships. The EPA is a great example. What a great program they have in the Smart Way program. It's just a terrific, terrific program that encourages the freight industry to reduce emissions and increase efficiency. And we do have the ability to perhaps influence the world by demonstrating how it's done. This is how we believe it could happen: by sharing information with other companies, by being as transparent as possible, by inviting those regulators in on discussions, and by taking them as partners as opposed to isolating ourselves or looking at our regulatory agencies as foes rather than business colleagues and business partnerships.

Q: TO ME, WHAT'S REALLY INTERESTING IS THAT YOU'VE BROUGHT SUSTAINABILITY TOGETHER WITH STRATEGY. YOU'RE COMBINING THE TWO IN THE PHRASE "BUSINESS SUSTAINABILITY."

Right. It's a beautiful marriage, really. You know, business and sustainability don't stand alone. They can't. As a business, we have responsibilities to our shareholders to do things in the most economical way possible. There are things that we would like to do from an environmental standpoint, but it doesn't make good business sense to do it. The return on investment may not be there right now because the technologies just aren't there yet. But that's where you have the dialogs with manufacturers, inventors, NGOs, and the government organizations to help tap into those entrepreneurs, those companies that are doing the research to make sure that research dollars are allocated and that we keep those kinds of things moving forward. But it's not to say that within a few years we won't be able to do more.

I think this is the most exciting time at Wal-Mart. We're going through so much change and transformation that at times you just have to hold on to your chair because things are happening so fast. But it's the right thing.

WHAT TO DO

COMMUNITIES:

LOOK FOR NEW PUBLIC–PRIVATE PARTNERSHIPS AT THE LOCAL LEVEL

With their do-it-yourself attitudes and their smart-networking skills, citizens of sustainability are likely to innovate community institutions as well as markets. The opportunity here is to forge new kinds of public–private partnerships, leveraging the sociability and literacy of the commons that these people will bring to community issues—while also engaging their entrepreneurial spirit. Watch for platforms that further community eco-health goals by linking local producers and merchants to community sustainability practices. For example, they might offer rewards and incentives, such as discounts or points at local merchants, to local citizens of sustainability who support local health and environment projects. Those same citizens will increasingly reward companies that support local sustainability—in the broadest terms—by endorsing them in local forums focused on ecological health.

TECHNOLOGY:

LEVERAGE WEB 2.0 FOR UNDERSTANDING HEALTHY ECOLOGIES

Technology companies have much to offer to citizens of sustainability. In particular, Web 2.0 companies and their descendents can help leverage the local knowledge of these players in a global marketplace of ideas and practices. Reversing a familiar refrain, such tools will create the platform for people to think *locally,* act *globally*. In a next-generation cross between MeetUp.com and WebMD, local platforms could help local users explore their own health in the context of local environmental factors. Ultimately, like the emerging online communities that rate health remedies, these new communities could provide a wealth of bottom–up information about the best strategies for managing personal and community ecological health—and link those strategies to ongoing monitoring and analysis tools for implementation and feedback.

GLOBAL DEVELOPMENT:

GET THERE EARLY WITH ECO-HEALTHY PRODUCTS

Increasingly, and not surprisingly, the desire for a healthy home, community, and planet is shared by people all over the world. With the Internet as a means to diffuse information more widely and with more companies providing sustainable products and services on a global level, there is great potential for sustainability-friendly practices and products to leapfrog to developing nations. Global corporations are in a perfect position to get there early, providing environment- and health-focused products and solutions for consumers in places like India, China, and Russia today. The urgency to act now is real, as awareness about the eco-health impacts of products is spreading rapidly; acting in the present will help companies avoid future backlash and even liability.

EDUCATION:

OPEN ECONOMY MAKEOVER

Ever since the *Nation at Risk* report in 1983 warned America about the perils of a failing public education system, most debates about the future of public education have focused on structural fixes to a 20th-century institution. Issues of funding, class size, standards, testing, and school have shaped conversations at the state and national levels. At best, these discussions have led to incremental changes. Now, however, the open economy, with its flexible network structures, self-organizing groups, and cooperative practices, may offer solutions that fundamentally transform public education into a 21st-century institution, staking out alternative ways to manage resources and create value.

EDUCATION: THE NEXT FRONTIER FOR DISRUPTION

The open economy has already shaken the economic assumptions of many commercial industries. Entertainment, software, and news media are waking up to a world of grassroots citizen reporters, critics, editors, self-publishers, and cultural producers using blogs, YouTube, podcasts, and other participatory media. Businesses in the pharmaceutical, design, and manufacturing industries are restructuring R&D processes using so-called solutions commons and distributed, collaborative knowledge bases to catalyze innovation. Consumer products industries are recognizing that personal media and social networks have the clout and passion to put products and services on the consumer's radar screen almost instantaneously.

Over the next decade, the open economy will produce similar disruptions in the public sector. Philanthropies are leveraging the dynamics of bottom–up value creation to invest in the social good and turn a profit. The health system in the United Kingdom is promoting smart wellness mobs and transparent health databases to support individual and group management of health. Public education in the United States is next.

FROM OPEN ECONOMY TO LEARNING ECONOMY: THE KEY DRIVERS

The knowledge economy and a growing consumer value on personal growth are driving the expansion of a diverse market for learning experiences. Innovative public schools and districts will acknowledge that they are participants in this expanding market, as their students and parents integrate products, services, and experiences from across this diversifying public–private market ecology. Among the key drivers will be:

- **Personalized and participatory pedagogy:** From new brain research that supports individual learning models to new media platforms for ad hoc learning communities and experiences, learning products and paths will become more personal and participatory.
- **Media-rich pervasive learning:** From online social-networking sites like MySpace, Facebook, and Xanga to multiplayer games and virtual worlds, immersive media will be key venues for serious play, social experimentation, identity formation, and development of a new civic voice for youth.
- **New learning agents:** New learning media and venues bring new kinds of people and talent into the learning economy, transforming conventional views of education as a profession.
- **New urban-wilderness lifestyles:** Urban learning will focus on bottom–up innovations that address urban needs, such as deteriorating infrastructure, poor health status, and growing diversity and uncertainty.

NEW COMMONS: THE MODELS FOR NEW LEARNING INSTITUTIONS

The open economy will intensify the democratization of learning and challenge the hold that public education institutions maintain on the majority of K–12 students, teachers, and parents. New digital media will continue to distribute the authority of knowledge creation across a vast web of learners, mentors, experts, and coaches. New forms of social networking and self-organization will catalyze the emergence of diverse forms of learning environments and knowledge acquisition.

All these innovations represent new kinds of commons that provide a real alternative to education as a monopoly public good. Formal institutions that recognize this shift and find ways to participate in these commons will transform what we think of as education; those that that fail to find new ways to support bottom–up learning will lose relevance, political support, and a respected niche as civic anchors of local communities.

—Andrea Saveri

AS THE OPEN ECONOMY MEETS PUBLIC EDUCATION, A NEW BOTTOM-UP LEARNING ECONOMY MAY TRANSFORM THE TROUBLED INSTITUTIONS THAT PREPARE US FOR TOMORROW

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Perspectives 2007
SR-1064
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APPLYING THE OPEN ECONOMY TOOLKIT:
THE DILEMMA OF K–12 EDUCATION

IFTF's Open Economy Toolkit is a six-step process for rethinking complex issues in new terms—to find ways to resolve tensions in seemingly intractable dilemmas. As such, it provides a framework for thinking, envisioning, and evaluating alternative strategies to complex situations like K–12 public education in the United States.

In this Perspective, we use the toolkit to take a close-up look at one strategy that has engendered much debate—charter schools. We neither advocate charter schools nor rule them out, but rather we want to understand how the dilemma they pose can be resolved through open economy principles.

BEFORE YOU START

Because most people come to a strategic design process with a general sense of the problem to be solved—and often with some favored solutions—we always start the toolkit process by expressing the problem and listing the responses that have been suggested.

In the case of public K–12 education, we might say that the system is rife with complex challenges and has reached a point of unsustainable systemic gridlock.

The K–12 Dilemma

The public has lost much of its faith in the ability of public education to provide broad access to quality education and learning for all students. Families with economic means are increasingly opting out of public schools. While there are pockets of high achievement, overall high dropout rates for students and teachers reflect poor system performance. For those students who do attend and complete public K–12 education, the value of their achievement is under debate as many believe it does not meet civic or career expectations. In general, there is growing disrespect of K–12 education as a public institution.

Views of the problem—and suggested solutions—are extremely polarized and politicized. Various stakeholders have responded to the general challenges of "fixing" public education at the K–12 level by initiating and supporting a range of efforts. The Open Economy Toolkit provides a way to evaluate each of these initiatives.

AN INVENTORY OF CURRENT RESPONSES

Charter schools. These schools receive a charter from the state, a public school district, or a designated nonprofit to form a new school outside the immediate governance of the district. With the ability to experiment, charters are driven by parents, teachers, agencies, and communities who want a smaller, safer environment for their children. Many charters focus on specific populations, such as special-needs students, or specific pedagogical approaches.

National accountability system. The intention of this solution it to motivate schools to maintain a minimum level of skill and subject-matter achievement. With the "No Child Left Behind Act," states set standards of achievement, but the federal government tests achievement and enforces compliance, linking funding to school performance. Critics claim that the Act does little to help schools achieve improvements and is more punitive than supportive.

Smaller schools. Many research studies demonstrate the effectiveness of small schools, especially for disadvantaged students or those with special needs. The goal is to lower the student caseload for teachers, from 180 to 60 for example, and create more personal relationships among students, teachers, parents, and the larger community. Small schools also create the opportunity for more school-centered self-governance and decision making.

Schools as community center. This intervention seeks to provide more integrated service to the whole student and the family—based on findings from the classic *Coleman Report* published in 1966 that demonstrated a link between students' performance and their broader environment. Proponents attempt to integrate the school with the broader community, engaging more people and organizations from the community in the school.

Financial reform. Successful lawsuits in several states have directed legislatures to comply with constitutional provisions requiring states to provide "thorough and efficient" or "equitable and adequate" systems of public schools. The first court judgments addressed the inequities in school funding based on diverse property values. More recently, cases have attacked the adequacy of the state and local funds to support a sufficient education.

STEP 1. FENCES & TRAPS

REVEAL HIDDEN LONG-TERM COSTS AND BENEFITS

To evaluate the charter schools as a solution to the dilemma of K–12 education, we begin by assessing long-term costs and benefits that may or may not be obvious. In any dilemma, stakeholders generally try to avoid immediate costs and take advantage of near-term gains. This strategy, however, ignores the *fences* and *traps*. Fences occur when short-term costs block access to long-term benefits. Traps occur when short-term benefits blind us to long-term costs.

Step 1 involves using a simple 2x2 matrix: it quickly reveals these important diagonal relationships between short- and long-term costs and benefits. We discover two fences:

- **Short-term costs associated with diverting money from local public schools to privately run charter schools.** Over the long term and across schools, this investment could create a set of small schools autonomous from the public school district in which teachers and principals can exercise more control over decision making and professional skill.
- **Disconnection of the privately chartered schools from the school district, resulting from animosity between public school administrators and those who join charters.** Disconnection is an immediate cost, but in the long term, it actually creates the potential for more open experimentation in pedagogical and organizational approaches for dealing with special needs or local educational challenges.

We also discover traps that make charters look very appealing in the short term but hide potential long-term costs:

- **Short-term benefits of reduced case loads for teachers and personal environments for students.** If too many charters are granted to reduce case loads and focus on special needs, ineffective companies may become overloaded with charter schools and fail to scale appropriately to maintain quality, oversight, and financial integrity.
- **More pedagogical control for teachers in their classroom.** Relegating special needs and "experiments" to schools disconnected from the district means that local public schools are losing valuable insight about new approaches and innovations.

By taking this longer view of both costs and benefits, we see more clearly the kinds of problems that need solutions. The next step is to consider the stakeholders who may need help getting over these fences and out of these traps.

FENCES AND TRAPS IN THE CHARTER SCHOOL STRATEGY

	COSTS	BENEFITS
SHORT TERM	• Dollars per pupil are diverted away from public system toward funding private charter schools. • Animosity between public schools and private charter schools creates proprietary closed-door behaviors by those who leave the district.	• Charters create reduced student case loads for teachers and personal environments for students and their families. • Teachers gain more control over pedagogy in the classroom and schools are able to creatively address special needs and distinct local challenges.
LONG TERM	• Ineffective private companies get too many charters and students suffer from poor scaling of organizational and oversight approaches. • Results from innovation and creativity are not shared actively across the public school district, with public schools losing opportunities for insight in how to develop new creative solutions. The safety net frays.	• Autonomous, small charter schools gain more control over decision making, allowing teachers and administrators to push their skills in addressing specific needs or challenges. • Charter schools enable safe local environments for teachers and students supporting innovation in pedagogy and organizational approach.

Fences
Traps

STEP 2. STAKEHOLDERS & INTERESTS

RECOGNIZE UNDERAPPRECIATED INTERDEPENDENCIES

The tensions surrounding charter schools emerge from the diverse interests of the stakeholders—parents, teachers, administrators, students, charters school staff and charter company management, and government funders and policy makers. Each of these stakeholders is motivated by distinct wants and values—things they care deeply about. But, as in any social dilemma, there are underappreciated interdependences, and these can point us toward unexplored synergies. So Step 2 helps us map these interdependencies and potential synergies.

First, we map wants and values in a grid. Looking across the grid, we can then see places where these converge or become closely linked. For example, parents, students, and teachers all value personal relationships. School administrators, charters, and governments are all concerned about performance. Governments and communities are both looking for accountability. And both teachers and students seek trusted peer-to-peer interactions.

These four areas—personal relationships, trusted peer-to-peer interactions, performance, and accountability—are focal points for innovation and cooperative strategies that will help everyone get past the fences and traps. But the kinds of innovation that will work will depend on the systemic conditions: the drivers and barriers that the institutional world of education poses. Evaluating this context for stakeholder action is the next step.

2 STAKEHOLDER INTERESTS

Stakeholders	Wants	Values
Parents	Safe, personal environment for their children. Well-funded, quality local public schools.	Safety, quality, personal relationships
Students	Compelling learning environment. Personal and trusted relationships with educators.	Stimulation, discovery, peers
Teachers	A supportive teaching environment that respects their profession. A community of learners—students and teachers—not isolation.	Classroom independence, control, creativity, personal relationships, community
Public school administration (principals, superintendents)	Financial flexibility and control over local decision making. Quality performance of teachers and students.	Reliability, consistency, performance, control
Private charters	Ability to attract students and meet their needs. Local control and flexibility to experiment, do things differently.	Autonomy, innovation, financial return, performance
Government agencies	Positive results and quality performance of schools for constituents.	Accountability, performance, data
Communities	A safe, compelling place for all children to learn to become productive community members. A community focal point for learning and civic participation.	Equity, safety, relationships

3 FOCAL POINTS FOR INNOVATION AND COOPERATION

STEP 3. DRIVERS & BARRIERS

EVALUATE THE CONTEXT OF STAKEHOLDER ACTION

Stakeholders live and make decisions in an institutional context, not a vacuum. In this context, there will always be drivers and barriers. We can think of these as features of the system that can be tuned to make it more or less easy to resolve basic dilemmas. Step 4 applies a set of seven tuning levers from cooperative theory—they focus our attention on the kinds of drivers and barriers that the are most likely to be important in an open economy where cooperative strategies are often the key to success.

The seven levers are: structure, rules, resources, thresholds, feedback, memory, and identity. Structure, rules, and resources play a prominent role in shaping the tensions related to charter schools, which are creating more adaptable local structures and governance frameworks to deal with local needs. These, in turn, appeal to teachers' desires for professional creativity and control, and to families' and communities' concerns that the specific needs of their children are met. However, charter schools suffer from the lack of systemic feedback and shared identity, and the prevalence of competitive resource strategies prevents the public school districts from gaining new knowledge and insight that could address shared interests related to performance, innovation, and accountability.

These insights set the stage for action: designing cooperative solutions in which everyone is better off. This is the next step.

4 DRIVERS AND BARRIERS IN THE CONTEXT OF PUBLIC EDUCATION

STRUCTURE	The public education system is hierarchically structured and slow to change. Decision making and authority originate from the top and trickle down. Schools and districts have decreasing latitude to experiment and initiate change, with little reward. Schools receiving a charter move outside the hierarchy, gaining a degree of autonomy and self-determination not widely found in local public schools.
RULES	Rules are created and enforced from the top, with little bottom–up legitimation or ability to influence their modification or interpretation. Rules governing local schools are externally imposed by state and federal policy, providing local schools with little latitude to experiment and change rules to support new approaches, such as how funds, staff, or even curricula and pedagogical approaches can be deployed. For many, the appeal of charters is the ability to work under different organizing principles and rules of interaction.
RESOURCES	Resources tend to be allocated based on legislated notions of equity and are treated as proprietary or private resources. Strategies to manage and grow resources (funding, knowledge, professional skills) tend to be more competitive than cooperative. Knowledge resources developed in charter schools, for example, are not shared resources within the district. There is little sense of common-pool goods (those resources that would benefit both public and charter schools). Nor are there shared goals that guide the cooperation of charter schools and local public schools.
THRESHOLDS	Data may be tracked for specific thresholds—such as effective group size for learning and management, attrition rate of school population due to dropouts, private/parochial/home schools, percent of AFDC or ESL families—but this information is not linked to visible triggers for action. Charters could be interpreted as one way of dealing with the negative consequences of crossing specific thresholds. Visible triggers can often motivate action to avoid or encourage crossing a threshold.
FEEDBACK	There is little systemic feedback in public education, other than quantitative statistics about performance/achievement and financial measures. Most qualitative feedback about learning and professional development is local within a school or district. New knowledge from innovations or experiments conducted at charters does not flow across the system well, but remains within local geographic or pedagogical communities.
MEMORY	In the context of public schools, institutional memory could be a barrier to developing new approaches to solving both old and new problems. In the form of legacy or bureaucracy, institutional memory may be holding back innovations. Charter schools could be seen as a way of breaking through the hold of rigid institutional memory by creating new local histories and memories.
IDENTITY	District identity is generally weak. The strongest sense of affiliation often exists at the school level, though it may vary depending on position (teacher vs. administrator). Charter schools lose "membership" and affiliation in any meaningful way with the district, decreasing the likelihood for cooperation and sharing. District identity is weak and may not be a powerful motivator for cooperative learning and innovation with charter schools.

STEP 4. PRINCIPLES & PLATFORMS

DESIGN FOR OPENNESS

Now that we're ready to begin looking for solutions, design principles from the open economy can provide guidelines and potential insights. Step 4 centers on a core set of design principles. If we apply these principles to the fences and traps we identified in Step 1, we find ourselves asking new kinds of questions about the design of educational systems.

For example, let's consider the lack of feedback and learning from charter school innovations. Parents and teachers may want charters for their pedagogical flexibility and school autonomy, yet their local districts (and the larger system) don't get anything back. Current institutional structure and rules fail to capture learning from charter schools and prevent teachers and administrators from achieving the level of control and autonomy to develop their own solutions to local problems.

A few key design components that may provide alternative solutions to these tensions are peer-to-peer design, distributed authority, common-pool resources, and group-aligned self-interest. We can begin by asking questions about what these solutions might look like, given the stakeholder interests. Ultimately, we would develop these into a set of alternative scenarios, but for now, we'll just pose the questions before going on to consider the next step of building concrete strategies that speak to the incentives of each of the stakeholders.

5 KEY DESIGN PRINCIPLES FROM THE OPEN ECONOMY

PEER-TO-PEER DESIGN leverages diverse and distributed expertise through carefully designed aggregation processes.

What to focus on:

- Who are contributors?
- What can they contribute?
- What are the processes and platforms (social and technological) for contributing?
- How are contributions filtered, aggregated, and integrated?

Example: If stakeholders of charter schools were all considered peer contributors, what does the process of aggregation that would provide benefits to all those touched by the creation of charter schools look like? How can the experiments and new approaches of charter schools be aggregated to produce a resource that would contribute to all local public schools?

DISTRIBUTED AUTHORITY pushes rule making, monitoring, and sanctioning out to the periphery of a network.

What to focus on:

- What decisions can be made or actions taken at the edges of the network?
- How can those decisions and actions be made visible?
- How do decisions and actions get evaluated?
- What are the individual and group consequences for poor decisions and actions?

Example: What would a set of rules look like that would support teachers and principals of local and charter schools in developing strategies for gaining the long-term benefits of charter schools and avoiding the long-term costs? What kinds of distributed monitoring and sanctioning would be meaningful to create a common-pool resource?

COMMON-POOL RESOURCES provide diverse sources of value from basic tangible and intangible goods that a group jointly sustains.

What to focus on:

- What resources are some stakeholders in the group already creating?
- What value would those resources have for other stakeholders?
- What is the value of sharing those resources?
- What are the processes and tools for creating, using, and maintaining the resources?

Example: What common-pool resource (knowledge, innovation, skill development, access to funding, reputation) could be created that would serve both local public schools and charter schools? What type of interactions between local public schools and charter schools would support the creation of a common-pool resource?

GROUP-ALIGNED SELF-INTEREST enables individuals and groups to act in their own best interest and contribute to system-wide benefit.

What to focus on:

- What kinds of individual actions might create value for the whole?
- What individual benefits derive from contributing to the whole?
- What value do free riders add to the system?
- How can hidden value be revealed?

Example: Where are there synergies in self-interest that could be points of cooperation among stakeholders of local public schools and private charter schools? How can interactions and rules be structured to support individual interest and collective benefit? How does the local public school district gain from private charter schools?

STEP 5. INCENTIVES & STRATEGIES

CREATE STRATEGIC INCENTIVES FOR COOPERATION

New design principles and platforms require buy-in and often demand behavior change among stakeholders. Designing successful strategies thus requires us to map these design principles against the incentive profiles of the participants.

Step 5—a set of three incentive profiles—is designed to help us with this task. Each of these incentive structures may be linked to specific open-economy strategies based on the tuning levers we introduced in Step 3. Without changing the actual motivations of any of the players, we restructure the system to recover lost value. For example:

- By opening a new feedback channel between parents who opt out of the public schools and the district administration, we capture information that could improve the system for those who remain and ultimately lead to greater retention.
- By setting up a platform for district-wide fund-raising competitions among PTAs, we redraw the boundaries of group identity and raise the overall funding for the entire district.
- By using reputation and rating systems to encourage a shared innovation repository across public and charter schools, we create a new resource not only of innovations but of social capital in the community.

This framework drives the design of open-economy solutions to specific strategies for specific groups, with well-defined incentives appropriate to the participants. Ultimately, these strategies should create new value throughout the entire system, as revealed by the final step in the process.

6 INCENTIVE PROFILES FOR STRATEGIC DESIGN

	INDIVIDUALS	GROUPS	INSTITUTIONS
INDIVIDUALIST: **self-interest maximizer**	**Focus:** Parents want the best for their kids regardless of community **Strategy:** Create a feedback channel to districts for exiting parents		**Focus:** Public and charter schools are focused on meeting mandated performance standards to access federal funding **Strategy:** Create an open-source standards and testing platform to engage the community in defining and measuring broader performance standards
COMPETITOR: **relative maximizer**		**Focus:** PTA groups focus their concern on their own school community, developing ways to attract grant money and link to the larger community **Strategy:** Develop district-wide fundraising competitions and award points to people who share fundraising tips	**Focus:** Private charters want to attract funding and the best teachers to their schools **Strategy:** Develop a district-wide innovation forum with reputation and rating system, with annual personal awards for contributors
COOPERATOR: **joint-outcome maximizer**		**Focus:** Community groups (school boards) may take into account joint interests and help bridge across schools and other boundaries **Strategy:** Set up participatory planning processes that widen participation in school board decisions and attract innovative solutions	

STEP 6. NEW PATTERNS & INSIGHTS

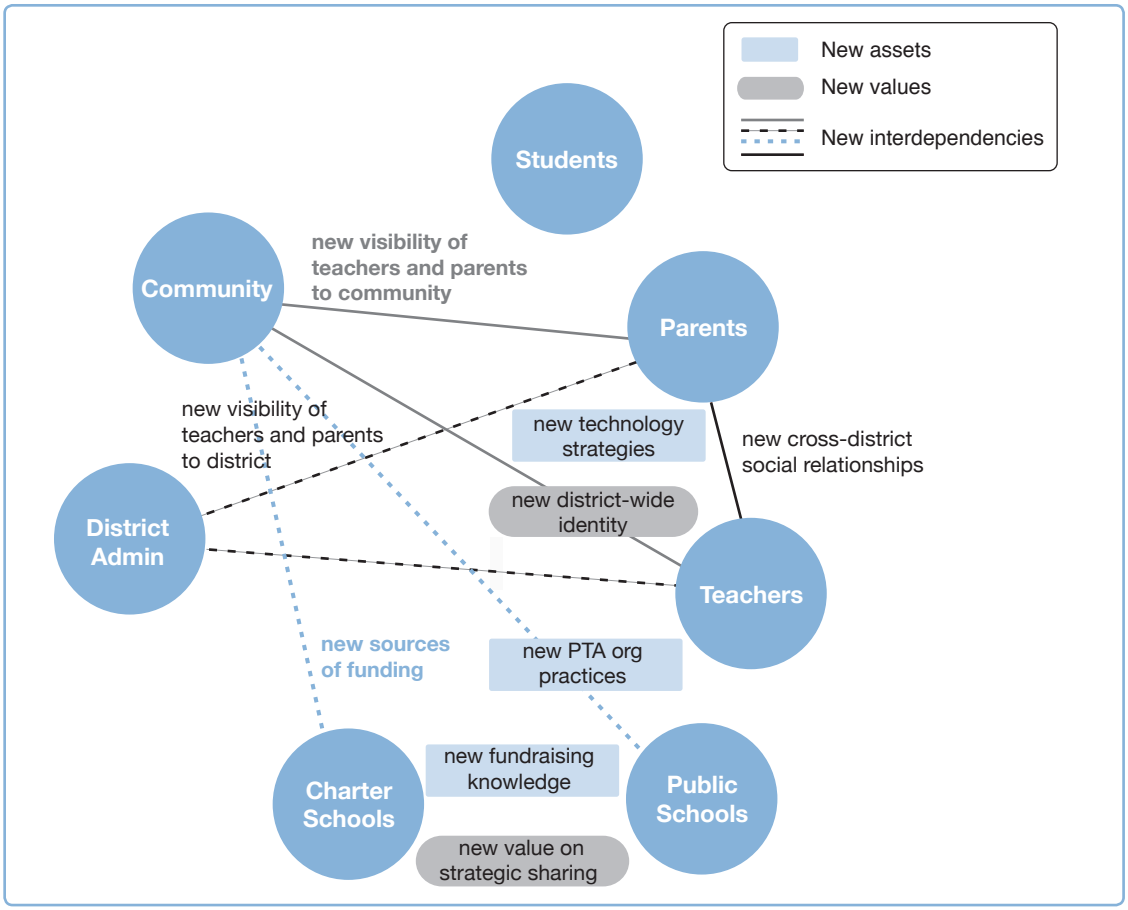
TAP INTO THE NEW ECOLOGY

New open-economy strategies should ultimately lead to new value in the system—in this case, the educational system. Step 6 uncovers this new value by creating a map of the new ecology. This map will show us new interdependencies, new assets, and new values.

For example, in the case of our cross-district competitive PTA fundraising platform, we might find new social relationships between parents and teachers and a new visibility of parents and teachers to the community and the district administration. We would also expect to find new assets, such as new organizational practices among PTAs, new technology strategies for outreach, and new knowledge commons around fundraising strategies and practices. Finally, we might also find a shift in values to include a broader district-wide identity in some activities and a norm around sharing between charter and public schools.

This new value is regenerative—that is, it suggests additional ways to create new value in the system. For example, the new visibility of teachers and parents in the district and community may create new opportunities to engage them in other civic forums or in leadership of the district. We can now return to the beginning of our cycle of diagnosis and design to figure out how to design additional platforms for generating yet more value in the system.

7 THE ECOLOGY OF NEW INTERDEPENDENCIES, ASSETS, AND VALUES



Source: Institute for the Future

For more details about strategic planning in an open economy, see "Methodology: The Open Economy Toolkit." For more information about how to apply the toolkit to strategic planning challenges in your organization, please contact **Andrea Saveri** (asaveri@iftf.org).

SCIENCE:

THE NEXT REVOLUTION?

Sometimes enterprises fail when dazzling successes obscure subtle but fundamental problems. Science may confront such a crisis in this century. Vastly exploding observational capabilities, new computing methods, and growing technological prowess make science look stronger than ever. But these achievements may hide—and in the future will magnify—a growing uncertainty about whether science can answer the most fundamental questions. Some preach the end of science, but a new Scientific Revolution seems more likely.

BEFORE THE REVOLUTION: TECHNOLOGY PRECEDES SCIENCE

Centuries ago, Europe saw an explosion in scientific and technical knowledge. Engineering knowledge grew, particularly in the cutting-edge fields of metallurgy and mechanics. Navigators equipped with new instruments, ship designs, and sailing techniques explored regions of the world that had long been only myth. The invention of linear perspective gave savants the ability to accurately record flora and fauna and engineers the ability to precisely describe innovative machines. Improvements in instruments allowed scientists to measure a wider range of physical phenomena.

Sounds like the Scientific Revolution? It wasn't. All these events occurred in the century before the Scientific Revolution. Late medieval and early Renaissance advances in engineering, geography, art, and instrumentation undercut scientific theories that had been in place for millennia and forced scientists to develop a new understanding of everything from the physics of machines to the structure of the earth and the workings of the cosmos. All of this added up to the modern worldview that still guides our thinking.

THE KNOWLEDGE PARADOX: POST-MODERN TOOLS OF UNCERTAINTY

Today, we may be entering a similar era of basic uncertainty in science. And once again, the very success of our tools for exploring the world, creating and managing knowledge, and crafting intelligence is to blame.

We're beginning to see a mismatch between technical success and scientific knowledge. Evolutionary-design techniques, in which computers "evolve" and test solutions to technical problems are starting to yield designs that work well, but border on the inexplicable.

In emergence, problem solving is running ahead of understanding. Scientists can mimic emergent phenomena across the physical and biological sciences. However, it's not clear why emergence happens and whether it's possible to test theories of emergence using the traditional scientific method. Finally, evolutionary and emergent systems learn from their mistakes, grow stronger and subtler, and eventually could evolve into intelligences as incomprehensible as their designs.

Other branches of science are dealing with a split between the volumes of data produced and the power of the theories used to make sense of them. In high-energy physics, factory-sized instruments are turning out terabytes of data per year, and a new generation of instruments is about to generate an order of magnitude more information. Yet string theory, which attempts to make sense of that information, is still contentious.

THE END OF SCIENCE? NO, BUT ...

These aren't marginal fields that border on pseudoscience. Evolutionary design is used in everything from electronics to biology and animation. Emergence has attracted the attention of Nobel laureates and made contributions in a variety of industries and disciplines. String theory has been at the center of theoretical physics for decades. As was the case 500 years ago, the problem is not that we don't know enough. We know a lot. It's just not adding up.

This doesn't mean that we're reaching an "end of science," as John Horgan put it. Applied science won't come to a halt; innovation and technological change won't cease. But the growing disconnect between our ability to create new technologies, to change our world, and to understand our technologies and anticipate change will create more risk and uncertainty, and ultimately cracks in our consensus of reality.

—Alex Soojung-Kim Pang

FUNDAMENTAL UNCERTAINTY, DRIVEN BY THE BASIC TOOLS AND PRACTICES OF SCIENCE, MAY PUSH US INTO A NEW ERA OF "POST-NORMAL SCIENCE"

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Perspectives 2007
SR-1064

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Oxford's Jerry Ravetz argues that we're entering a period of "post-normal science," in which the confident technocratic vision of the relationship between science, technology, and society is undergoing profound change. In this interview, Alex Pang helps us understand where this era of change might take us.

Q: WHY DO YOU SAY THAT WE HAVE ENTERED A PHASE OF POST-NORMAL SCIENCE, AND WHAT DO YOU MEAN BY THAT?

Post-normal science contrasts to the "normal science" described by Thomas Kuhn in *The Structure of Scientific Revolutions*. This kind of science is undoubtedly the great driving force of modern global civilization. In the conventional understanding, science discovers nuggets of fact; technology turns them into tools that enable the conquest of nature; and that leads to the improvement of society and human welfare.

But we can no longer separate science, nature, and society. The combination of lifestyles and markets drives innovation in the science-based industries, and their cumulative effect is to further disrupt the complex global natural systems on whose stability we all depend. The degradation and destabilization of the natural environment as a result of globalized science-based industry increasingly threatens the survival of civilization itself.

The situation of science in its social context has become increasingly turbulent in recent years. Science has long established structures that carry great prestige and influence. There's also an institutionalized counter-expertise: for example, major environmental groups can engage in a critical dialog with "official" experts.

Consequently, we've entered a world in which facts are uncertain, values in dispute, stakes high, and decisions urgent. Traditional mechanisms for regulating science are becoming obsolete. With nanotechnology, it's practically impossible; with converging technologies, which are all about linkage, it's inconceivable.

In such contexts of policy making, there is a new role for natural science. Science in the policy context must become post-normal.

Q: WHAT'S NEW HERE? HASN'T THE APPLICATION OF SCIENCE ALWAYS HAD UNCERTAINTY AND UNEXPECTED CONSEQUENCES?

Of course there have always been problems that science could not solve. But increasingly over recent generations, our civilization has been able to tame Nature in so many ways.

Now, however, we are finding that the conquest of Nature is not, and cannot be, complete. As we confront Nature in its disturbed and reactive state, we find extreme uncertainties in our understanding of its complex systems, often at a regional or global scale.

Q: MIXING SCIENCE AND POLITICS USUALLY JUST YIELDS BAD SCIENCE. SO WHY ISN'T BETTER SCIENCE THE WAY TO DEAL WITH THESE PROBLEMS?

The uncertainties of post-normal science will not be resolved by mere growth in our databases or computing power. Increasingly, we live in a world in which we must make hard policy decisions where our only scientific inputs are irremediably soft.

But we're not talking about traditional areas of research and industrial development. These are areas where traditional mechanisms of quality assurance, like peer review and publications, are patently inadequate.

Q: SO WHO IS INVOLVED IN DOING POST-NORMAL SCIENCE?

In the post-normal science context, what might be called "extended facts" can become important in the dialog. These can range from "housewives' epistemology" through pupils' surveys to investigative journalism and leaked scientific documents. Furthermore, particularly at the local level, we've seen that people not only care about their environment, but also can become ingenious and creative in finding ways to improve it.

ALEX SOOJUNG-KIM PANG
is a Research Director at IFTF, currently initiating a new program of research on the long-term future of science.

THE MANAGEMENT OF COMPLEX NATURAL AND SOCIAL SYSTEMS AS IF THEY WERE SIMPLE SCIENTIFIC EXERCISES HAS BROUGHT US TO OUR PRESENT MIXTURE OF TRIUMPH AND PERIL. THE ROLE OF SCIENCE IS NOW APPRECIATED IN THE FULL CONTEXT OF THE UNCERTAINTIES OF NATURAL SYSTEMS AND THE RELEVANCE OF HUMAN VALUES.

So the quality is not merely in the verification, but also in the creation; local people can imagine solutions and reformulate problems in ways for which the accredited experts, with the best will in the world, are not prepared.

Q: ISN'T THIS A PRESCRIPTION FOR DUMBING-DOWN AND ENDLESS GRIDLOCK?

No one can claim that the maintenance of quality through extended peer communities will occur easily and without its own errors. But in the processes of extension of peer communities, we can see a way forward, for science as much as for the complex problems of the environment.

And the post-normal science approach should not be interpreted as an attack on the accredited experts, but rather as assistance. The world of normal science in which they were trained has its place in any scientific study of the environment. But it needs to be supplemented by awareness of the post-normal nature of the problems we now confront. The management of complex natural and social systems as if they were simple scientific exercises has brought us to our present mixture of triumph and peril. We are now witnessing the emergence of a new approach to problem-solving strategies in which the role of science is now appreciated in the full context of the uncertainties of natural systems and the relevance of human values.

Q: AMERICANS ARE STILL FAIRLY POSITIVIST IN OUR THINKING ABOUT SCIENCE-BASED PROBLEMS. IS POST-NORMAL SCIENCE TAKEN MORE SERIOUSLY IN THE UNITED KINGDOM?

My impression is that you have a much more vigorous fringe in America, but the mainstream is decades behind what you have here in Britain. Look at our leading scientists. You've got Martin Rees, who writes a book about science in which he asks whether we'll survive this century—and gives us a 50/50 chance. You have Bob May, who'll tell you that he got into science after joining Greenpeace. You've got the chief scientist, Sir David King, who left South Africa during the days of apartheid. I disagree with him on some issues, like nukes, but he's been out there slugging away on climate change. I wonder, where did these guys come from? What did we do to deserve this?

Q: WHAT IMPACT DOES POST-NORMAL SCIENCE HAVE ON THE WAY SCIENTISTS THINK ABOUT SCIENCE?

I just came back from a meeting in Vancouver, and what emerged there was something remarkable. Lots and lots of nano scientists are worried. We've never before had rank-and-file scientists so worried about the ethics and consequences of what they were doing. You had a sprinkling of atomic scientists during the Cold War, the Asilomar crowd, and the MIT strike in 1968 against military research. I felt it was going to happen sooner or later in some field, and nano is it.

Now, nano scientists have a degree of consciousness, and get really upset at the accusation that they're unethical or uninterested in the consequences of their work. It's not that these people read about post-normal science, but they're part of a different generation, with different career patterns, which means that this is a shift that won't go away. With them, one can imagine things happening in science that were unimaginable before.

EVOLUTIONARY DESIGN: WILL TECHNOLOGY LAP NATURE?

One sign that our current science may still have a ways to go is that we've created a growing list of technologies—and tools for creating new technologies—that we don't entirely understand. Among the most intriguing of these is evolutionary design, which began as a technique for finding optimal solutions to engineering and computer programming problems. With these tools, as James Martin notes, evolution can happen a billion times faster in a computer than in Nature: an ecosystem as complex as the fynbos ecosystem in South Africa can evolve in two days on screen.

As evolutionary design techniques are more widely deployed, the solutions often look radically different from those created by people. University of Sussex scientists using evolutionary programming to design circuits admit "they sometimes don't even understand how their evolved circuits work, despite the fact that they function perfectly as required. It seems that artificial evolution is able to tap into the subtle physical behavior inherent to silicon circuitry." Oxford biologist Richard Dawkins wrote: "Nothing in my biologist's background, nothing in my 20 years of programming computers, and nothing in my wildest dreams, prepared me for what actually emerged" when he created a program that artificially evolved trees. His experience is not unusual.

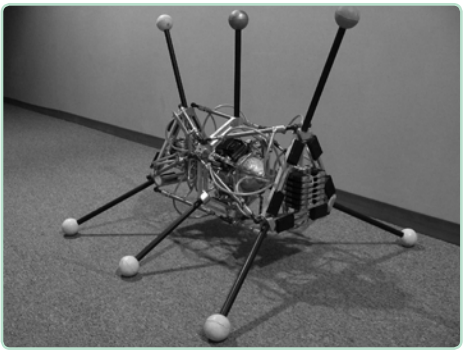
Roboticists at Cornell University use the technique to generate both new robot designs and new ways for those robots to move. The nonaped, for example, has a long, triangular-shaped body with nine legs, six of which touch the ground at any time. (In rugged terrain, this design allows the robot to fall and right itself quickly.) Biological evolution hasn't produced anything like this creature since the Cambrian Era, if then. But evolution doesn't stop there. Because there are no organisms that the nonaped can mimic, scientists have used evolutionary design to generate and test different algorithms for walking.

Evolutionary-design techniques are applied not just to the design of the object, but also to the design of its construction. The Genetically Organized Lifelike Electro Mechanics (GOLEM) project at Cornell is designing programs that evolve creatures that "take advantage of the nature of their own medium—thermoplastic, motors, and artificial neurons" to achieve more efficient means of self-construction. Like the nonaped, these designs have evolved independent of prior ideas about how robots should look; consequently they look nothing like either mechanistic or biomorphic robots. As one NASA scientist says, "We try to give as little antenna knowledge as possible to our software and let evolution be free to design the antenna as it sees fit."

Still more applications: Architects have begun to adopt some of its principles in the design of buildings and industrial infrastructure. Bioscientists have begun to use it as a methodology for creating novel drug molecules. Even game designers are starting to use evolutionary-design processes to generate unique aspects of game worlds and characters.

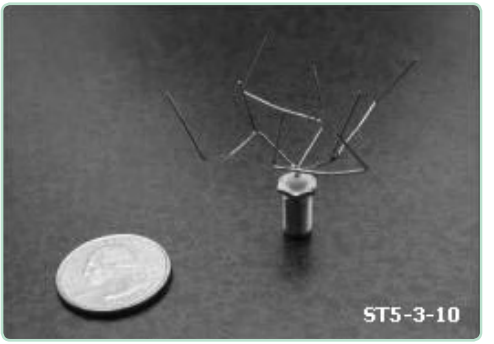
The next step for evolutionary design looks to be co-evolutionary design, relying on competition and cooperation between two or more different populations to accelerate and enhance the evolutionary process.

1 THE NONAPED HAS EVOLVED NINE LEGS AND NEW ALGORITHMS FOR WALKING



Source: http://ccsl.mae.cornell.edu/research/nonaped/images/FullRobot.jpg

2 A NASA ANTENNA THAT HAS EVOLVED ITS OWN FORM



Source: http://ic.arc.nasa.gov/people/jlohn/

EMERGENCE:
EXPLANATORY RULES OR CREATIVE TOOLS?

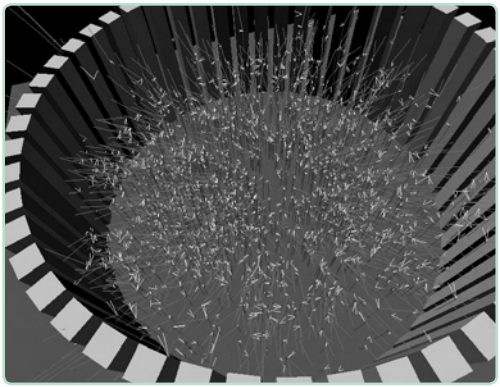
The rapid growth in computing and graphics power has transformed the study of emergence and of the mathematics of self-organization. More powerful computers have been able to run the agent-based models that reveal emergent phenomena in the interactions of large populations. Once you know about them, emergent phenomena seem to be everywhere you look: they appear in chemistry, with compounds that are unexpectedly stable; in biology, in everything from physiology to animal behavior; and in virtually every aspect of social life. But emergence is dogged by two fundamental questions.

First, do agent-based models (or other simulations) reveal the underlying rules governing real physical and social phenomena? Emergence can do a good job of modeling natural phenomena and displaying results that look fairly accurate. But do birds actually avoid collisions using the rules written into flocking programs (to take but one example)? As philosophers and historians of science point out, the ability to conduct experiments that verify or disprove the existence of phenomena or accuracy of theories has long been central to the progress of science. Direct experiments are difficult to conduct on emergent phenomena. Some researchers have argued for similarities between, for example, rat pups and robot dogs. But while suggestive, such comparisons remain speculative.

Second, why does emergence happen? Researchers on emergence are split on how to explain emergent phenomena. Supporters of “weak emergence” argue that emergence can be explained as a consequence of physical and chemical actions (much as thought can be explained as a consequence of neural activity). As Tufts cognitive scientist and weak emergence proponent Daniel Dennett puts it, emergence is “not in principle unpredictable or irreducible or anything like that.” Proponents of “strong emergence,” in contrast, contend that emergence cannot be explained in terms of lower-order phenomena. Australian astrophysicist Paul Davies has suggested an experiment involving quantum entanglement to determine if emergent phenomena are reducible to physical phenomena. Scientists should have the equipment to perform the experiment within the next few decades, he estimates.

We may not understand emergence completely, or even be able to have confidence that what goes on in the simulation is really similar to what happens in the world, but that hasn’t stopped scientists from applying agent-based models to everything from economics to movie animation—often with compelling results. If emergence doesn’t explain the world, it still provides a good basis for creating new ones.

3 3D COMPUTATIONAL MODEL OF FLOCKING BEHAVIOR



Source: http://www.cs.princeton.edu/~jhalderm/courses/boids.gif

FROM BYTES TO EXABYTES: TOO MUCH OF A GOOD THING?

Science has always been about data. Satellites orbiting the earth beam down 100 gigabytes of data every day. The U.S. government's National Oceanographic and Atmospheric Administration (NOAA) has over 650 terabytes of basic scientific data on 364,000 magnetic tapes. In 2002, the Stanford Linear Accelerator Center's BaBar project gathered its 500th terabyte of data and declared itself the world's largest collection of scientific data. NASA's Center for Computational Science has nearly 100 terabytes of data and receives over 200 gigabytes per month.

The challenges are going to become even more severe when the Large Hadron Collider (LHC), the world's largest scientific facility, becomes operational. The LHC, located at CERN on the Swiss–French border, will employ thousands of scientists. Its two major detectors, ATLAS and CMS, will have 2,000 scientists each, organized into complicated hierarchies: subsystem groups, an experimental Executive Board, and an LHC-wide Collaboration Board. The LHC is expected to generate some 10–15 petabytes of data per year. As one CERN scientist puts it, this will be "more than 1,000 times the amount of information printed in book form every year around the world."

Put another way, the LHC will generate, on average, about 1.7 terabytes of data every hour, 41 terabytes a day, and 288 terabytes a week. In one hour, it will generate 15 times as much information as all the satellites orbiting the earth beam down in a day. In less than three weeks, it will generate as much information as NOAA currently stores. That information will be stored and processed in the world's largest computing grid, stretching across over 100 sites in Europe, North America, and Asia.

Still these numbers pale by comparison to the human exchange of information through e-mail and telephone—and these interactive media may more closely resemble the future of scientific machine-to-machine communication as computing grids share resources and as programs become increasingly context aware, searching more or less autonomously for new patterns in content that has been processed in other contexts by other machines. The question is whether there will come a point where that machine-generated knowledge passes verification tests designed by humans but is based on theories that only machines can understand.

4 MEASURES OF INFORMATION

	Number of bytes	Equivalent
Kilobyte	1,000	Half a typewritten page
Megabyte	1,000,000	6 seconds of high-fidelity sound
Gigabyte	1,000,000,000	2 CD-ROMs of digital data
Terabyte	1,000,000,000,000	NOAA climate database
Petabyte	1,000,000,000,000,000	3 years of Earth Observing System data
Exabyte	1,000,000,000,000,000,000	Half of all the information generated in 1999

Source: Adapted from P. Lyman and H. Varian, *How Much Information? 2003*, http://www2.sims.berkeley.edu/research/projects/how-much-info-2003/execsum.htm.

5 COMPARISON OF INFORMATION FLOWS

	Bytes per year
NASA's Center for Computation Science	24,000,000,000
Earth-orbiting satellites	365,000,000,000
CERN's Large Hadron Collider	1,500,000,000,000,000
E-mail (worldwide)	400,000,000,000,000,000
Telephone calls (worldwide)	17,000,000,000,000,000,000

Source: P. Lyman and H. Varian, *How Much Information? 2003*, http://www2.sims.berkeley.edu/research/projects/how-much-info-2003/execsum.htm.

GRAND THEORIES: AT THE LIMIT?

In addition to the challenges of dealing with petabytes of data, more robustly connecting agent-based models to the physical and biological world, or making complex decisions in an era of post-normal science, some observers have made the argument that we're witnessing a larger crisis in science.

Most notably, science writer John Horgan's *The End of Science* contends that the era of new big theories and discoveries may have come to a close. Big theories like Darwinian evolution, electromagnetism, and quantum mechanics have been refined but not replaced. The cost of making fundamental new discoveries is growing tremendously: today's particle accelerators are vastly more expensive than the instruments physicists used to discover the quantum nature of light or map atomic orbits. At the same time, the cost of extending existing knowledge or developing science-based applications is falling: for example, genome sequencing is much cheaper now than when the Human Genome Project began a decade ago. Together, Horgan argues, these trends suggest that all the really big discoveries in science have been made, and we're now just filling in the gaps.

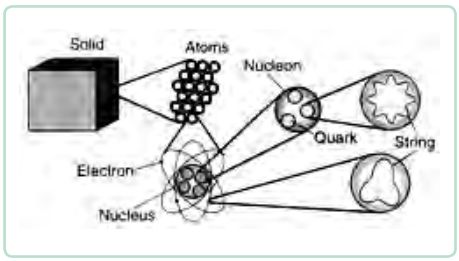
Others note that some scientific questions that once seemed within reach have proven surprisingly elusive. Neuroscience has seen a number of significant advances in instrumentation and application over the last several decades. Magnetic resonance imaging and positron emission tomography let us watch the brain in action. Cochlear implants route around profound deafness by connecting electronics directly to the nerves that link to the brain's hearing centers. More recently, direct brain–computer interfaces have taken this work further, demonstrating that humans and monkeys can learn to control computer cursors and robotic arms through thought. Nonetheless, these advances in *techne* have not been matched by equally profound advances in *theoria*: we can see much more of what happens in the brain but seem no closer to answering the big questions about the nature of consciousness or thought.

Another example of a grand theory that has resisted definitive proof is string theory. Lee Smolin argues in *The Trouble with Physics* that string theory, which promised to provide a unified explanation for the forces of gravity, electromagnetism, and subatomic attraction, has become unverifiable. There are a number of variants of string theory, which have produced an enormous number of predictions—too many to ever be tested thoroughly. More practically, while high-energy particle accelerators at CERN, Fermilab, and elsewhere have managed to create a whole family of subatomic particles by smashing together atoms and electrons, one would need an accelerator 1,000 light years in circumference to generate enough energy to reveal the existence of strings.

The combination of fast-moving experiment and application, on one hand, and slower-moving theory, on the other, has often signaled a coming crisis in science. The early 20th-century revolution in quantum physics and relativity sought to explain anomalies in classical physics observed after decades of experimenting with radiation, crafting electrical devices, and working with power and radio networks. The similarities to today's situation are striking and perhaps foreshadow a 21st-century reorganization of equal or greater proportions.

6 HOW STRINGS MAKE UP MATTER

Beyond direct observation, strings are theorized to be tiny loops of vibrating energy that make up subatomic particles



Source: Virgil Renzulli, "A Universe of At Least 10 Dimensions," *Columbia University Record*, March 27, 1998, http://www.columbia.edu/cu/record/23/18/14.html.

7 HOW STRINGS INTERACT

Two string loops interact by joining together into a third string

Source: Virgil Renzulli, "A Universe of At Least 10 Dimensions," *Columbia University Record*, March 27, 1998, http://www.columbia.edu/cu/record/23/18/14.html.

WHAT TO DO

EDUCATION:

TEACH THE CONTROVERSY, LEVERAGE SUPERCOMPUTING, BUILD TRANSDISCIPLINARITY

Whether or not we're headed for the end of science, uncertainty will increasingly dog basic science. To prepare, science institutions should not retreat from the controversy, but rather, incorporate the many controversies posed by the potential limits of scientific investigation into student curricula at all levels and prepare the next generation to think beyond the so-called limits of science. Universities in particular should provide future scientists with a new literacy of abundant computing: as we move toward a world where abundant supercomputing power will be readily available, researchers will have new tools to apply to solve a whole range of problems. Finally, academic, research, and corporate R&D institutions need to move beyond *interdisciplinarity* to *transdisciplinarity*. Where the former focuses on collaboration among experts with different expertise, the latter emphasizes researchers who are trained in more than one discipline. Ultimately, the potential is to bring a more sophisticated perspective to research—perhaps analogous to the advance from CAT scans to MRIs. This more sophisticated view will elevate the discourse on what science is, what research can and can't do, and what should be included in the scope of the R&D project. Companies should start now in their quest to hire people with transdisciplinary skills and encourage R&D groups to build trandisciplinary teams.

R&D:

HARNESS EVOLUTIONARY DESIGN AND EMERGENCE IN HUMAN SCIENTIFIC EFFORT

With abundant computing power and an increasingly networked world, there is a potential for sharing the burden of solving our most vexing scientific problems with a wider universe of scientists—and doing it in a way that consciously mimics the principles of evolutionary design and emergence. Such tools and processes don't just mean better collaboration or schemes for sharing and analyzing data across more institutional boundaries, although those will be important. This approach also goes beyond applying the tools of evolutionary design and emergence to more problem spaces. It is fundamentally an organizational problem: how to redesign the organization of R&D to harness the invisible intelligence in these processes. If people are learning agents of the kind that iterate and evolve in evolutionary programs, how do we organize them to evolve in the same way—and ultimately contribute to an unexpected collective solution?

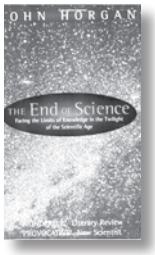
CULTURE:

ANTICIPATE TRANSHUMANIST STRATEGIES TO DEAL WITH THE PERCEIVED LIMITS OF SCIENCE

Individuals will deal with perceived limits of science in different ways. For example, some may seek more answers from religion. Others are likely to turn to what we call X-People attitudes and behaviors—the extension of human capacity to sense, to think, to interact. A new generation is already turning to drugs that enhance cognitive performance and tools that capture vast stores of data for later access in a kind of "external wearable memory." Whether or not these practices will produce the transcendent insight that launches the next scientific revolution, they cut to the quick of human identity and are precisely the kinds of behaviors that are likely to incite religious backlash.

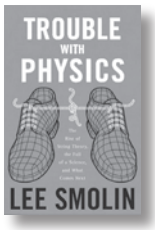
WHERE TO LOOK

John Horgan's
The End of Science,
Abacus, 1998



Horgan argues that all the really big discoveries in science have been made, and we're now just filling the gaps.

Lee Smolin's
The Trouble with Physics,
Houghton Mifflin, 2006



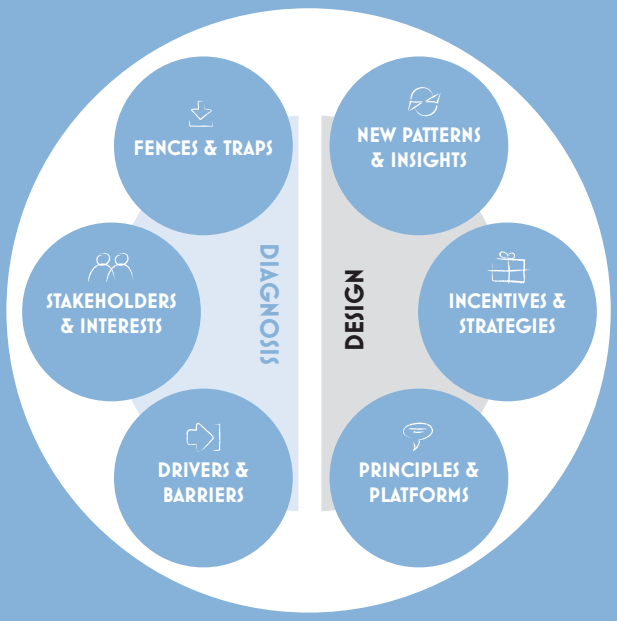
Smolin argues that string theory, which promised to provide a unified explanation for the forces of gravity, electromagnetism, and subatomic attraction, has become unverifiable.

METHODOLOGY:

THE OPEN ECONOMY TOOLKIT

The open economy is rooted in the convergence of three forces for change: the rise of flexible network structures, the dynamics of self-organizing groups and systems, and the practices and principles of cooperation. Today, the combination of these forces presents a powerful shift in social, economic, and cultural production. New forms of production leverage individual creativity and self-interest. They create value out of shared, open resources. And they distribute decision making and management away from the top or center of systems and out to the edges.

A major challenge for creating sustainable organizations, communities, and systems in this new environment is moving from current practices and processes to new strategies that will take advantage of the open economy and the new sources of value it promises. The Open Economy Toolkit is designed to help people meet this challenge—whether they are trying to develop innovative business strategies or solve complex social problems.



The Open Economy Toolkit is a six-step process for rethinking complex issues in new terms—to resolve tensions in seemingly intractable dilemmas. It includes thinking tools, exercises, and a process for designing open economy strategies. It incorporates a series of frameworks for:

- Analyzing complex systems—especially the so-called social dilemmas where the open economy can provide innovative solutions and generate new value
- Tuning organizations and situations for better cooperation—drawing on the research of scientists across the leading disciplines
- Understanding design choices—and the technologies that can support them

This document describes the toolkit. To see how it might be applied in diagnosing a complex social situation, see "Education: Open Economy Makeover."

This work was supported by IFTF's Ten-Year Forecast Program, under the leadership of Andrea Saveri and Kathi Vian, in collaboration with Jamais Cascio, Peter Kollock, Jerry Michalski, and Howard Rheingold. To use The Open Economy Toolkit in your organization, contact **Andrea Saveri** (asaveri@iftf.org).

THE OPEN ECONOMY TOOLKIT IS A SIX-STEP PROCESS FOR RETHINKING COMPLEX ISSUES IN NEW TERMS

INSTITUTE FOR THE FUTURE

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THE TOOLKIT: SIX STEPS TO AN OPEN ECONOMY STRATEGY

The Open Economy Toolkit is a six-step process for systematically diagnosing opportunities for innovation and designing strategies that take advantage of the open economy principles. It's an iterative process that can be integrated into corporate strategic planning, community development efforts, public policy, or even forecasting exercises. It is not a one-time, one-afternoon project, but rather a way of thinking about problems that can become a basic toolkit for business, government, and social entrepreneurs.

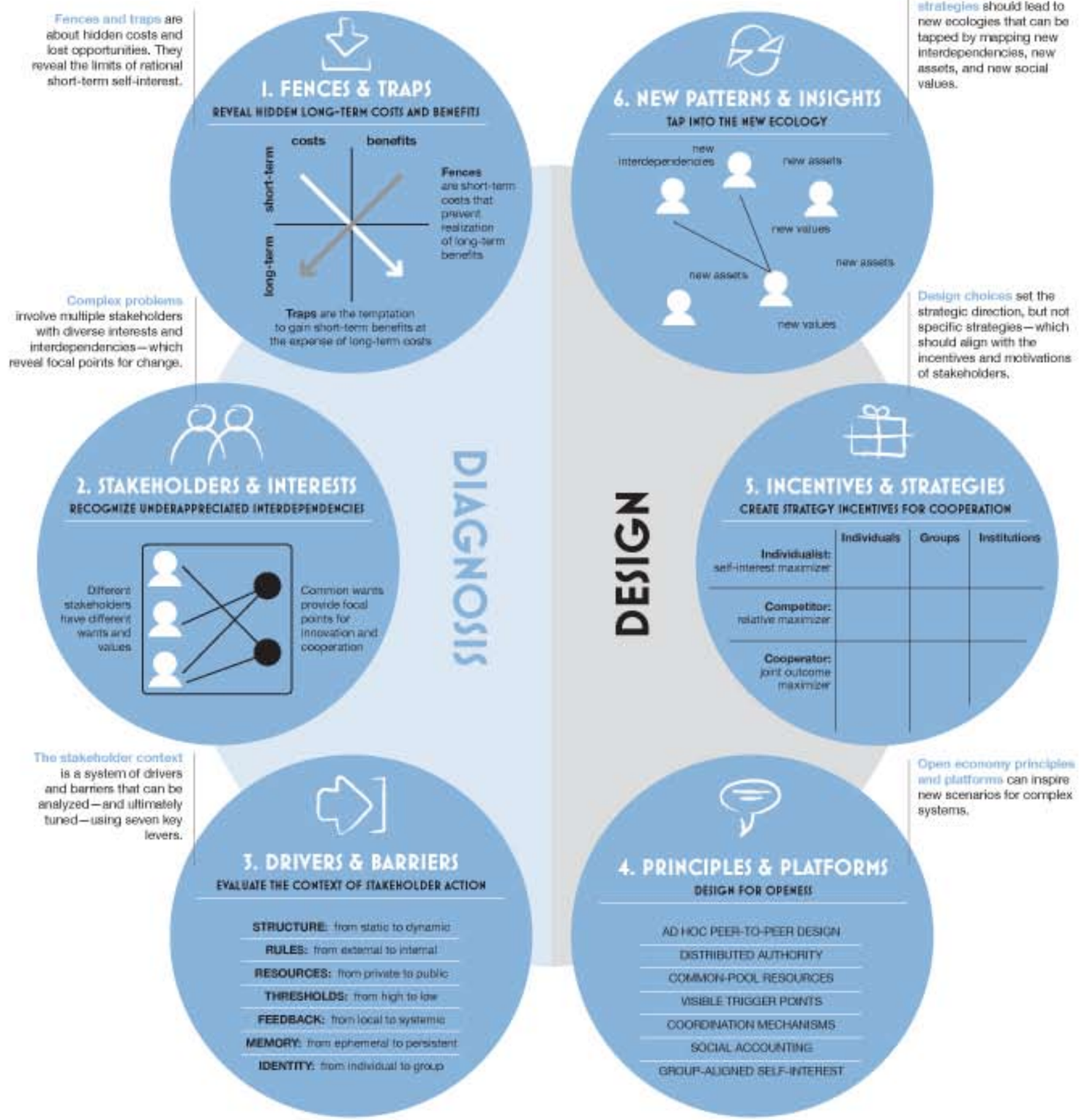
Just as traditional economics requires a basic understanding of supply and demand, of inputs and outputs, and of market dynamics, the open economy requires an understanding of four key dynamics: social dilemmas, networks, self-organizing systems, and cooperative theory. These basic forces shape both the problems to be solved in the open economy and the opportunities for innovation. They also provide a foundation for the thinking tools and strategies in The Open Economy Toolkit.

SOCIAL DILEMMAS

A core assumption of The Open Economy Toolkit is that many challenges and opportunities we will face as we adapt to the open economy stem from the tensions of so-called social dilemmas—tensions between the interests of the individuals (or groups) and the whole. According to sociologist Peter Kollock, such dilemmas arise when individual rational behavior leads to irrational outcomes in which everyone is worse off. Social dilemmas have been described in the literature in terms of three classic narratives:

- The prisoner's dilemma, which illustrates the failure to cooperate in a transaction with incomplete information.
- The tragedy of the commons, which illustrates the temptation to abuse a common-pool resource that is easily depleted.
- The failure of public goods, which illustrates the challenge of reaching and maintaining a threshold of participants to contribute to the creation of a public resource, knowing that some users of the resource will not contribute and become free riders.

Social dilemmas have always existed, but in a world of increasing network connectivity, group formation, and personal empowerment and expression through social media, they are likely to become more widespread across many domains, institutions, and levels in our society.



FLEXIBLE NETWORK STRUCTURES

As Walter W. Powell has argued, networks are a distinct organizational form, different from either the hierarchies of nation-states or the markets of the commercial world. Networks, like dilemmas, have always existed, but new technologies have made it easier to build, visualize, monitor, and even monetize networks. They have elevated so-called smart networking to a basic skill set for everyone from the most sophisticated business consultant to youths moving from the rural villages of China into its urban manufacturing economies.

Networks tend to diversify and scale more quickly than hierarchies because they cross boundaries more easily and distribute intelligence to the edges. This tendency makes them natural disruptors for business and social strategies that focus on centralized leadership and effective boundary control. Networks also have a resilience that hierarchical organizations achieve only at considerable overhead costs. Taking out a leadership node does not destroy a network, which simply reforms around a new node. In the open economy, the explosion of social media has amplified the disruptive potential of networks, enabling individual agents to find each other and form affinity groups. Blogs, wikis, social software, instant messaging, and buddy lists all make this process both easier and more visible—and, perhaps most important, self-organizing.

SELF-ORGANIZING SYSTEMS

Self-organization is the process under which an adaptive system redesigns itself when it has been disrupted by internal or external factors and has lost its equilibrium. Typically the new state is emergent, rather than planned because it has not been experienced before and cannot be engineered with existing knowledge and skills. Emergence is the outcome—a new state or condition. Examples of emergent self-organization include the swarming behavior of bees or our immune system's resistance to influenza.

Bottom-up emergent systems can provide solutions to complex problems and mobilize resources rapidly. Yet directing an ad hoc distributed system is difficult. Tapping the power of self-organizing systems thus requires a new set of skills and strategies—many of which emerge from the nascent theory of cooperation.

COOPERATIVE STRATEGY

Over the last few decades, scientists and researchers from many fields have begun to create the building blocks of a new interdisciplinary theory of cooperation—as well as specific practices and principles to enhance cooperative behavior. This work on cooperation suggests new strategies for creating wealth and forms of value by assuring shared advantages and increasing resources for the whole. In general, cooperative theory reframes competitive situations as non-zero-sum games.

A key challenge of cooperative strategy is to enlist selfish interests to build and maintain a common pool of resources. By carefully restructuring incentives, groups can create conditions where so-called free riding can become a benefit rather than a detriment to the commons. Indeed, this ability to recast free riders as resources in the system has been central to many of the commercial and social successes of the Internet.

BEFORE YOU START

Most people come to a strategic design process with a general sense of a problem to be solved or a need to be addressed. They also often arrive with many possible responses or solutions. The Open Economy Toolkit takes these basic inputs—the problem statement and possible responses—and uses them to reveal the embedded social dilemmas and ultimately to discover open economy designs that can transform those dilemmas.

So even before you start the toolkit process, you should:

- Descibe the problem in general terms
- List the key solutions or responses that have been proposed

Ultimately the toolkit will lead you away from this problem-solution mindset to one in which you understand the complexity of the situation and use that complexity to inspire new kinds of thinking and create new kinds of value. But it's important to start with a problem and a list of possible solutions or responses. This will provide the focus for the in-depth diagnosis and design activities in the toolkit.

A MARKETPLACE EXAMPLE: ORPHAN-DISEASES

The problem: One of the ongoing problems in the pharmaceutical industry is the lack of attention paid to so-called orphan diseases—those that afflict relatively small populations or very large populations that can't afford to compensate drug companies for their investment in research, development, and testing.

Some responses:

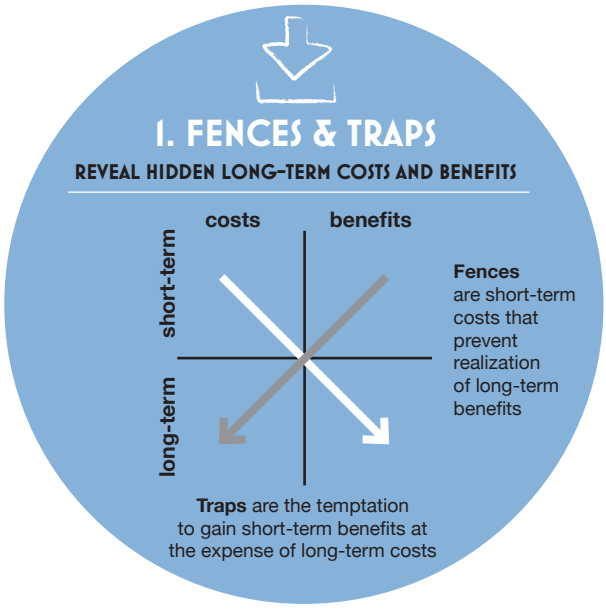
- Government and institutional investment in medical research
- Transnational community-based R&D programs like the Tropical Disease Initiative
- R&D solutions markets
- The mirror-image practices of restrictive patents on one hand and piracy on the other
- Distributed desktop R&D or so-called laptop science

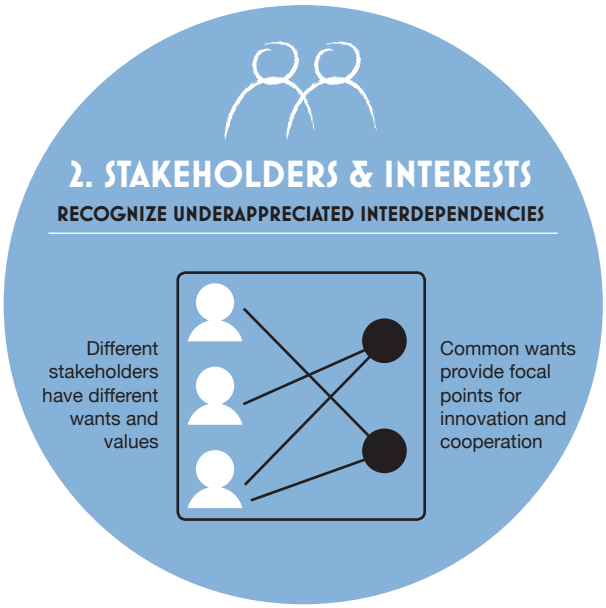
A SOCIETAL EXAMPLE: K–12 PUBLIC EDUCATION

The problem: The public has lost much of its faith in the ability of public education to provide broad access to quality education and learning for all students. Families with economic means are increasingly opting out of public schools while dropout rates for students and teachers are high. People question the value of public education for both civic and career preparedness, and in general, there is growing disrespect for K-12 education as a public institution.

Some responses:

- Charter schools
- National accountability system
- Smaller schools
- Schools as community centers
- Financial reform





STEP 1

Fences and traps are about hidden costs and lost opportunities. They reveal the limits of rational short-term self-interest.

EXERCISE:

Identify the short- and long-term costs and benefits of each suggested response. Pay special attention to the diagonal relationships as you move from short to long term. These are the tensions that create social dilemmas.

For each short-term cost, identify the possible long-term benefits of this cost that could emerge over time and in the aggregate. These are fences.

Example:
In the K–12 education, charter schools are often criticized for diverting dollars from public schools. But these short-term costs could create greater autonomy and innovation in education in the long term.

For each short-term benefit, identify the possible costs that could arise over the long term and in the aggregate. These are traps.

Example:
In the orphan-disease example, the short-term benefits of solutions markets, with cheaper solutions based on volunteer labor and individual rewards to the prize winner, mask the long-term costs that accrue from the failure to develop a shared body of knowledge (either within a company or across institutions); this shared resource could be used to address other disease situations.

STEP 2

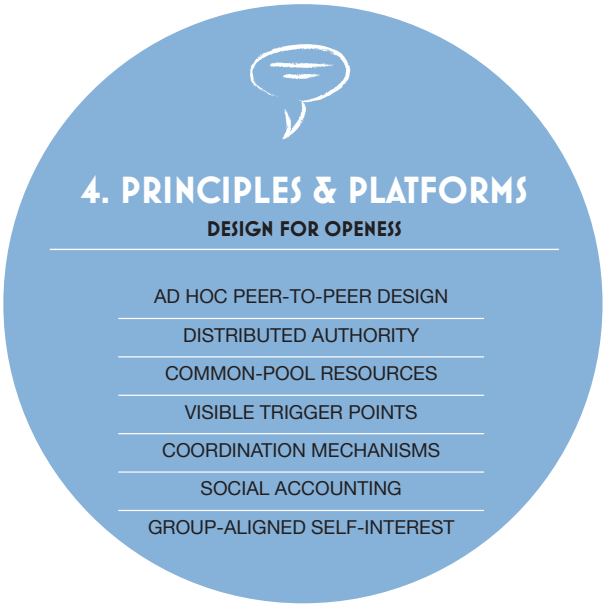
The second step is about recognizing the interdependencies of diverse stakeholders—by analyzing their various wants and values. Playing a connect-the-dots game across these stakeholder objectives will reveal focal points for innovative solutions.

EXERCISE:

For each possible solution, describe the wants and values of various stakeholders. Then identify where some of these wants and values converge—these are key interdependencies that can form the basis of cooperative strategies.

- Who are the major stakeholders in the problem?
- What are the wants and values that drive their short-term actions?
- What are their interdependencies—shared wants or values—that could form the basis of cooperation for overcoming fences and traps to achieve long-term benefits or avoid long-term costs?

Example:
In the case of orphan diseases, the stakeholders include entrepreneurial scientists who want to solve problems, make a distinct contribution, and win prizes; pharmaceutical companies who want to leverage their marketing expertise and minimize their development costs as well as meet demands for globally responsible practices; individuals or regions who struggle with orphan diseases and want solutions; and national health institutes who want to build the body of medical science. A common focal point for scientists, pharma companies, and national institutes is the need for a body of knowledge that can be leveraged to find rare-disease solutions.



STEP 3

Stakeholders make choices and take actions in an institutional context that has its own drivers and barriers. Cooperative theory tells us that these drivers and barriers can be altered by making changes in seven key dimensions of this context, shown above. We can think of these as tuning levers that can tune up the system for cooperation. But first, we must understand the current drivers and barriers.

EXERCISE:

Use the cooperation levers to help describe the institutional context of each stakeholder and their interests related to the fences and traps.

- How does each lever act as a barrier or an enabler to resolving the tensions of the fences and traps?
- Which levers offer the most promise for changing the context of stakeholders and their incentives for action?
- Which levers create the most problems for resolving social-dilemma tensions?

Example:
In the case of K–12 education, charter schools suffer from the lack of systemic feedback and shared identity, and the prevalence of competitive resource strategies prevents public school districts from learning from charter school innovations.

STEP 4

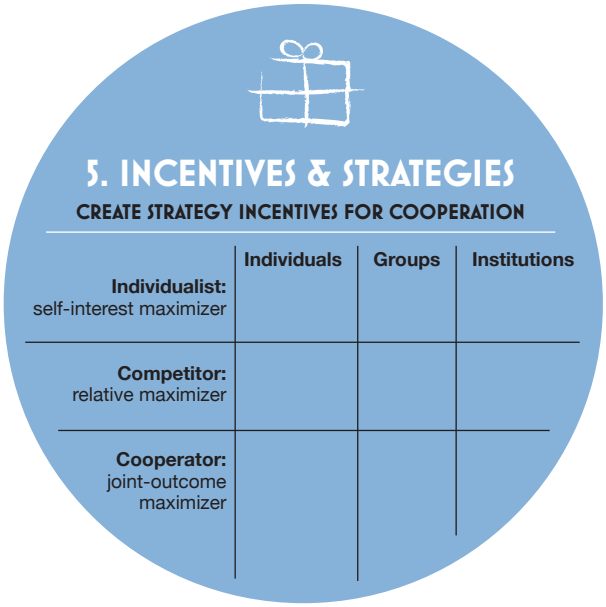
This step begins the shift from diagnosis to design as we examine how some key design components of the open economy can help support the drivers and overcome the barriers identified in Step 3. Open economy experiments have already demonstrated the potential for transforming dilemmas and creating wealth through seven key design principles, shown above.

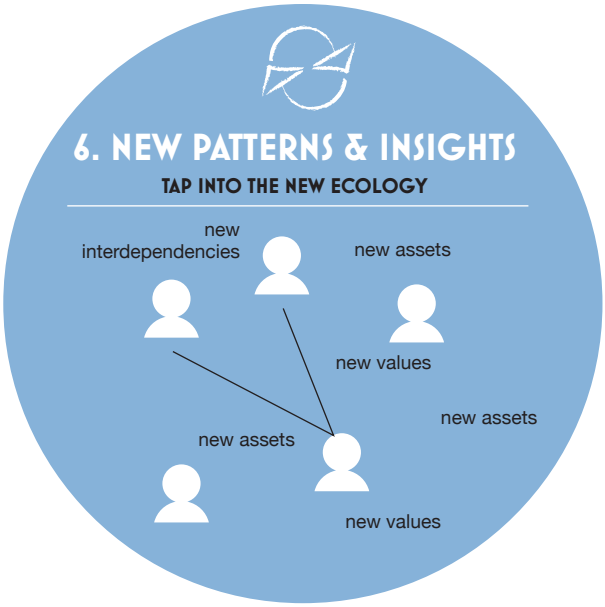
EXERCISE:

Identify and describe how specific design choices can help lower fences and avoid traps.

- Which design choices can leverage drivers to help resolve the social-dilemma tensions?
- Which design choices would tackle the biggest barriers to resolving these tensions?
- What changes would need to be made in the organization/system to implement these design choices?
- How will specific levers need to change to achieve distinct design choices?

Example:
In the case of both education and orphan diseases, social accounting systems could be used to encourage contributions to a common-pool resource of innovative knowledge as well as evaluate the quality of solutions, whether educational or medical.





STEP 5

Design choices offer strategic direction but do not specify actions. Actions are driven by incentives and perceived outcomes or payoffs. Step 5 focuses on describing the incentives that will motivate individuals, groups, and institutions and help make design strategies successful. These strategies must recognize three classes of actors—individualists, competitors, and cooperators—and look for implementations of the design principles that provide incentives for these types of actors.

EXERCISE:

Map incentives of major stakeholders—individuals, groups, and institutions—that will drive successful implementation of strategic design choices. Then design your strategy to maximize those incentives.

- Which stakeholders, in which situations, are acting as individualists, competitors, and cooperators?
- How can you use these incentives in an open economy design to take advantage of these behaviors in a way that will create greater value for everyone?

Example:
In the case of education, PTAs act as competitors for resources in the district, but a district-wide competition could bring them together to share fundraising strategies and increase the effectiveness of all the PTAs—as well as the overall flow of educational funding in the district.

STEP 6

Once a strategy is implemented, traditional problem-solving approaches tend to focus on evaluation, but open economy approaches anticipate new dilemmas and look for new opportunities for value creation. These opportunities are likely to be found in new interdependencies among the stakeholders, in new assets and resource flows in the system, and in new values that emerge from the new practices and relationships in the system.

EXERCISE:

Actively scan for new patterns of interaction and flows of resources that suggest new dilemmas and new opportunities for innovation and new value creation.

- Map new social networks and relationships across stakeholders.
- Identify tangible and intangible assets across stakeholders.
- Identify new kinds of resources, values, and stakeholders.
- Iterate the entire six-step process to identify new fences and traps, shifting stakeholder interests, and design innovations.

Example:
In the case of charter schools, a shared innovation commons with social accounting processes might highlight the best contributors in a district and create the opportunity to link them to donors who might support future distributed innovation efforts by these contributors.

DETAILS

TUNING UP FOR COOPERATION:

SEVEN LEVERS

Over the last 50 years, researchers in such diverse fields as mathematics and political science, biology and sociology have been studying cooperation, deriving principles that have great relevance to the open economy.

From this work, we have identified seven key levers that can be used to understand the cooperative potential of an organization, institution, or strategy—and ultimately guide us in designing new institutions and strategies. The seven levers are:

1. Structure refers to the configuration of actors and processes in an organization and their interrelationship. Structure can range from static to dynamic.

2. Rules provide a framework for interaction in a system, setting the boundaries that delineate acceptable behavior. Rules range from external to internal.

3. Resources can be organized according to various regimes that set the conditions and rights for their use. Resource regimes range from private to public.

4. Thresholds reflect points of transition in a system. Threshold trigger points range from high to low.

5. Feedback frames the information context of a system and the knowledge horizon of its actors. Feedback flows range from local to systemic.

6. Memory is a form of stored knowledge that generates future action. Memory about people, places, actions, and things ranges from ephemeral to persistent.

7. Identity helps delineate group boundaries and establish trust. Forms of identity range from individual to group.

DESIGNING FOR AN OPEN ECONOMY:

SEVEN DESIGN CHOICES

The open economy embodies the principles of networks, self-organizing systems, and new cooperative strategies. These offer design choices that can overcome fences and traps—and provide platforms for success in the emerging economy. Seven key design choices that have already demonstrated the capacity to change system behavior and create new value are:

1. Ad hoc, peer-to-peer production aggregates distributed resources and local expertise.

2. Distributed authority pushes rule making, monitoring, and sanctioning to the periphery.

3. Common-pool resources aggregate critical shared resources sustained by collective action and leverage free riders rather than punish them.

4. Visible trigger points signal transition to new conditions and spur actors in the system to new behaviors without centralized control or top–down monitoring.

5. Coordination mechanisms allow local and system-wide functions or processes to work together without depending on economies of scale or centralized control.

6. Social accounting establishes trust, reduces uncertainties, and reveals the most valuable players, contributions, or assets in a system.

7. Group-aligned self-interest connects individual self-interest with collective benefit, assuring payoffs for the system as well as the individual.

For more information about how to apply the toolkit to strategic-planning challenges in your organization, please contact **Andrea Saveri** (asaveri@iftf.org).

DATA:

2006 TEN-YEAR FORECAST SIGNALS SURVEY

Survey methodologies have always been part of IFTF's forecasting toolkit. In its earliest days, founding member Olaf Helmer advanced the Delphi method for aggregating expert opinion. Through the late 1980s and into the early 2000s, sociologist Andrea Saveri and economist Greg Schmid worked on some of the first surveys designed to tap people's views on things they have yet to experience. With these surveys, we characterized infomated households, future workspaces, and the New Consumer—lead users of information-rich technologies that would reshape the landscape of consumer spending. Today, sociologist Mani Pande leads our survey work, bringing a new perspective to what we now call our Ten-Year Forecast Signals Survey.

Signals have become part of IFTF's lexicon of forecasting, especially following Paul Saffo's essay on "Weak Signals" in the *2005 Ten-Year Forecast*. In that forecast, Paul considered the relative value of a few strong, well-defined signals versus clusters of many weak signals—suggesting that in a world of uncertainty, the latter could be more useful.

Strong signals can also be seen as those that are very apparent because they're already widely diffused in the population. These are most useful for near-term forecasting. In contrast are distinctive sets of weak signals that, while much less diffused, point to possibilities that might distinctly change the character of the future.

Our 2006 Ten-Year Forecast Signals Survey produced both strong and weak signals. There are many ways to identify and evaluate the signals. In the case of our Signals Survey, a first step is to develop indexes—clusters of behaviors and attitudes that, taken together, define emerging patterns of innovation or clear trends in a particular area. Having developed these indexes, we can then return to the individual survey questions to highlight the most important responses and cluster them in ways that let us see them as a kind of "signal cloud." These can then be graphed from weak to strong to give us an at-a-glance view of the big transitions in the emerging landscape.

In this summary of the 2006 survey, we provide an overview of six indexes: five are reported in-depth elsewhere in this volume; the sixth is our X-People Index, which is detailed here. In addition, we include our 2007 Signals Survey Summary Graph.

For more information about our Ten-Year Forecast Signals Survey and our analytical methods, please contact **Mani Pande** (mpande@iftf.org).

THE SIGNALS SURVEY OFFERS A QUANTITATIVE VIEW OF WEAK AND STRONG SIGNALS OF CHANGE

OUR METHODOLOGY

The 2006 Ten-Year Forecast Signals Survey surveyed 2,002 adults aged 18–74 living in the United States. The sample was weighted to match national parameters for sex, age, education, race, Hispanic origin, and region.

The survey covered a wide range of topics including work, education and learning, creative activities and hobbies, health and nutrition, technology, mobility, extended self, and media. Responses for most questions were collected on a Likert scale that measures positive or negative responses to a statement. These data were treated as ordinal for further analysis. Ordinal data do not have a distribution that resembles a bell curve or what statisticians call a "normal distribution." This raises challenges in data analysis because most statistical techniques are not robust when the data don't have a normal distribution.

Therefore we used structural equation modeling using LISREL for the analysis of the data. Structural equation modeling assumes that for each ordinal variable Z there is an underlying continuous variable Z*. The underlying variable Z* is used in structural equation modeling in place of the observed variable Z. This underlying variable assigns a metric to the ordinal variable, allowing us to use traditional multivariate techniques like factor analysis.

We thus employed confirmatory factor analysis (CFA) for ordinal data using structural equation modeling to build each of the indexes. CFA lets us hypothesize a model based on theory and previous research—and then analyze the fit of the model with the data. The fit can be determined by looking at goodness-of-fit indexes that statisticians have developed over the years. If the model has an acceptable goodness of fit, it forms the basis of an index. Each factor in the index accounts for the intercorrelations of multiple response variables. Factor analysis thus allows us to identify a latent or hidden set of factors.

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THE INDEXES

This year, IFTF developed six indexes for leading behaviors and attitudes. An index allows one to compare the entire survey population for clusters of responses rather than single responses; it can also be used to score individual respondents and correlate them with other indexes or to specific questions in the survey. This year's indexes are:

Do-It-Yourself

The profile of do-it-yourselfers that emerges from this index is a substantial segment of people who are self-organizing and increasingly skilled at what we call "online sociability." These people tend to be young and married, often self-employed, actively engaged in their own health, concerned about sustainability issues, and likely to use digital tools for a range of online collaborative activities, including online giving to political and religious organizations. There are no correlations between high DIY scores and gender, race, religion, native U.S. citizenship, or political views. For more details, see "Manufacturing: Do It Yourself?"

Sustainable Citizens

Sustainable citizens are people who create a link between personal care and healthy communities. They tend to buy locally, support local farmers, recycle and buy recycled goods, eat organic food, buy products that are not tested on animals, and consider health benefits when buying many different kinds of products. They tend to be do-it-yourselfers and smart networkers who contribute to online sites. They also fit the profile of X-People.

They are almost mainstream in U.S. society. For more details see "Communities: Citizens of Sustainability."

Smart Networking

We first created the Networking IQ Index in 2005. We updated it this year based on survey results, which showed a number of key behaviors around group participation, collective behavior, online lifestyle, mobile communication, locative behavior, and computer connectivity. Youth have the leading edge in this index, which is still a "lead-user" phenomenon. More men than women score high; they have a slightly higher education level and they tend to be slightly more liberal in their politics. There is no relationship with income. For more information, see "Culture: Digital Natives, Civic Spaces."

Collective Behavior and Sociability

Two key sets of behaviors define this index: social-network development and social-identity creation. As with the Smart Networking Index, high-scorers on this index tend (slightly) to be young, male, and better educated. There are no political, religious, or income correlations with this index. For more information, see "Culture: Digital Natives, Civic Spaces."

Literacy of the Commons

The Internet represents a new kind of commons, and a small population of lead users is defining a new literacy for it. This literacy involves two main factors: maintaining the commons and personal expression. Again, the lead population here tends to be younger, though there is no correlation with gender, education, political affiliation, or income. For more information, see "Culture: Digital Natives, Civic Literacy."

X-People

Based on research over the last few years, we have identified a trend toward what we call "extended self." To determine the nature and extent of this trend, we developed an X-People Index. The two defining attitudes of X-People concern factors that we call artificial bodies and transhumanist values. When we score all the survey respondents, it turns out that the X-People profile is normally distributed—that is, nearly mainstream. For more information, see the back page of this survey summary.

SIGNALS SURVEY SUMMARY GRAPH

WEAK (0–16%)	LOW MODERATE (17–50%)	HIGH MODERATE (51–84%)	STRONG (ABOVE 84%)

11% | Use blog or wiki with team members to share information, post comments, and provide updates

7% | Use tagging software to let team members see what you're reading and bookmarking

3% | Create audio or video media such as a podcast for free online use by others

2% | Contribute to open-source programming like Linux

3% | Contribute to a public wiki such as Wikipedia

2% | Use tagging services like del.icio.us

13% | Post family or personal pictures online for others to see

4% | Subscribe to RSS feeds from blogs or other Web sites

7% | Regularly contribute comments or pictures to a blog

7% | Have a personal blog

9% | Belong to an online community such as Meetup or Friendster

2% | Watch entertainment on a video iPod

14% | Get news from blogs

14% | Watch entertainment on a mobile phone

19% | Watch entertainment on TiVO or other digital video recorder

25% | Watch entertainment from on-demand cable TV

33% | Use public transportation to help reduce carbon emissions

38% | Choose to live in areas with greenbelts and sustainable wildlife policies for health and well-being

38% | Download content such as music or video

42% | Leave e-mail or IM open on a computer, PDA, cell phone, or other mobile device

50% | Talk to people online

40% | Believe humans should use body arts such as piercing, binding, and tattooing to express their individuality

47% | Believe humans should develop their ability to communicate directly with other animal species

42% | Believe humans should redefine lifestages rather than following the normal progression of childhood, adolescence, adulthood, and old age

35% | Watch entertainment that has been downloaded to a computer

43% | Seek health benefits in things for yard or outdoor space

37% | Seek health benefits in travel or vacation packages

32% | Seek health benefits in personal electronic devices such as mobile phones or MP3 players

46% | Seek health benefits in furniture for home or home office

49% | Buy from companies that contribute to environmental organizations

49% | Buy products that have not been tested on animals

50% | Participate in community projects for health and well-being

50% | Buy products that protect the rights of farmers and laborers

51% | Buy locally made products for health and well-being

53% | Buy products that promise minimal impact on the environment for health and well-being

53% | Choose where to work

58% | Support local farmers for health and well-being

57% | Believe humans should extend their senses beyond the boundaries of their physical bodies

54% | Seek health benefits in kitchen utensils like pots, pans, or bakeware

57% | Seek health benefits in household appliances like vacuum cleaners, washers, and dryers

59% | Seek health benefits in clothing or shoes

59% | Seek health benefits in automobiles

59% | Seek health benefits in home materials like insulation, carpet, or air filters

65% | Believe prayer or meditation is important to maintain health

67% | Leave computer connected to the Internet

65% | Believe humans should be able to develop personal networks that include hundreds of people around the world

67% | Believe humans should be able to process more information more quickly in order to interact more effectively

68% | Recycle and buy recycled goods for health and well-being

70% | Believe having an active sex life is important to maintain health

73% | Believe seeing a health care provider regularly is important to maintain health

74% | Work on a flexible schedule that meets family commitments

74% | Believe humans should be able to replace body parts that fail or are damaged

73% | Get news from online news Web sites

70% | Seek health benefits in household cleaners and laundry detergents

70% | Seek health benefits in grooming or beauty aids

78% | Seek health benefits in personal hygiene products like soaps or shampoos

82% | Believe spending time outdoors is important to maintain health

83% | Believe knowing your family's medical history is important to maintain health

85% | Believe eating healthy foods is important to maintain health

86% | Believe having health insurance is important to maintain health

86% | Believe having a clean home is important to maintain health

90% | Believe spending time with family and friends is important to maintain health

85% | Believe avoiding stress or mental harm is important to maintain health

90% | Seek health benefits in food

WORKSTYLES
SOCIABILITY & ONLINE COMMONS
MEDIA USE
HEALTH & SUSTAINABILITY
EXTENDED SELF
HEALTHY LIFESTYLES
HEALTH ECONOMY

THE SIGNALS SURVEY SUMMARY GRAPH

Social scientists have used the distribution of the bell curve (normal distribution) to classify stages of diffusion. For example, Everett Rogers, one of the founders of innovation theory, classified adopters of new innovations as innovators, early adopters, early majority, late majority, and laggards based on the distribution of the bell curve. We have also used the distribution of percentages in a bell curve to classify our signals into four categories from weak to strong.

LEAD USERS	EARLY ADOPTERS	MAJORITY ADAPTATION	ESTABLISHED PRACTICE

X-PEOPLE: A PERVASIVE CULTURAL BIAS

As individuals discover that technology can extend their bodies and minds—and even their lives—beyond what has been taken to be normal for humans, a segment of the population is working to resolve two inherent contradictions of contemporary life. The first is conflicting trends toward increased individuality versus collective identity. The second is the power of technology versus the integrity of the natural world. We call this segment "X-People" for the extensions they are experimenting with.

X-People express a kind of transhumanism—that is, a sense of connectedness with the larger world, on one hand, and a positive belief in the potential for rapid human evolution, on the other. At the same time, they also see the body as a platform for highly individual experimentation and expression, with a disregard for what's "natural." In short, they define themselves by two factors: artificial bodies and transhumanist values.

While it often appears that X-People are outliers, the survey results show that the underlying attitudes are actually pervasive in U.S. culture: the distribution of X-People scores across the population is nearly normal.

1 THE FACTORS THAT DEFINE THE X-PEOPLE INDEX

FACTOR 1: ARTIFICIAL BODIES

Agree with:

- Using body art such as piercing, binding, and tattooing to express their individuality
- Ability to replace body parts that fail or are damaged

Disagree with:

- Never tampering with your own body
- Making the most of safe technologies to enhance personal capabilities
- Ability to process information more quickly in order to interact more effectively

FACTOR 1 is a measure of the extent to which humans think of the body as a platform for individual self-expression and experimentation; it captures the desire for a fierce individuality and a disinterest in collectivity.

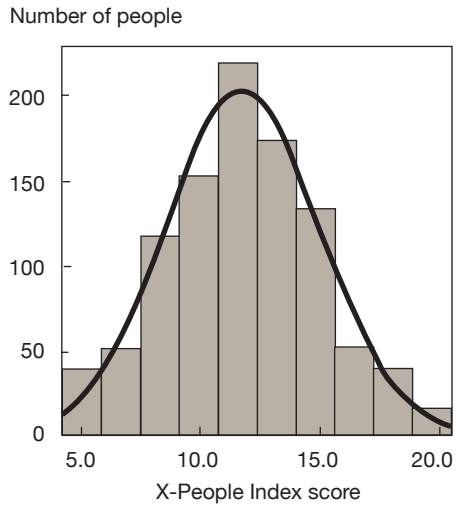
FACTOR 2: TRANSHUMANIST VALUES

Agree with:

- Making the most of safe technologies to enhance personal capabilities
- Never tampering with your own body
- Ability to shed old skin in favor of new, just like snakes
- Ability to process more information more quickly in order to interact more effectively
- Developing ability to communicate directly with other animal species
- Ability to live forever in the foreseeable future
- Redefining life stages rather than following the normal progression of childhood, adolescence, adulthood, and old age
- Ability to replace body parts that fail or are damaged

FACTOR 2 is a measure of the extent to which humans are willing to extend and evolve human capabilities individually and participate in reshaping collective capacity.

2 DISTRIBUTION OF X-PEOPLE INDEX SCORES



Source: 2006 Ten-Year Forecast Signals Survey

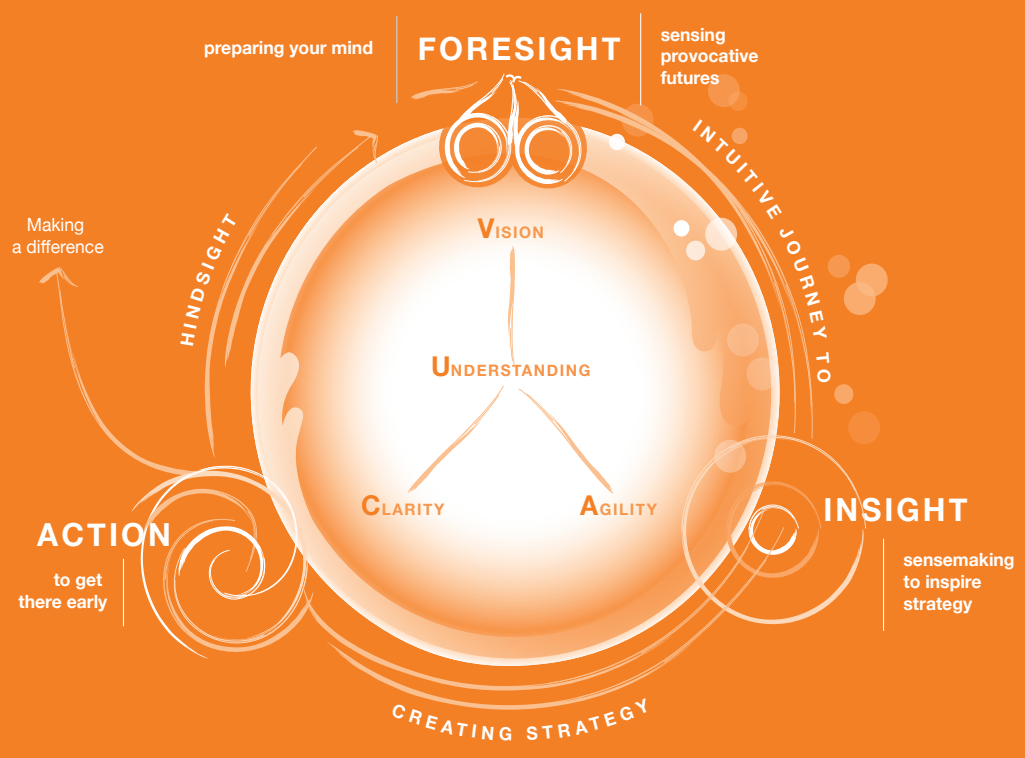
PRACTICE:

GET THERE EARLY

The annual *Ten-Year Forecast* is part of a process that we call foresight to insight to action. This process has been developed at the Institute for the Future (IFTF) over three decades of working with business leaders and organizational strategists to incorporate thinking about the future into their visions and strategic plans. For more than 30 years, Bob Johansen, former president and current IFTF Distinguished Fellow, has been on the frontlines of this effort, refining the practice. This year, Bob has captured the learning from this journey in a book called *Get There Early*. This *Perspective* is an executive overview of these lessons in practice.

The foresight-to-insight-to-action cycle was designed to stimulate winning decisions in a world where leaders must concentrate on managing dilemmas—while others continue to focus on problem solving. It's a cyclical process that begins with developing foresight to sense and understand the context around the dilemmas that challenge today's organizations and communities. As this context becomes clearer, it is possible for people to develop their own insight about the future and stimulate insight for others; this is a key sense-making step. Then comes the time for action. Leaders must learn when to act and how to learn from their actions. This learning creates change and the change creates new possibilities for the future, which cycles us back to foresight.

Here we share Bob's perspective on this process, along with guidelines and tools for each stage in the cycle. For more details, look for *Get There Early*, to be published in August 2007 by Berrett-Koehler.



IN A WORLD OF DILEMMAS—WHERE TRADITIONAL PROBLEM-SOLVING OFTEN DOESN'T WORK—FORESIGHT CAN PROVOKE INSIGHT THAT LEADS TO WINNING ACTION

For more details about the practice of Foresight to Insight to Action, as well as many real-world examples, look for *Get There Early*, published by Berrett-Koehler (San Francisco), August 2007.

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BOB JOHANSEN

is a Ph.D. social scientist who has led IFTF through the earliest computer-conferencing field trials to today's efforts to bring intelligence about the future to some of the top leaders in organizations around the world.

Bob's forthcoming book on the foresight-to-insight-to-action process recently created a perfect opportunity for our newest member of the Ten-Year Forecast team, Matt Chwierut to "learn the ropes" of forecasting. Here Matt poses some basic questions about the topics in the book.

Q: WHAT IS A FORECAST? HOW IS IT DIFFERENT FROM A PREDICTION?

It's a good question, and it speaks to a common confusion. A forecast is not a prediction and at IFTF, we generally correct anyone who uses the term. A prediction is a statement that something will happen, and these statements are almost always wrong. Journalists and others love to highlight predictions that didn't come true, but why are they surprised? If we have learned anything from forecasting, it is that nobody can predict the future. Predicting the future is more entertainment than research. Fortunetellers predict the future; forecasters don't.

A forecast is a plausible, internally consistent view of what might happen. It's designed not to be predictive but to be provocative, able to inspire your imagination and challenge your assumptions. It should open up new thoughts: new insights, new possible actions, new ways of thinking. When you really think about it, a prediction can be pretty useless—either you want it to happen or you don't, but you aren't given any agency. A forecast, in being plausible, highlights the inherent ambiguity of the future, and ultimately, the ambiguity of the present. Dilemmas are everywhere, and we just need to be attuned to them. Once we recognize them, we can engage with them as opportunities. Even within broad trends and driving forces, there's a lot of room for innovation and creativity, and that's what forecasts are supposed to stimulate.

For example, think about how worried some people are about the baby boomers and their looming retirement. Social Security crashing, businesses losing top talent, the retirement economy strained. These possibilities are real, and if we ignored them, we wouldn't respect the ambiguity of this situation, but we can also recognize that baby boomers will have a large amount of wealth, a desire to keep active and engaged, and many more years to live. Life expectancy is high enough that retirees have years ahead of them, entirely new lifestages. They'll want to stay involved in society and politics and culture. We can start thinking of creative ways to involve them in these discourses, to help them redefine retirement, to carve new spaces in the economy.

Q: SO CAN A FORECAST BE WRONG AND STILL BE USEFUL?

A forecast doesn't need to "come true" to be worthwhile. In fact, you don't need to agree with a forecast to find it useful. Herman Kahn, who invented modern scenario planning at the RAND Corporation, had a unique disclaimer in the front of some of his reports that read something like this: "Some of the ideas in this report are deliberately misleading, in order to provoke thought."

One of Kahn's most important books is *Thinking About the Unthinkable*. Forecasting is a way to help us all think in ways we don't normally think. Kahn's unthinkable thinking fueled military strategy. He framed the debate about thermonuclear war in new ways by describing a frightening future in a vivid way that helped policy makers consider the future implications of their action or inaction. The scenarios were designed for the military, but they proved just as useful for war protesters—if they were open-minded enough to read them.

What a wonderful leadership skill: the ability to think the unthinkable and create futures that nobody else can imagine—or to prepare for futures that nobody else thought to protect themselves against. Forecasting is about learning to be comfortable with ambiguity so that you can make better decisions in the present.

Q: WHY FOCUS ON A TEN-YEAR FORECAST HORIZON, ESPECIALLY WHEN SO MANY ORGANIZATIONS HAVE PLANNING CYCLES THAT ARE MUCH, MUCH SHORTER?

Ten-year forecasting is about leadership, not management. It provides a unique perspective—a futures context—that helps you create a distinctive and guiding vision for your own organization.

The ten-year time horizon is an important choice. Looking ten years ahead, we can see patterns more clearly, even if the details are unclear. To be most useful, a forecast should be far enough in the future to go beyond an organization's normal planning horizon but not so far ahead that it becomes unbelievable or irrelevant. Most of our forecasts focus ten years ahead,

MATT CHWIERUT
a recent Stanford University graduate in interdisciplinary studies, with a particular interest in social entrepreneurism, has joined the Ten-Year Forecast team as a research editor.

TEN-YEAR FORECASTING IS ABOUT LEADERSHIP, NOT MANAGEMENT. IT PROVIDES A UNIQUE PERSPECTIVE—A FUTURES CONTEXT—THAT HELPS YOU CREATE A DISTINCTIVE AND GUIDING VISION FOR YOUR OWN ORGANIZATION.

though our range for recent forecasts has been from three to 50 years. Generally speaking, looking ten years ahead balances between being accessible and being provocative. It can be best at highlighting the dilemmas that are most important.

Q: CAN YOU SAY MORE ABOUT DILEMMAS—HOW DO YOU RECOGNIZE THEM AND HOW DO YOU WORK WITH THEM?

Modern strategic dilemmas have several key characteristics. They tend to be unsolvable, recurrent, complex, and often messy. They are both threatening and puzzling. They offer multiple choices, and in many cases, more than one of those choices is attractive.

It's important to distinguish a dilemma from a problem. A problem is a question or a puzzle that needs to be solved. Typically, at least in current thinking, a problem has a binary (either/or) solution, or at least a clear solution. It is fun to solve problems, and you get a sense of accomplishment. As we're taught by dictionaries and our modern culture, problems feel like they "need to be solved."

In a world of dilemmas, we still have many options for response, but usually the options aren't simple, and usually they don't come in pairs. Yes/no is not enough. What's beyond the yes/no? What might be a third way, or a fourth, or a fifth? Expecting a binary solution can get you in big trouble in the world of dilemmas.

Today's leaders must learn how to thrive in uncertain spaces—while listening to and perceiving what is going on—without jumping to judgment too soon. Rapid judgment is great when it's appropriate to the situation, but premature judgment can be downright dangerous. When so many people are hungry for a simple moral equation, the times are ripe for premature judgments.

Unless you are in an extreme situation, reflection is usually more useful than reaction. Dilemmas can be a source of insight and inspiration, if you can figure out how to engage with and learn from them. You need to cultivate an ability to hold, listen, and learn—while resisting the temptation to know too soon. In addition, you need the courage to decide when the time is right.

Dilemmas are messy and frustrating, but they are also fertile ground for new insights and new inspiration, to create strategy that succeeds—even when you cannot solve. Dilemmas must be held in one's mind and exercised. Dilemmas cannot be resolved with quick judgment or analytics. As Voltaire said, "Doubt is not a pleasant condition, but certainty is absurd."

Q: HOW, THEN, DOES FORECASTING HELP WITH DILEMMAS?

Forecasting is a particularly useful method for engaging with dilemmas because it's all about sensing and sensemaking, about becoming aware of what's around you. Sensemaking isn't complete comprehension, but rather finding frameworks that generate insights. True sensing is hard work because it requires not only watching and listening but also rethinking your own frame for understanding what you're seeing and hearing. Sensing is a discipline of waiting actively—but acting when the timing is right.

Q: YOU'RE A CONSTANT CHAMPION OF THE FORESIGHT-TO-INSIGHT-TO-ACTION CYCLE. WHY DO YOU THINK IT'S SO IMPORTANT FOR TODAY'S DECISION-MAKING CLIMATE?

The biggest challenge for leaders today is to learn to live with—and even embrace—the tensions inherent in dilemmas. The foresight-to-insight-to-action cycle is a framework for sensing and making sense out of dilemmas—even if you can't fully understand or control what's going on. The key is holding complexity in your mind while still making strategic decisions. Foresight helps you identify dilemmas and acknowledge ambiguity—indeed, it forces you to confront ambiguity. If you resist the impulse to jump to conclusions, you find yourself asking good questions, which yield good insights. Insights are "a-ha" moments, which foster innovation. You start to see dilemmas as opportunities, and you come up with creative approaches. Then you can start to craft your strategy—your action in the present to engage productively with dilemmas.

BEFORE YOU START:

PREPARING YOUR MIND

Even before you begin a forecasting exercise, a first step is to prepare the mind for the always uncertain future. A prepared mind is ready to think the unthinkable. It's also able to hold multiple realities without jumping to judgment too early.

Preparing your mind is a readiness exercise, to probe where you are as a leader—at any level of your organization. It's also about probing where the organization is. Once you know where you are, it is much easier to sense where to start in the vast array of future options that you might consider.

The best sensing is done with an open mind that resists judgment long enough to figure out what's going on—even if what's going on doesn't fit your expectations or honor your values. Often, the most innovative ideas come from engaging with what feels most foreign, from those moments when you have a strange sense in the pit of your stomach that something doesn't fit.

You can always be working to prepare your mind, especially in tough situations. A key practice is to resist shutting down or responding instinctively when what is going on catches you off guard. The first question to ask when you arrive early in a new situation is, "What's going on here?" If you're having strong reactions, ask yourself, "Why am I reacting this way? Which of my assumptions are being challenged? Do those assumptions deserve to be challenged?"

Deep sensing is difficult because we are often rushing for judgment and are rewarded for speed in decision making. Sensing requires a pause, sometimes a long pause. Sensing requires reflection to get beneath surface reactions and see what is really going on, beneath what it looks like is going on or what others might like you to believe is going on.

Sensing requires the discipline to hold at the perception stage just long enough, before moving to judgment. Foresight encourages you to spend more time sensing, to develop skills in asking questions that matter and resisting answers that don't. The quest is to avoid answers that are premature, answers that reflect only your assumptions—and get to the new insight that might be revealed from more careful consideration.

Preparing your mind may be the most important stage in creating a forecast that is truly useful.

PREPARING YOUR MIND BEFORE THE FORESIGHT BEGINS

What to ask: What are the current pain points for you and others in your organization? What pains keep you and your team awake at night?	**WHY:** Although a compelling vision sometimes prompts major change, innovative directions are more commonly prompted by pain. If you understand the current pains of your organization, you can figure out what kinds of foresight are likely to be most provocative in generating pain relief.
What to ask: What is your intent as a leader?	**WHY:** If intentions are understood, then foresight becomes a context for your intentions. Foresight is focused on external future forces. Intent always lives in a larger context, and foresight can help you understand—and possibly influence—that context.
What to ask: What is the destination for your organization?	**WHY:** This will help you identify the waves of change that you could ride to reach that destination and the waves of change that could drive you off course.
What to ask: What is the biggest business challenge you are facing right now? How might that challenge be informed or influenced by external future forces?	**WHY:** Ultimately, you will want to link foresight to your present-day decisions and actions. Focusing on real near-term challenges helps you interpret the meaning of future forces for your own dilemmas. This is where insight comes from.
What to ask: What's going on in the lives of the participants, outside your forecasting effort? How might these outside influences shape your efforts?	**WHY:** Sometimes outside forces will influence a forecasting project—whether it's a month-long effort or a day-long meeting. Foresight encourages people to step outside their normal routines, but the day-to-day pressures of life can still bleed in. Being aware of these influences can help you understand and redirect the reactions of individuals if they stray from the goals of the exercise.

FORESIGHT:

THE KEY TO STRATEGIC VISION

We develop foresight to sense and understand the context around the dilemmas that challenge us. The goal is not to predict what's going to happen but to provoke our collective creativity and prepare for the biggest challenges, many of which are likely to come in the form of dilemmas.

Foresight is the first step in any good strategy process: the search for external forces and environmental factors creates the context for both strategy and innovation. Leaders are always sensing, as well as coaching others, about what's important and what's not in this future context. Foresight is thus the ability to sense what could happen before it happens, the ability to identify innovation opportunities. The result is a strategic vision of where you are and where you want to go, and a pretty good idea how you are going to get there early.

Vision is your own personal statement, or your organization's statement, of the particular future that you intend to create. Vision is the beginning of strategy.

SENSING AND SORTING: WHAT'S IMPORTANT

Foresight is derived from listening for, sensing, and characterizing futures that provoke your own creativity. But as you sense, how do you sort the important from the merely new and interesting? Here are some questions to guide you in filtering what you're sensing.

WHAT'S UNDER-THE-RADAR AND NON-OBVIOUS?

You aren't looking for the familiar headlines here, but rather things that no one necessarily expects. Pay special attention to your own field of expertise, using your familiar sources, but with an eye to what might cause unexpected disruptions and or opportunities to move in a new direction. Then get others, including outside experts, to do the same—these multiple expert perspectives will give you the best ideas.

WHAT MIGHT CAUSE UNEXPECTED DISRUPTIONS?

You may well have an intuitive sense for picking out disruptive triggers. But there are some questions you can ask yourself to help decide if a signal that you're sensing is something that can escalate to a large-scale threat or opportunity:

- **Does it involve a change of scale?**

When scales of activity or impact change, the results are often disruptive and even revolutionary. Technological change often enables many people to do what only a few could do before, for example.

- **Does it involve a redefinition of existing boundaries?**

Boundaries—whether political, geographical, organizational, or conceptual—define what's included and what's excluded. Changes in these boundaries or new ways to cross existing boundaries almost always destabilize a situation, opening the possibility for innovation and change.

- **Does it have the potential to spread virally?**

We used to think of biological pathogens as the main types of viral disruptions, but it is now clear that economic and technological innovations can also rapidly diffuse virally—that is, by contact. Consider machine-to-machine and species-to-species contact as well as human-to-human or organization-to-organization contact. "Stickiness" is a key concept in viral spread. Something is sticky if it tends to persist in a network of "carriers."

- **Does it shift world views for a significant group of people?**

Any major paradigm shift carries with it the potential for disruption and innovation as people adopt (or fail to adopt) the new paradigm at different speeds. The key here is understanding the inflection point: is the new paradigm likely to spread slowly, gradually changing the social fabric or is it something that will have a very sudden onset once it is recognized? Finally, do those espousing it hold some special status in society or constitute a large enough share (sometimes only 20% is required) to have a major impact on the global landscape?

- **Does it point to a strong shift in identity?**

Identity is one of the key markers for both cooperation and competition. Any innovation or shift in identity may point to a reorganization of the way people and organizations will change the way things are done.

- **Does it challenge existing authority?**

Authority may be political, organizational, religious, or intellectual. Innovations or activities that challenge any of these authorities are potentially disruptive and could even escalate to conflict.

WHAT IS THE SCOPE OF IMPACT, BOTH GEOGRAPHIC AND TEMPORAL?

The potential for significant change may be local, regional, or global. Be clear about the scope of your current challenges and tune your sensing to the appropriate scope. But don't overlook signals outside your geographic scope that could ultimately open opportunities or exacerbate your current dilemma.

Also, tune your foresight to provide a long enough view to take you beyond your present frameworks and assumptions, but close enough to be actionable. For most business organizations, a ten-year horizon is a good target, although certain very long-term trends may require unexpected decisions in the present. For organizations with large-scale social agendas and for policy setting, a longer horizon—20 or even 50 years—may be more appropriate.

INSIGHT:

FROM SENSING TO SENSEMAKING

Leaders are sensemakers: They help others make sense—often by asking penetrating questions. It turns out that foresight is a particularly good way to stimulate insight, to help make sense out of dilemmas and imagine what you might do next.

Sensemaking is, essentially, a search for an "a-ha!" that contributes to your strategy and seeds innovation. Insight is the core element of any good strategy, but insight is scarce, and it doesn't just happen. Insight is most likely to happen as a result of hard work, open-mindedness toward future possibilities, intuition, and a touch of serendipity.

Foresight is inherently provocative, but leaders must draw lessons from the provocation if they are to create a clear, compelling, and productive way forward. This is insight, and it must be communicated clearly so that not only you understand it but so also do those whom you need to engage.

In the end, insight is a necessary prerequisite for a winning strategy.

WAYS TO BUILD INSIGHT FROM FORESIGHT

Juxtaposition and cross impacts

Sometimes just putting two seemingly unrelated forecasts side by side can provoke an insight. Simple questions can guide you: What happens when these two things intersect? And what does that mean for us?

You can also juxtapose forecasts to current practices and situations. A good way to do this is to make a two-column list. The first column is a list of current practices and assumptions; label this column "What we're moving from." Then juxtapose elements of the forecast with each of the practices to see where they might lead; put these new practices in the second column and label it "What we're moving to." These kinds of from–to statements are a form of insight.

Finally, you can do this much more systematically in a cross-impact matrix. Put your most important current assumptions and practices on one axis and the most important forecasts on the other. Then explore the cells, asking "How might this forecast change this practice? Each cell is a potential insight.

Clustering and connecting the dots

Clustering is similar to juxtaposition, but it involves finding the relationships among multiple forecast elements. In the process of trying to cluster, the mind automatically draws on intuition, and as this intuition rises to the surface, insights often emerge.

Clustering can be done by one person or many. With many people, it's more difficult because tapping on intuition tends to draw one's attention inside; in a group environment, it's hard to create space for this "going inside." One way to do this is an exercise we call "silent clustering." In this exercise, dozens or maybe even a hundred forecast elements are placed on sticky cards and posted randomly on a wall. Then everyone in the group begins to move the cards around to cluster them, all without speaking. Over about a half hour, stable clusters tend to emerge, and participants can begin to label them. Sometimes the labels themselves represent an insight. Sometimes the insight emerges from probing how all of the cards in a cluster are related and what those relationships mean for your practices—or for any dilemmas you may be facing.

Scenarios and storytelling

Scenarios and storytelling take clustering to a more refined level. Instead of just grouping forecast elements together, they engage our "what if?" thinking to picture the combined impacts and possibilities in a "real-life" situation. Scenarios can be very simple or very complex, but one practice that can help in drawing out insights is creating a little vignette—a story that is populated with imaginary people in the future who are coping with a dilemma.

These peopled stories, like real-word examples, make the abstract concrete. Everybody likes examples because they provide a hook to hang a lot of ideas on. Sometimes present-day examples are compelling enough to produce an insight. But when they're not—or when the forecast diverges significantly from the future, examples may not be readily available. Then vignettes can fill the gap, again drawing out our own intuitions and linking them to foresight to produce insight.

Immersion experiences

When you're immersed in a situation, all your channels of knowing and sensing are receiving signals. This complex feed of environmental information can often reorganize the way you think about the world. So a very effective way of using foresight to provoke insight is to find present-day situations that suggest or point to the future, and immerse yourself in them.

These immersion experiences can be short field trips or extended stays. Many organizations are increasingly interested in ethnography as a way to get these immersive experiences. Guided by forecasts—for example, a forecast about the growing importance of a region—ethnographic visits can provide a multi-dimensional sense-picture of an unfamiliar landscape that has elements of the future landscape. This sense-picture is another form of insight.

Simulations, which come in many forms, offer another form of immersion. Simulations create a low-risk environment where people can learn in a first-person way. These can range from 3-D virtual worlds to alternate-reality and role-playing games. They can be particularly effective at developing new skills. You can practice without the pressure of real-world consequences, and this can prepare you to face real challenges.

ACTION:

FLEXIBILITY AND AGILITY

Even in a world of dilemmas, decisions need to be made. But leaders must be tuned to the emergent realities around them in order to decide what to do and when to act. Connection is key, and leaders are always connecting: people to people, ideas to ideas. Many innovations are simply connections that are made for the first time. Leaders need a flexible learn-as-you-go style—since most dilemmas keep changing faces. Strategy leads to decisions and action—in order to make a difference. Even when the action begins, it must be carried out with agility—in order to respond to the inevitable corrections that will be required. Firm action is needed, with an ability to flex.

Action is aimed at results, at making a difference. In the business environment, making a difference can mean making a certain amount of money within a designated timeframe, but making money can be defined in many different ways, with different processes: outcomes, return on investment, implementation, shareholder value, rollout, change, commercialization, institutionalization, or execution. These are all outcome oriented, but even outcomes often come about in stages.

The ultimate basis for evaluating a forecast is not what you got right in the forecast but whether the forecast helped leaders make better decisions that led to action that made a difference.

Example

Biotechnology at Procter & Gamble

In 1999, our forecasts suggested that biotech was becoming increasingly important and that it was mixing in very creative ways with information technologies, as we can see much more clearly today. We presented this forecast to the Global Leadership Council of Procter & Gamble (P&G). Our foresight for P&G was that biotech would become increasingly important for many P&G products. The top 12 people at P&G looked around the table and realized that none of them had the expertise needed to make good business decisions with regard to biotech. This was an insight, an "a-ha!" moment, for P&G.

The action was to create a Biotech Reverse Mentoring Program for the top 12 people at P&G. We located young Ph.D. biotech scientists, all of them at P&G, who were willing to become reverse mentors for their senior executive colleagues—meeting about once a month for one year. The result was a considerable increase in the biotech expertise of the top executives: they did not become scientists, but they certainly knew a lot more about the business implications of this new area of science. At the end of the year, P&G had a biotech strategy, and you can now see the results of this strategy reflected in many P&G products, especially in detergents and hair care products. One of the top executives, A. G. Lafley, continued to use his reverse mentor, Len Sauers, as an informal science adviser even after he became CEO of Procter & Gamble.

Example

Campbell's Soup and Healthy, Portable, Nutritious Eating

In 2005, Campbell's Soup executives looked at the marketplace for their products and thought ten years ahead. As part of this process, they concluded that healthy, portable, and nutritious eating will be an important driver for the food industry. They also concluded that Campbell's should be at the center of this space.

The future of food will go to those providers who do not view taste and nutritional value as an either/or choice. Rather, the most successful foods will be both tasty and nutritious. In the health economy, more and more consumers will use health as a filter to evaluate products and services for purchase. Food companies must engage with the dilemma of creating healthy foods that taste good.

IFTF works with Campbell's to do forecasts of external future forces affecting the concept of portable nutritious foods like soup. We also helped Campbell's organize a Future State Advisory Board to advise it on external future forces. The Campbell's USA leadership team developed a destination statement, thinking ten years ahead. The focus was on where they wanted to be as a brand and as a product line in ten years. The essence of this destination is the slogan "Nourishing people's lives everywhere, everyday."

Around this core statement, specific dimensions of success were developed, including measures that could be used to track their progress. This process was a useful approach to strategic foresight, where Campbell's began with a careful analysis of where they wanted to be in ten years. From that destination statement, they could work backward to figure out what they needed to do between now and ten years from now in order to reach their destination.

WORKSHOPS:

GETTING THE MOST FROM GROUPS

For somewhat mysterious reasons, small groups are particularly good at listening for the future in creative ways, to generate insights and seed innovation. In an interactive workshop setting, a group of 7–25 people can be amazingly productive—if they can learn to engage constructively with one another. An ideal foresight-to-insight-to-action workshop involves about 20 smart and engaging people from varied generations and backgrounds.

When planning, start by assessing where you'd like to focus. In IFTF's work with top executives, a typical workshop will have the following emphasis: 40% on foresight that is provocative for this particular organization, 40% on insight provoked by the foresight, and 20% on possible actions.

Next, figure out who the meeting owner is and what his or her goal is. Target an outcome. Invite a diverse group of participants. If possible, use a content facilitator who both knows the content and understands how to guide a group through the variety of exercises that lead from foresight to insight to action. And of course, make sure you have a good forecast to work with.

Then explore the techniques shown here to meet the small group challenges and achieve your goals.

CHALLENGE	WORKSHOP TOOLS & TECHNIQUES
Introductions for a familiar group, where most people know one another.	Routine introductions can be short, but establishing a voice for each participant is important. For example, "Tell us something that your colleagues do not know about you."
Introductions for an unfamiliar group, where most people don't know one another.	Introductions should be longer in order to engage the group. Keep the introductions personal and draw links to content when appropriate.
Presentations where there is a lot of complex material that is new to participants.	Allow for very brief presentations to share material, and for discussion so people can ask clarifying questions and make links to their own work situations (individual learning), or to the situation or challenge under discussion (group learning).
Exploring possibilities or stories, leveraging the group's experience to do so.	Use small-group work for scenario-creation activities. Provide clear guidelines and, in some cases, an example to stimulate people's thinking. Imaginative activities are usually most effective when people have had an opportunity to review new material before being asked to create scenarios or stories.
Focusing on individual learnings, rather than group decision making.	Provide tools such as learning journals and time to allow people to gather their thoughts. Allow time for individuals to work on their own to develop their ideas, and use small-group discussions and sharing to enable people to learn from one another.
Focusing on group learning and decision making.	Use the time to go back and forth between sharing information and both large- and small-group discussion. When you break into small groups, allow time for reporting out and discussion that builds on the ideas developed in the small-group setting. Small groups can leverage the diversity of expertise in the room to dig deeper into specific topics.
Focusing on experience-based learning.	Use group immersive experiences with time to debrief and share the lessons. For example, consumer home visits or shop-alongs can be used to explore new product possibilities.
Prioritizing insights or agreeing on action steps.	Include dot voting on ideas or strategies once they are presented and discussed, and include both small- and large-group discussion to build shared understanding and consensus. Small groups can be effective at advancing complex ideas, particularly when you have a lot of material to cover.
Generating new insights or possible action steps.	Divide people into small groups to maximize creativity. Use the large-group work to share new ideas and explore critical questions. If needed, use the large group to stimulate new discussion.
Going for actions, with sign-ups regarding who will do what by when.	If participants are responsible for making sure the work gets done, use part of your session to sign people up for next steps. Encourage your outcome owner to have a list of people he believes could successfully implement any actions you agree to take.