

The background is black and features an abstract graphic of various colored dots (grey, cyan, orange, yellow) and thin white lines that curve across the page, suggesting a network or data flow.

the future of work **perspectives**

Technology Horizons Program

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124 University Avenue, 2nd Floor
Palo Alto, CA 94301
650.854.6322

acknowledgements

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RESEARCH/WRITING

Jamais Cascio

Maureen Davis

Rod Falcon

Jean Hagan

Jess Hemerly

Crystal Keeler

Michael Liebhold

Mike Love

Rachel Maguire

Jane McGonigal

Sean Ness

Mani Pande

David Pescovitz

Alex Soojung-Kim Pang

Jason Tester

Anthony Townsend

PRODUCTION

Robin Bogott

Jean Hagan

Lisa Mumbach

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introduction

It is not possible to write about the Future of Work without reflecting on your own organization and work experience. In many ways, this report is a product of a new way we work at IFTF and the dilemmas we try to navigate daily. The six themes we highlight in the report emerged as a result of IFTF's signals process: a highly collaborative effort that brings together experts from within and outside of IFTF who are asked to contribute signals—developments, events, observations—that are weak indicators of larger future trends. The process of tagging and clustering these signals allowed us to build on each other's ideas and synthesize them into larger themes. We used highly social, collective, improvisational, and augmented behaviors to produce a deeper and, hopefully, better result.

As inevitably happens when working in a **highly collective** and **augmented** way, we faced a dilemma: how do we assign authorship to a product of collective intelligence? As much as we value the collective contributions, we also believe in the need for individual recognition. Ultimately, this report is not a product of a faceless mass but of a group of individuals, each bringing his or her unique knowledge and perspectives. Thus, “stewards”—people who had ultimate responsibility for shaping each perspective—are listed as authors. It is important to remember, however, that all the individuals listed on the cover have contributed to this effort and we could not have done this work without all of their input.

We moved into the highly **visible world** at IFTF a few years ago when we migrated our offices from Sand Hill Road, where each person had a closed office, to our current digs on University Avenue. There are very few walls or doors in our current location except for the doors we brought from our old office and now use as desks. Transparency is almost a given in the new physical environment—you have to assume that whatever happens, everyone will know right away. Between the open space environment, instant message windows on everyone's computers, Google Docs and signals platforms for collaborative work, Plazes, Facebook, and other platforms for enhancing visibility many staff use, it is indeed hard—at times nearly impossible—to be invisible. At the same time, we are working on various ways to make our content more tangible and sensory rich: in the world of radical transparency, there is a huge gap between being visible and being noticed. You may have no choice but to be visible, but it is harder than ever to be noticed. Between navigating all the dilemmas inherent in the world of radical visibility—what, when, and to whom you want to make what visible—we tackle the challenge of how to make what we do more tangible and accessible to our clients.

Diversity is one of the hardest dilemmas to navigate for everyone—individuals, societies, and organizations, IFTF included. For as much as we say we value diversity, we inherently want to be surrounded by “people like us.” It is just so much easier to live in a world where everyone agrees with you. It saves time if you don't need to do all that arguing, convincing, and cajoling. Finding people like us and sticking together along whatever dimension of similarity we find at hand—team logos, likes, dislikes, heritage, religion, ethnicity—is almost hardwired into our brains. So, it takes a special effort to not only bring in people who think, work, or communicate differently, but more importantly to really hear them.



INTRODUCTION

Deep diversity makes for messy organizations, as structures, processes, and incentives are bent to accommodate non-mainstream preferences. But, if managed well, messiness often brings with it creativity and innovation—traditional assumptions are challenged and new ways of “seeing” emerge. But how much messiness to accept, at what points, and in what parts of the organization—these are some of the dilemmas inherent in the world of deep diversity.

Health and **sustainability** are not only becoming key areas of IFTF’s work but are also becoming clearly intertwined, as personal health evolves as a lens for how people experience issues and dilemmas of sustainability. Although IFTF has been doing forecasts around sustainability, climate change, and health for many years—almost since the founding of the Institute—we have just now begun to realize that these are becoming a cornerstone of all of our work, just like technology has been a cornerstone for the last 40 years. As health emerges as a key value and brand identity, every company, whether one wants to admit it or not, is becoming a health company. Health and sustainability are emerging as lenses for judging attractiveness of workplaces—and for thinking about personal lifestyle and career choices.

Our sixth theme is about integrating new **sciences**—neurosciences, biology, and mathematics—as a part of the organizational toolkit for training, development, planning, and other areas. Although we are far away from using brain scans and biological data to understand individual skills and to put together optimal work teams, the language of neuroscience is definitely entering our conversations. In fact, the strand of research on understanding which part of the brain is involved in futures thinking is obviously of particular interest to us. The fact that it is closely related to the part of the brain where memories are stored provides a scientific explanation for what we’ve believed for many years—in order to look forward, you need to be able to look back. Understanding of history and the future are closely intertwined. What other experiential or “gut feeling” phenomena will we be able to explain using new scientific evidence? And how will we navigate the dilemma of over-reliance on scientific evidence versus experience and instincts?

New sciences aligned to understanding management and organization dynamics is a trend for which I have found a weak signal in my own work: I find myself increasingly drawn to reading magazines such as *Scientific American Mind*. The September 2007 issue particularly drew my attention. In an article titled “New Insights About Leadership,” authors cite evidence that the best leaders are not necessarily the ones projecting winning charisma, sharp intelligence, and an aura of absolute authority – these traits are not the ultimate keys to greatness. Instead, their research suggests, “effective leaders must work to understand the values and opinions of their followers – rather than assuming absolute authority – to enable a productive dialogue with followers about what the group embodies and stands for and thus how it should act.” Leadership, in their words, means the ability to “shape what followers actually want to do, not the act of enforcing compliance using rewards and punishments.” Good leadership depends on cooperation and support of constituents; it is not a top-down process. In order to gain credibility among followers, leaders must try to position themselves among the group, rather than above it. Some leaders have had an intuitive grasp of this idea before – how exciting to find it explored and expanded in a quantitative setting and with the rigor of scientific analysis.



Phew—and finally a good scientific explanation for why I find it really important to place my desk in the “bullpen,” in the middle of where the staff is, and where most of the work gets done. On a related note, this is finally a good bit of scientific support for IFTF’s organizational chart! It took an incredible amount of dialogue and consensus building to create—a process that seems so sharply at odds with most traditional organizational models. The chart speaks well to the fact that at IFTF, the Executive Director is a spokesperson for the commons and is an equal among equals. It points out that there are many leaders in the organization and that leadership is dynamic—different people assume leadership positions at different times and in different contexts. For every would-be leader, there is an optimal leadership context; for every leadership challenge, there is a perfect candidate.

—*Marina Gorbis*
Executive Director, Institute for the Future

1 the amplified individual

FROM INDIVIDUAL TO SOCIAL, COLLECTIVE, IMPROVISATIONAL, AND AUGMENTED

New technologies of cooperation are combining to create a generation of amplified individuals—workplace superheroes. In some cases they will compete with traditional organizational models; in others they will amplify capabilities of organizations where they already work.

DILEMMA



While the value and strength of amplified individuals comes from their connection with the collective intelligence of others, the need for individual recognition remains. Organizations will have to navigate the boundaries of what is collective and what is individual—values of the collectives in organizations should supercede the personalities of individuals.

The amplified workers of the future share four important characteristics. First, they are highly **social**. They use tagging software, wikis, social networks, and other human intelligence aggregators to supplement their individual knowledge and to understand what their individual contributions mean in the context of the organization, giving meaning to even the most menial tasks. Amplified individuals are highly **collective**, taking advantage of online collaboration software, mobile communications tools, and immersive virtual environments to engage globally distributed team members with highly specialized and complementary capacities. Amplified individuals are also highly **improvisational**, capable of banding together to form effective networks and infrastructures, both social and professional. Finally, amplified individuals are highly **augmented**. They employ visualization tools, attention filters, e-displays, and ambient presence systems to enhance their cognitive abilities and coordination skills, thus enabling them to quickly access and process massive amounts of information.



1 THE AMPLIFIED INDIVIDUAL

An amplified skill set emerges. As networked amplification becomes the norm, individuals are developing new super-individual skills that enable them to thrive in an increasingly complex and collaborative work culture. These include:

- **Mobbability**—the ability to work in large groups, and to organize and collaborate with many people simultaneously.
- **Influency**—knowing how to be persuasive in multiple social contexts and media spaces, and demonstrating awareness that each context and space requires a different persuasive strategy and technique.
- **High Ping Quotient**—responsiveness to other people’s requests for engagement; propensity to reach out to others in a network.
- **Protovation**—fearless innovation in rapid, iterative cycles.
- **Open Authorship**—ease with creating content for immediate public consumption and modification.
- **Emergensight**—the ability to prepare for and handle surprising results and complexity.
- **Multi-capitalism**—fluency in working with different capitals (e.g., natural, intellectual, social, financial, virtual).
- **Longbroading**—thinking in terms of higher-level systems, massively multiple cycles, and the very big picture.
- **Signal/Noise Management**—filtering meaningful information, patterns, and commonalities from the massively multiple streams of data and advice.
- **Cooperation Radar**—the ability to sense, almost intuitively, who would make the best collaborators on a particular task.

Amplified Individuals Are Highly Social they provide and rely on social filters of information

Peter Pirolli and Stuart Card, who built a theory on the visual cues people use when searching for information, coined the term “information foraging” in 1995. They examined the process of search through the lens of economic calculus, defining the worth of an information source “as the value of information gained per unit cost of processing the source.” Information foraging works hand-in-hand with social filtering, which has been adopted as a solution to the information overload problem. Social filtering can be defined as participation in community that, through ranking, tagging, or adding other metadata to web content, helps make more relevant or higher-quality information rise above the noise. This practice facilitates the processing and synthesis of massive amounts of information. Social filtering services range from social bookmarking sites like del.icio.us, to news aggregator sites like Digg and reddit, to RSS readers that offer “reblogging” such as Google Reader.



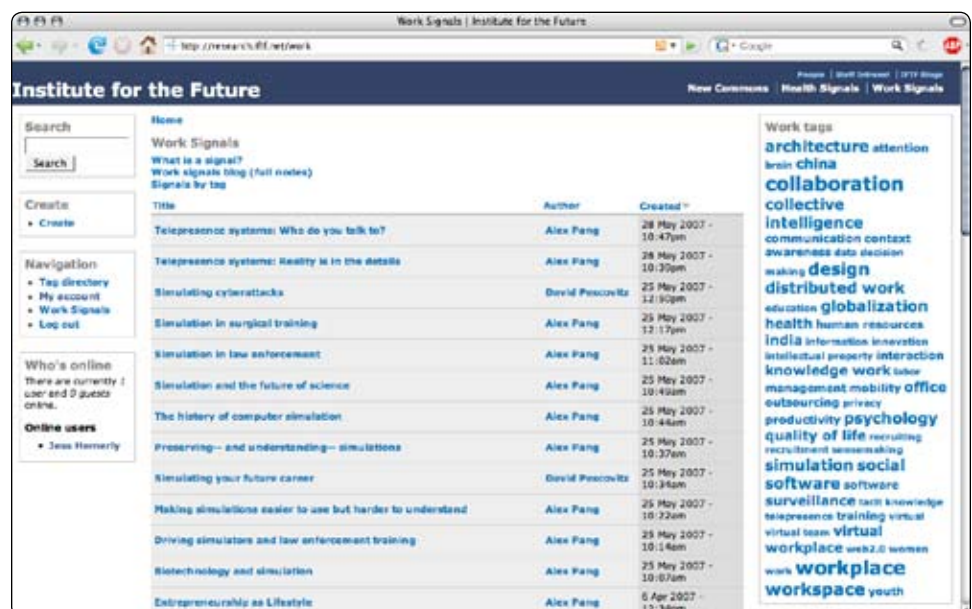
For a few years now, IFTF researchers have been using del.icio.us to keep a shared record of sites that we find relevant to our content, tagged with keywords. A daily snapshot of this stream of web activity is then automatically published on the Future/Now blog¹. Since we wanted a record of our digital research anyway, publishing it allowed us to potentially connect with other interested parties at no cost. It was a first attempt at turning our research process inside out.

Starting in 2006, we prototyped and began using a new platform for our internal process for collecting “signals,” expanding on the social filtering functions of del.icio.us. Signals are events, observations, or developments suggestive of a larger trend or shift. In a signals process, researchers and handpicked experts convene for about two weeks around a topic on our platform, adding short entries and tagging them with keywords. We try to recruit experts for whom it will be relatively easy to answer the question, “What are 10–20 important weak signals about the future of _____?” since they are already actively reading or writing in this area.

Signals link to sources for more detailed analysis, including web content, articles, reports, or ethnographic interviews. Once the signals have been identified, we use a variety of methods—from tag clouds and network diagrams, to face-to-face meetings of researchers—to gather signals into clusters that might tell an important story for our clients.

The highly social signals process and platform facilitates many desirable outcomes: we can capture what might otherwise be ephemeral interactions with experts since they can add signals on their own time; researchers on different teams and in distributed work environments have a virtual environment to stay abreast of each others’ insights; and, since the platform is built on Drupal², an open-source content management system, it encourages further experimentation.

Built on Drupal, an open-source content management system, IFTF’s signals platform allows experts and researchers to contribute to and annotate signals, which are later clustered to identify bigger trends and stories.





1 THE AMPLIFIED INDIVIDUAL

Amplified Individuals are Highly Collective They access and contribute to crowd intelligence

Collective intelligence, or CI for short, has been a major story since the emergence of successful collaborative knowledge projects, like Wikipedia, and powerful prediction markets, like the Iowa Electronic Markets. The territory is new and difficult to explore: crowds can become easily disorganized and unfocused, or they can just as quickly turn against your intended goals and attack with remarkable efficiency and organization. Companies often shy away from collective intelligence tools, fearing that they'd prove more of a distraction than a benefit. The appropriate state of mind when tapping into the new movement of collective intelligence should be experimentation followed by critical analysis and reformulation.

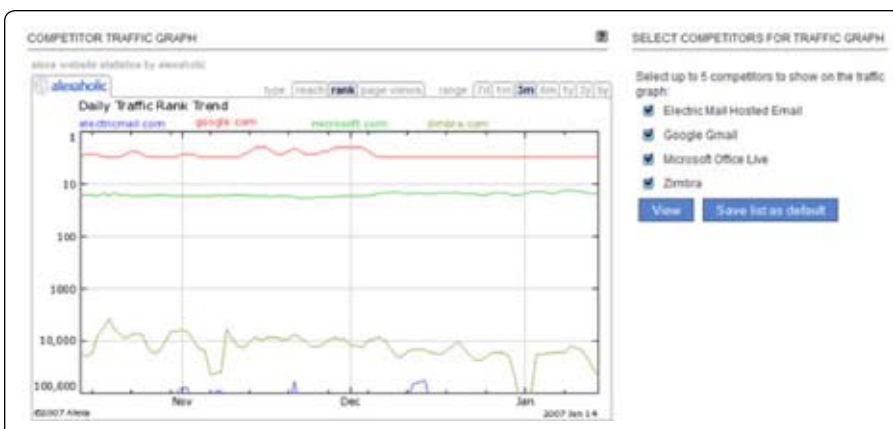
An early example of collective intelligence software specifically aimed at businesses is Competitious, a program that leverages internal CI to document and generate insight about the competition. Competitious software invites all members of an organization to participate in collecting, tagging, and circulating news about competitors. Individuals can contribute to a shared competitor matrix that tracks attributes of different competitors while wiki-style components of Competitious³ invite collective analysis. The goal? To generate bottom-up understanding of the competitive marketplace.

While some companies have experienced trouble making use of the collective intelligence potential of their workforce, others, like Nokia⁴, have found great success. What started there as a subversive, open-source wiki established by the corporate strategy team—without permission from IT—has grown to company-wide adoption of collaborative tools. An estimated 1,000 to 1,500 employees use these collective intelligence platforms to share information with fellow employees. These practices have proven so successful that Nokia has invested in a company-wide wiki, as well as a bevy of other collaborative tools. They've even established a “project” team to set up on-demand collaborative platforms for specific projects and departments quickly and efficiently.

Google Earth and Microsoft's Live Search have enabled an entirely novel form of collaboration: mostly unaffiliated, distributed individuals contributing micro-efforts to a large project, termed “crowdsourcing” by Jeff Howe, contributing editor at Wired magazine. Online communities have formed around Google

and Microsoft's satellite imagery services to find and analyze images from across the globe. Examples include military retirees taking their guess at different sites in North Korea and the search for computer scientist Jim Grey, whose boat went missing off the California coast.

Competitious relies on user input to generate a bottom-up understanding of the competitive marketplace.



Source: www.competitious.org



Amplified Workers Are Highly Improvisational

They band together quickly to create infrastructure and resources for accomplishing tasks

It is now easier than ever to band together, perform distributed work, share ideas, and be productive despite physical separation. It's less and less important what country a particular team member lives in. Indeed, new collective experience software is helping to solve the traditional problems a globally dispersed team might pose and to overcome the isolation that the independent worker experiences when lacking access to a central and social workplace. More and more, individuals are banding together ad hoc to design collective experiences without top-down direction.

A few years ago, a group of self-employed developers and writers in San Francisco created a community office space called Hat Factory⁵ that allowed them to pool money and share a workspace with friends in unrelated fields. They advertised online: "Tired of working from coffee shops every day? Miss community and structure in your work life?" For \$200 a month, independent workers have access to a variety of traditional office amenities like a meeting room, Wi-Fi, and a projector and sound system. Since the creation of Hat Factory, the coworking community has spread into more than fifty cities in the United States and Canada and spans more than a dozen other countries. Although they don't necessarily work in the same professional fields, by banding together, coworkers get the advantage of a broadened professional network and a social work environment that serves as a compromise between the isolation of a home office and the public coffee shop. By defining and publishing roles such as the SpaceOwner, SpaceCatalyst, Coworker, or just Interested, coworkers have effectively created a collective experience model that can be recreated.

Immersive online environments are also increasingly capable of simulating the social experience of sharing the same physical workplace. Researchers at Stanford University's Virtual Human Interaction Lab and the Palo Alto Research Center are exploring the real-world social benefits of co-habiting virtual worlds like *World of Warcraft* and *Second Life*. They report that the collective experience of a virtual environment, especially environments with 3D avatars, provides significant social-emotional benefits. Players in the same world experience other players as co-present and available to each other, yet are able to focus on individual in-world work. The research indicates that simultaneous co-presence does not necessarily promote active social interaction. Instead, it creates a sense of ambient sociability. This kind of casual co-presence may become an important tool in holding together the distributed workplace, as it creates a thin layer of live social experience and common ground without distracting from tasks at hand.

By banding together, coworkers at places like the Hat Factory get the advantage of a broadened professional network and a social work environment that serves as a compromise between the isolation of a home office and the public coffee shop.



Source: www.flickr.com/photos/cirne/685867674



1 THE AMPLIFIED INDIVIDUAL

Amplified Workers Are Highly Augmented

They use cognitive enhancement tools and hacks to accomplish complex tasks

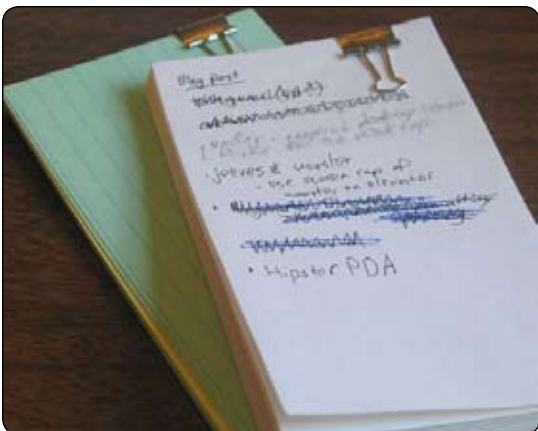
With the unrelenting deluge of information we face every day, and with an increasingly varied range of responsibilities and tasks, individuals frequently seek and design tools and processes that will enhance their performance or just help them filter and make sense of everything. These forms of augmentation range from games and visualization tools to smart drugs and “life hacks.”

Just as an athlete might use steroids to run, pedal, or swim faster, today’s student often relies on pharmaceutical aids such as Modafinil and Ritalin—“smart drugs”—to enhance academic performance. The practice is starting to become a norm. An even newer compound, called CX717, not only improves alertness but, according to a study at the University of Surrey, “improved performance in healthy male subjects that became impaired during 27 hours without sleep.” Meanwhile, Helicon Therapeutics and other labs are developing compounds designed from the get-go to increase cognitive performance and memory. As these students move from universities and into the workplace, these self-augmenting habits are coming with them.

Drugs aren’t the only way amplified individuals are augmenting themselves. Merlin Mann’s 43 Folders⁶ is just one of many blogs that highlights “life hacks,” a term coined by Danny O’Brien for systems, software, and processes that a group of programmers used to manage information and their lives. These systems are no longer reserved for infogeeks. Life hacks are commonplace, from the “Hipster PDA” to Smart Playlists. In addition to these hacks, visualization maps connecting related pieces of information are becoming more prevalent. Gapminder is one example of a company seeking to “make data more accessible and easier to use for instant visual analysis.” Gapminder creates need-based visualizations for information systems so that the connections between ideas, people, or places aren’t just inferred—they’re actually visible on the screen.

Additionally, in the next two decades, the emerging field of augmented cognition will deliver technologies that autonomously measure a worker’s psychological state and react accordingly. Panic setting in at work? An AugCog display will help you focus on the most important tasks. For example, DARPA is developing the CogPit, a context-aware airplane instrument panel that uses non-invasive brainwave monitoring to alter how much information is displayed on the screen at any moment, and other variables.

The Hipster PDA, one of many popular life hacks, is nothing more than index cards and a butterfly clip.



Source: www.flickr.com/photos/leff/4269370



“AMPLIFIED” IS NOT “ALWAYS ON.”

The trend toward amplification is *not* about increasing the pressure many workers today feel from the top down—pressure to be more productive, to log more hours at the office, or to be “always on.” Instead, amplification has the opposite goal: it aims to free up workers to design challenges that suit them, schedule their own hours, choose their own offices, and build their own highly flexible work teams. In short, an amplified individual is freed from many of the fixed time, location, and work flow constraints that typify a traditional job. And as a result, far from being “always on,” these amplified individuals might very well wind up end up working *fewer* hours, even as they produce more and better output for the company.

This shift from *fixed job* to *fluid and engaging work* is not only about increased productivity. It’s also part of the broader trend toward maximizing quality of life through better-designed work. Early signals of this new focus on workers’ well being include *The Four Hour Work Week*⁷, by Timothy Ferriss, a Princeton professor of entrepreneurship. It explores how mobile digital networks and collaboration software can help individuals create a better flow between work and everyday life—ideally enabling anyone to “escape the 9–5, live anywhere, and outsource your life.” Semco CEO Ricardo Semler takes the notion one step further with *The Seven-Day Weekend: Changing How Work Works*⁸, which documents his company’s successful efforts to radically de-structure the workplace by eliminating organizational charts, fixing job descriptions, and altering standard working hours.

In addition to innovative business theory, the field of positive psychology is a major driver of early efforts to amplify individual workers. The future of work was a primary theme of the 2007 Global Forum of the Gallup Institute for Global Well-Being⁹, where half a dozen plenary speakers focused on the potential for new positive psychology research to harness happiness for increased productivity and innovation at the workplace. One of the major insights emerging out of the positive psychology research space, captured recently in Markus Buckingham’s *Go Put Your Strengths to Work*¹⁰, is the importance of exercising and amplifying personal skills and talents while outsourcing weaknesses to others.

From developing a high ping quotient and strong cooperation radar to mastering multi-capitalism and exercising influence, it is clear that the amplified individual has an edge not only in achieving more work-related output, but also in improving personal quality of life. And while certain kinds of work might always involve tasks that are fixed to specific times and places, almost all companies would benefit from experimentation in pushing the limits of employee choice, flexibility, and ad hoc organization.

2 the visible world

FROM INFORMATION OPACITY TO UBIQUITOUS TRANSPARENCY

As networked memories proliferate, everything—people, places, things, and processes—will be surrounded by new layers of visible reality that challenge the way we find, create, and communicate knowledge in the workplace.

DILEMMA

visibility ►
◀ privacy

As the volume of private and business data rises exponentially, some of it revealed purposefully and some collected automatically as a part of daily activities, organizations and individuals will have to navigate highly contextual notions of privacy. Privacy norms and regulations will vary greatly in different local contexts and among different groups. A friend accessing information about a friend online may not be viewed as an intrusion; a potential employer or an ex-boyfriend regularly reading the same information or aggregating it with other visible sources, may be viewed as an intrusion or, even worse, stalking.

Everywhere we look today, sophisticated technologies for sensing and recording data are being embedded in our daily work. “The Spew,” as cyberpunk novelist Neal Stephenson called this information torrent, is filling up hard drives at an historic rate. According to a recent study by IDC, this year the amount of data created and replicated (255 exabytes) will exceed the storage capacity available (246 exabytes) for the first time in history. This means, simply, that we’re generating tons of information faster than we’re making hard drives to store it. In fact, corporate data storage requirements are expected to grow fifty-fold by 2010.¹¹

But information overload is nothing new. Since the dawn of computerization, large organizations have been challenged with managing and understanding mounting volumes of raw data. Over the next decade, however, the way we sense, understand and see the world through data will be transformed. Sensing embedded in our communications networks and the physical world will elevate the art of self-documentation to new heights. Social computing and the semantic web will create new ways for people and machines to collaboratively filter and extract meaning from data about our environments and ourselves. Finally, technical and conceptual breakthroughs in communication and presentation will provide new ways of telling compelling stories about complex data to support collaborative work. Adapting to this new world of visible data will be challenging. As both people and organizations reveal clouds of information about themselves, we’ll see new synergies and conflicts emerge at the intersection of these data clouds. As both present behavior and past history become more transparent, the visible world will require new management and communication skills at every level. In fact, transparency may emerge as the best practice in the workplace. In the visible world, it will be impossible to hide anything, so it’s best to have nothing to hide.



2 THE VISIBLE WORLD

Seeing: Self-documenting work and workers. A tectonic shift in our observational capabilities, driven by ubiquitous sensing, is a key enabler of a more visible world. The workplace of the future will likely be a place where everything is sensed and recorded—the things people write and say, where objects are located, the flow of money down to the transaction level, etc. As the cost of embedded sensing, computational resources, and wireless communications fall over the next decade, and demands for accountability continue to increase, these sensory platforms will be leveraged to document work at an unprecedented resolution. Simply by doing our work, we will create exquisitely detailed records of it.

Key platforms will include RFID, which will allow asset and inventory tracking in near real time as artifacts and consumable goods are moved about offices, campuses, and the larger world. Geographic positioning, implemented through a variety of technology platforms like GPS and Wi-Fi beacons, will allow information systems to “place-stamp” every bit of data they create, in much the same way they time-stamp records today. Extensible Business Reporting Language (XBRL) will provide a common format for transaction-level detail across entire industries. The array of personal identification technologies—voiceprint, gait, and facial recognition—will allow self-documenting workplaces to draw links between people, places, and objects.¹²

In addition to data related to our work, people are creating personal ecologies of visibility. From cell phones with built-in cameras to social sites like Twitter, Last.FM, Flickr, and iMeem, self-documentation has reached new heights. These technologies enable us to capture—and, subsequently, share—every aspect of our lives. iMeem is a great example of the self-documenting dashboard, allowing a user to integrate favorite personal visual and audio media, blogs, and more through the use of playlists presented on a simple profile page. Through this self-documentation, the user presents a handcrafted aggregation of his or her personality, visible for all to see and discover.

Knowing: People and machines making sense together. Neither people nor machines alone will be able to absorb the torrent of sensory data that will literally infest the future workplace. To address this challenge, we’ll see increasing innovation around information systems that combine machine intelligence and the power of groups to collaboratively filter and analyze raw data, and transform it into knowledge. However, tomorrow’s assistive technologies won’t simply tell us what to do, but rather provide us with more and new ways of looking at the complex data streams produced by people, the economy, objects, and places.



An early indicator of this shift can be seen in the financial sector. For the past decade, Professor Peter Levin of Barnard College has studied the changing nature of commodities trading. Once dominated by open outcry markets like the famous and intensely social pits of the Chicago Board of Trade, there has been a steady shift to electronic trading of commodities. With this shift from face-to-face trading based on the ticker to desktop trading from sophisticated personal research stations, massive new volumes of data are now at traders' disposal every minute of the day. Correspondingly, the style of work and skill sets of successful traders have shifted from those able to sense the body language and mob dynamics of the pit traders, to those with the mathematical and data literacy skills to leverage the computer-based platform. The great traders of the future won't be robots executing the trades determined by an all-knowing computer, but sophisticated analysts supported by machines that summarize and make accessible massive networked memories.¹³

Communicating: New modes of expression. Perhaps the most important shift in the visible world will be the way that we communicate what's interesting about the data we work with. The way we model, visualize, and interact with complex information will need to change as fast as the way we collect and analyze it. But as PowerPoint fades into the distance, what new modes of expression will enter the future workplace?

Today's trends in scientific visualization offer a window into the data-rich workspace of tomorrow. Physics and structural biology are two fields in which researchers' ability to generate massive sets of sensory data has utterly outstripped their ability to effectively visualize that data. As leading scholar Wayne Hendrickson of Columbia University says, "visualization is everything" in cutting-edge biomedical research.

The challenge of visualization in the visible world will be twofold. In a workplace where networked memories will provide infinite zoomability and instant access to excruciating detail, information design will need to find new and compelling views of the big picture. Second, the growing accumulation of time series data will invite us to look more deeply not just at snapshots of data, but also at processes that shape trends over time. Here, an increasing literacy and toolkit for building simulations will provide a mode of expression far more effective than eloquent writing or appealing illustration. Finally, as we reach the limits of the human nervous system's eye-mind circuitry, we'll see more non-visual augmentations to data visualization. Haptic, or tactile, technologies that let us step inside simulations and "move" data around will provide new opportunities for conveying newly visible data.



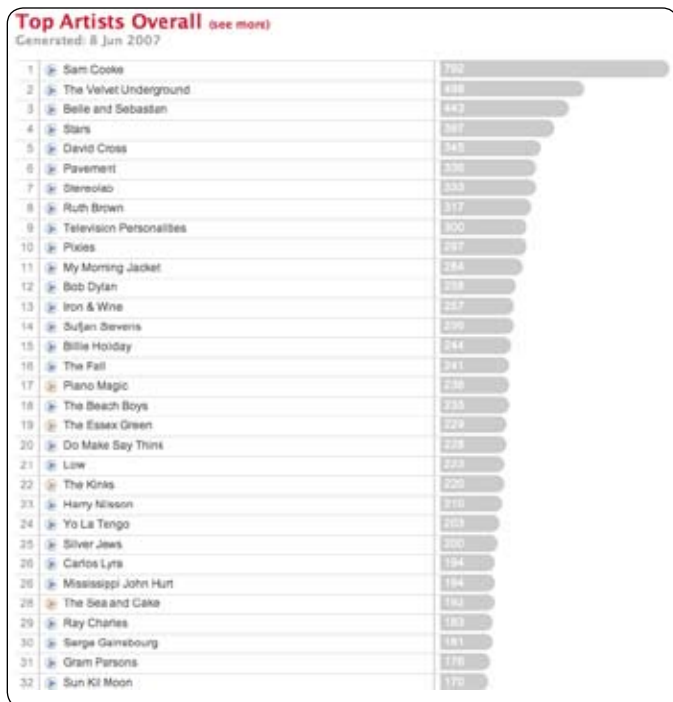
Last.FM software allows users to track their listening habits and view a variety of charts on their Last.FM homepages

Seeing

Persistent work leaves trails of data

In the future workplace, more and more detailed activity will be documented automatically (and often inadvertently) as a result of embedded sensing and increased electronic communication. Increasing demands for accountability will arise as regulators, customers, law enforcement, and courts gain greater awareness of these new records. These are some of the trails we're likely to leave:

Taste Trails—One of the most profound impacts social networking has had thus far is the idea of aggregating habits—listening habits, activities, interests, friends—into lists and dashboards that can be shared and displayed. In this corner of the visible world, manual self-documentation allows us to control our visible digital identity. Flickr is the most common example, enabling users to upload and manage the accessibility (private, friends only, family only, or public) of the images in their photostreams. Last.FM not only allows us to share what we're listening to but also provides us with comprehensive data and charts that visualize listening habits. Tracks and artists we'd prefer to enjoy without others knowing (guilty pleasures) can be manually edited and removed from our listening history. Through this self-documenting we have begun to create a personal ecology of visibility, controlling what we share and who we allow to see it.



Source: <http://ast.fm/user/agreatnotion>

Location Trails—Just as all data created by computers today is time-stamped, virtually all of the data produced in the workplace of the future will have a location stamp as well. This new attribute will enable us to track people, objects, or groups as they move through space, or answer entirely new kinds of questions about place. A subset of location trails will be presence trails created by tools like Twitter or Plazes that mix location and activity data to record what we were doing.

Collaboration Trails—The growing use of social software for knowledge creation and manipulation—wikis, social bookmarks, and blogs—generate more and more microdata about our work habits. As use of these tools grows, we'll leave detailed trails of data about whom we collaborate with, how, and when. It will be harder to erase this record as it proliferates across networked memories. Machine intelligence will be applied to managing human relationships—XBRL can provide the semantic context to help detect fraud in real-time, protect confidentiality, or initiate whistle-blowing to preserve corporate ethics.

Biometric Trails—Increasingly, workers will leave trails of biological data as workplace environments become more aware of their inhabitants. Our voices, faces, and gait will be used to detect our presence in workplaces as well as to link and cue information. Biometric sensing will become a powerful platform for making complex health and health-related information more integrated and visible in the workplace as companies seek to create better workplaces. For instance, an employee coughing or sneezing more than usual can be detected by the workplace environment, notifying that employee's boss that the employee may be sick and need to go home in order to prevent an office-wide flu outbreak.





Knowing

The social evolution toward artificial intelligence

Visions of artificial intelligence as an all-knowing, centralized intelligence are rapidly giving way to a messier reality of pattern recognition powered by abundant computing power, and the ability of groups to create new vocabularies for building knowledge. The social web may rapidly emerge as the ultimate synthesis of human and machine intelligence inside large organizations. Some interesting examples of human-machine innovation include:

People Training Machines—Amazon’s Mechanical Turk is a computing platform that coordinates the use of human intelligence to perform tasks which computers are unable to do easily, such as interpreting certain kinds of images. One of the most popular uses of this technology, however, is to train machines to perform more sophisticated tasks based on cues given by humans. Increasingly, we’ll see machines that learn from social activity on the web and inside organizational webs proactively recognize and organize information in ways that are intuitive to human users.

Smarter Social Webs—For much of the last 15 years, large organizations deployed knowledge databases in an attempt to capture and share lessons and re-usable work products. But, unexpectedly, these databases did not supplant people as key sources of information.

Today, the social web is primarily used by groups of people for manually recording and annotating information, without much intervention by machines. But over the next decade, we’ll see more and more machine intelligence emerge to help navigate and find useful information and knowledge within these new social webs. Reputation and ratings systems will help weigh information, valuing contributions from higher quality sources. Social network analysis will inform new knowledge-creating networks, and provide new ad hoc ways to organize information. Technologies like Yahoo! Pipes, which let individuals remix RSS feeds into their own syndicated news streams, amplify the ability of domain experts to publish and share their filters on the torrent of data produced everyday.

Reality Mining—Platforms like MIT’s Reality Mining project illustrate how machines will help people work together by augmenting their sociability. As sensed data about workplaces, workers, and the work itself accumulates, time-based patterns of association will emerge that can inform predictive models. For instance, we might be able to anticipate informal social gatherings at key locations to better understand how people collaborate in creative environments.

Communicating

A new literacy of data visualization

Over the last decade, PowerPoint has revolutionized the presentation of business data. Presentation authoring tools have driven a democratization of high-quality data visualization akin to what word processors and desktop publishing did earlier for written modes of communication. In many organizations, PowerPoint decks have replaced traditional written reports as the primary means of communicating analysis.

Going forward, however, the challenge of effective data communication will demand new tools and skill sets for data visualization. PowerPoint and the desktop interface will give way to new tools for summarizing and sharing highlights of multivariate data sets. These will include:

New Desktop Tools—Trendalyzer, a tool developed by the non-profit venture Gapminder, is a signal of a coming revolution in new desktop data visualization tools. Trendalyzer reduces the need for viewers to interpret data on the fly and increases the effectiveness and speed of communicating complex data by breaking away from the static slide paradigm of PowerPoint and visualizing multi-dimensional, time-series data in a continuous way. “Heat maps” are being used to summarize complex quantitative data in easily understood visual forms on geographic maps.

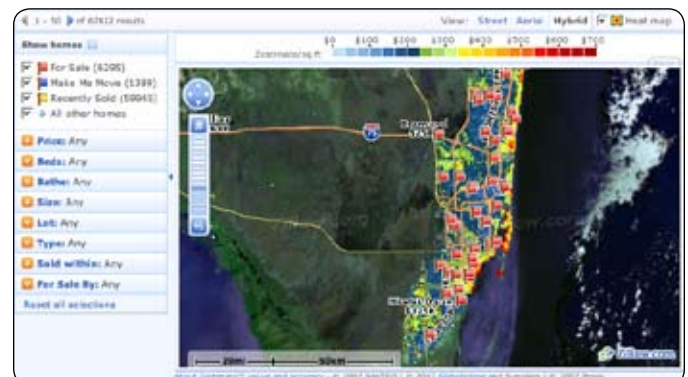


Visualization tools like Gapminder help a user synthesize large quantities of data.



Source: www.gapmindere.org

Heat maps like this map of Miami real estate by Zillow summarize complex data in visual form on a map, putting it into geographic context.



Source: www.zillow.com

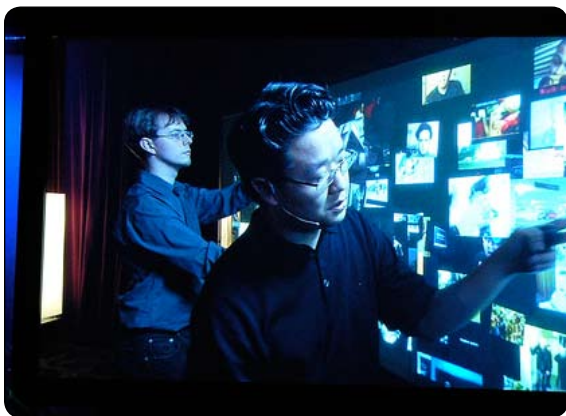
the details

Perceptive Pixel, founded by Jeff Han, creates multi-touch interaction surfaces that revolutionize visual display from a viewing screen to an interactive experience.

Collaborative e-Displays—As e-displays take on more of the functionalities of paper, we'll see digital systems that don't disrupt person-to-person and group collaboration practices but support them instead. This may be one of the most important impacts of flexible displays or e-paper: the ability to replicate the scale and interactivity of traditional paper, thus transforming computers from tools that disrupt older forms of collaboration into tools that support them. Jeff Han, a consulting research scientist for NYU's Department of Computer Science, has developed a web-famous technology for multi-touch interaction surfaces. Imagine a handful of designers grouped around a lightboard dragging photos and sorting them into piles—except the lightboard is a screen and the photos are digital.

Scientists today grapple with the challenge of visually presenting ever-mounting volumes of information. In data rich fields like high-energy physics and structural biology, scientists are engaged in an urgent search for news ways of working with and communicating data.

Immersive Haptics—The sheer complexity of data produced in protein modeling is driving innovations in immersive haptic displays. In these environments, scientists can deal with data through multiple sensory channels—3 D visual, auditory, and touch. By grabbing, pushing, and bending proteins, they can develop additional insights on the structure of the molecules. As MIT biologist Jonathan King has said, it is becoming clear to educators that “you need many, many forms of visualization to understand and interact with something as complex as protein structure.”



Source: www.flickr.com/photos/14657061@N00/414716166



Researcher Jurgen Schulze demonstrates an interactive protein visualization on a virtual reality wall at UCSD's Calit2.

Source: www.calit2.net/~jschulze/

Artistic Visualization of the Small World—Leading scientists are beginning to question dependence on computer-generated visualization of complex small-world structures, especially for trying to teach or communicate findings to audiences outside their narrow areas of research. This suggests a return of artists, who are exploring new data-rich fields like structural biology as a subject of inquiry. Increasingly, artists are using real scientific data to create “analog” visualizations off the screen. Some of the best examples include the knitted coral reefs created at the Institute for Figuring. Sculptor Mara Haseltine, daughter of prominent molecular biologist William Haseltine, used data from public protein structure databases to create her scaled-up “Waltz of the Polypeptides” at the Cold Spring Harbor Laboratory on Long Island. As we drown in raw data, graphic artists can provide skilled interpretations through representational imagery that is not possible with the algorithmic rendering of computer graphics, re-introducing human interpretation and storytelling into the visualization of data.



The Institute for Figuring’s crocheted coral reef takes a crafty approach to analog scientific visualization.



Source: www.flickr.com/photos/84445194@N00/315169802

Sculptor Mara Haseltine used data from public protein structure databases to create her scaled-up “Waltz of the Polypeptides.”



Source: www.flickr.com/photos/viknanda/315753844/

3 diversity redefined

FROM POLITICAL CORRECTNESS TO INNOVATION IMPERATIVE

For decades, diversity in many global organizations has been largely a political and social imperative. Conversations about “diversity” usually revolved around the gender, race, or ethnic characteristics of the workforce. In the next ten years we will see innovation emerge as a new imperative for diversity. In the process, what diversity means will be redefined, broadening it to include a host of new dimensions—age, skills, disciplines, and backgrounds; cognitive, work, learning, and thinking styles; and much more.

DILEMMA



Valuing diverse work styles, media preferences, cognitive abilities, work environments, in addition to traditional dimensions of diversity? Sounds like a recipe for chaos. Navigating the thin line between the creative chaos that helps make an organization innovative, and order that ultimately ensures things get done, is exactly what this dilemma is about.

Many companies are realizing the power of collective intelligence and the need to be truly global and transdisciplinary. Consequently, diversity is becoming a core competence for many organizations.

Diversity is at the core of what makes groups intelligent. Connective technologies are leading to increased appreciation of the power of collective intelligence and its role in the innovation process. From Wikipedia’s vast repository of user-contributed, non-expert knowledge to massively multiplayer gamers—whose players are, together, able to solve complex problems at a fraction of the time compared to individuals—we are seeing examples of the advantage and power of group intelligence and problem solving. What makes collectives truly successful, however, is the diversity of the group. Groups that include a variety of people with varying knowledge, including those who are not necessarily highly skilled or “expert,” for example, tend to be more innovative and make better predictions than groups of experts that are restricted only to the most renowned and traditionally intelligent.

Complex problems will require transdisciplinary approaches. With technology bleeding into nearly all aspects of modern work, fields of study and professions are beginning to overlap more than ever. Also, we are facing complex problems such as global warming or global epidemics that require knowledge from combinations of traditional disciplines. Researchers and problem solvers are called upon to work together and to speak common languages in order to solve such problems. Universities are beginning to prepare for this call to arms by creating rich transdisciplinary programs that allow people to study and work with specialists across a range of fields instead of being limited to one traditional field. In order to innovate and grow, organizations will not only have to ensure that the workforce contains a variety of multidisciplinary teams, they will also have to hire employees with diverse backgrounds and cognitive skills in areas such as abstract reasoning, problem solving, communication, and collaboration.



Innovation in the next decade will require skills in managing deep diversity. The United States and Europe no longer hold a monopoly on the markets for innovation. Part of this has to do with the exporting of manufacturing processes overseas. What was thought of as an exportable aspect of industry now turns out to be the segment of industry around which innovation flourishes. At the same time, organizations from resource- and infrastructure-constrained markets in developing countries like India and China in some areas (like mobile technologies) are innovating at a faster pace than those from developed countries. While large global corporations struggle to figure out how to revive innovation within their existing infrastructures and business models, lack of legacy infrastructure combined with rapidly growing markets are fueling growth of new companies in developing countries. These companies are often able to leapfrog established organizational models and seize market niches faster because they have fewer legacy systems and often less regulatory oversight. Presence in areas where new competitors are popping up is critical to survival, but it is not enough. The key is not just to employ people in these locales but also to effectively integrate these local employees and local business processes into the infrastructure of global organizations in order to remain competitive.

Diversity Makes Groups Intelligent Prediction markets and jams

James Surowiecki, author of the best-selling book *Wisdom of Crowds*, argues that what makes crowds smart is diversity. When you bring diverse sets of people with diverse lenses and points of view together, each person in the crowd brings a little information. If all the opinions are combined, all the erroneous information is randomized and cancels itself out. In his highly influential book, *The Difference: How the Power of Diversity creates Better Groups, Firms, Schools and Societies*, Scott E. Page, professor and director of the Center for the Study of Complex Systems at University of Michigan, Ann Arbor, agrees that diverse groups yield superior outcomes compared to homogenous groups. In his research, Page demonstrated that groups displaying a range of perspectives and skill levels outperform like-minded experts. He points out in the prologue of *The Difference* that, “Progress depends as much on our collective differences as it does on our individual IQ scores.”

To leverage the power of diversity in collectives, many companies are beginning to use prediction markets to enhance various aspects of their operations. Prediction markets are collective intelligence tools where participants essentially bet on the likelihood of outcomes. For instance, election season in the United States has made prediction markets for the candidates popular. The idea is that the collective knowledge of the participants will drive the market up and down, making it a more accurate predictor of outcomes than, say, a group of political pundits. Plus, because there is usually some sort of reward at stake in a good prediction market, like money or prestige, people tend to vote with their mind not their heart, thus generating different and generally more accurate representations than what would come from a small, homogenous group of decision makers. Simply put, part of the accuracy is derived from participants’ investment.

Some of the most popular prediction markets on the Internet include the Iowa Electronic Market, NewsFutures, and Intrade. Participants bet on everything from sports to politics to Harry Potter's fate. Inking Markets helps organizations set up their own company-specific prediction markets for things like book sales (O'Reilly Media) and acceptance of scientific research (Los Alamos Lab). Another example is Hewlett-Packard BRAIN (Behaviorally Robust Aggregation of Information) game, used for prediction in small groups. The betting game is anonymous and people have to back their bets with actual money. The game also assigns a behavior quotient to all the players to summarize their risk attitude and predictive behaviors, and weighs their responses based on the behavior quotient. According to HP, the BRAIN game consistently beats forecasts generated in a more traditional way.

IBM's JAMS are another large-scale collective endeavor. For 72 hours, May 21–24, 2001, IBM conducted an experiment in intranet diversity known as the first WORLD JAM. The company opened up what amounted to an employee-wide Internet forum, with the typical forum structure of thread title, or topic, and threaded comments. The threads were grouped into ten content categories, with moderators. The goal was for employees to have an open forum in which to share ideas and concerns with each other. Anonymity allowed people to feel uninhibited in their contributions. Because of the range of skills and experiences individuals brought to the table, IBM was able to learn a lot about its employees while letting its employees pool their collective intelligence to help each other. Today many companies are beginning to use versions of JAMS to poll employees around various issues, reach corporate-wide decisions, and even aid in making R&D decisions.



Prediction markets are collective intelligence tools where participants bet on the likelihood of outcomes in everything from R&D decisions to Nobel Prize winners.



Source: www.inkingmarkets.com

3 DIVERSITY REDEFINED: COMPLEX PROBLEMS WILL REQUIRE TRANSDISCIPLINARY APPROACHES



the
details

Calit2 is a groundbreaking transdisciplinary program that brings together artists, technologists, and scientists to solve complex problems that can't be addressed within a single discipline.

Complex Problems Will Require Transdisciplinary Approaches University programs and Calit2

In the United States, more and more universities have begun to experiment with transdisciplinary programs. Stanford currently has several new transdisciplinary programs, including BioX and MediaX. BioX brings together bioscience, engineering, physics, computer science, and more in order to facilitate innovation and experimentation. MediaX is similar, but focuses on how people use technology to connect with each other and access information. The idea is to apply insight from other fields of study to problems that were historically dissected by one homogenous team. One of the most interesting and visionary examples of transdisciplinarity is the California Institute for Telecommunications and Information Technology (Calit2) at the University of California's San Diego campus. (UC Irvine is also home to a division of Calit2.) Calit2 brings together researchers from the sciences, engineering, art, design, and myriad other disciplines to tackle large-scale societal problems. What is particularly unique about Calit2 is the integration of art and artists into many science teams. At Calit2's foundation is the belief that artists often have unparalleled foresights and insights that are relevant, prescient, and valuable when envisioning and building future technologies. For example, people with the ability to identify patterns and make sense of them through artistic visualizations and other techniques will be invaluable in helping us deal with the massive amounts of data available to us.

Calit2 director Larry Smarr likes to think of it as the Lab of the Future, where the projects underway are five years ahead of today's technology. Researcher Shannon Spanhake even calls the program "anti-disciplinary" because of the egalitarian way the program treats researchers from across a wide range of fields. With a BS in electrical engineering and a BFA and MFA in visual art, Spanhake exemplifies the kind of transdisciplinary background that will be indispensable in a world that emphasizes collaboration over homogeneity. Spanhake created a personal pollution monitor known as "Squirrel" which senses the level of pollution in the air around you and sends real-time information to a mobile phone or device via Bluetooth. The sensor can be clipped to a purse or a belt and Spanhake hopes to make the device fashionable in the future, like an iPod shuffle.

Of course, because this model is a fairly new one, it is not without its obstacles. People trained in different disciplines communicate using the language of their particular discipline. In order for the biologist to communicate with the electrical engineer, or the nanotechnologist to work with the sociologist, a common language must be developed. Furthermore, all disciplines must learn to interface with artists. This sort of high-level communication takes time to develop but Calit2 researchers realize that the development of a common language is possible because success of the collaboration depends on it.



Source: www.flickr.com/photos/bw/511078977

Innovation Will Require Skills in Managing Deep Diversity

Thriving on deep diversity

For decades, most multi-national companies have used their overseas subsidiaries as sales and technical support channels for the headquarters. In the last ten years, overseas companies, particularly IT ones, outsourced everything from customer services to software development. The model, however, has stayed the same: innovation and design have been the prerogative of R&D labs in developed countries. As markets in China, India, and other developing countries grow, it is increasingly difficult for the headquarters to develop products that can suit the needs of a whole different category of consumers. This will require deep understanding of local needs and market dynamics as well as reliance on local innovation talent.

GM understands this. The company sought to reach a younger market by redesigning its Buick LaCrosse for the Chinese market and chose Joe Qiu and a team of Chinese designers to make it happen. The new car has become so popular with the 30-something set in China that it is slated to sell over 110,000 units this year. The success of Qiu's design drove GM to look to the Shanghai team for an overhaul of the American market's LaCrosse. A team in Detroit will design the exterior but Qiu's team will have input into, and control of, the interior design. With the car market in China booming, GM took advantage of an opportunity to diversify their state-side innovation by creating a global team that had proven its ability to create something fresh and successful.

While multi-national companies look to integrate local talent, developing countries are trying to bring Western-educated expatriates back home. These companies are not hindered by a legacy of inefficient processes, and offer expatriates new growth opportunities back in their homeland. China's Zhongguancun Science Park, created in 1988, is housed in the Zhongguancun corridor, which has been called the "Silicon Valley of China." Thousands of Chinese-born IT businesses are headquartered in this zone but many multi-national companies—Intel and Qualcomm, for example—also have R&D centers or regional offices here. Many universities and research institutions also call this zone home, rendering Zhongguancun a truly powerful and diverse knowledge center. Local companies have easy access to graduating science and technology students and multi-national companies gain access to these local stars because of their presence in an area where innovation is valued and encouraged.



The redesigned Buick LaCrosse was so successful in China that GM plans to use the same Chinese designers to work on the interior of a new LaCross design for the US market.



Source: www.flickr.com/photos/chijis/133367527

4 science at work FROM EXPERIENCE AND INTUITION TO DATA AND DESIGN

We are on the brink of a new “scientification” of work. Traditional management theory and workplace optimization have largely been based on social sciences. Over the next decade though, workplace science will more frequently draw from advances in neuroscience, biology, and mathematics, enabling design based on quantifiable information.

DILEMMA

analysis ►
◀ intuition

With the influx of data, the desire to make decisions based on “scientific” evidence is likely to grow. In fact, in many cases, scientific justification will become a requirement. However, in some situations science may not be the right default approach. It is good to remember that the greatest athletes and musicians are at their best when they do not calculate their moves, but make them instinctively. Thus, balancing the need for data with the appreciation for scientifically unexplained intuition will be necessary.

Just as smart design differentiates products in an overcrowded marketplace, so will smart design become integrated into various aspects of work, from workplace design to organizational processes. We will apply knowledge from math and science to maximize creativity, foster innovation, boost productivity, and improve the quality of life for employees. Once we understand the patterns governing such previously amorphous processes, we will not be leaving anything to chance. The next step will be to design work processes, spaces, and interactions to achieve desired outcomes.

Neuroscience gets a job. Historically, workplace psychology has been relegated to human resources, a “soft” science that managers might draw on to solve problems and resolve employee conflicts. But breakthroughs in neuroscience and cognitive psychology are deepening our understanding of human behavior. Technologies like functional magnetic resonance imaging and quantitative electroencephalography, combined with powerful computers running pattern-recognition algorithms, are opening the black box in our heads. By reverse engineering the software (mind) that runs on our hardware (brain), scientists are developing an accurate picture of mysterious mental processes and phenomena like creativity, decision making, attention, and even happiness.

From that research, new theories are emerging that will lead to powerful organizational applications. For example, scientists have observed that you can, in fact, “teach an old dog new tricks.” Neuroplasticity refers to the fact that the organization of the brain, specifically the way information is processed, is not “hard wired” into fixed circuits as we once thought. Scientists have also shown that, contrary to popular belief, the adult brain can grow new neurons. These findings will likely impact how new skills are taught at work and provide a scientific basis to the importance of exercising our brains: “use it or lose it.”



4 SCIENCE AT WORK: NEUROSCIENCE GETS A JOB

Mathematics of work and workers. Management science attempts to use social science-based techniques to enable better decisions. With rapid advances in data mining and analytics, computer simulation, and diffusion of sensors to monitor various workplace processes, mathematics will become an integral part of that management science.

Keith Devlin, executive director of Stanford University’s Center for the Study of Language and Information, has coined the term “soft mathematics” to describe math applied to individual people, where traditional statistics breaks down. The earliest and best examples of soft mathematics are indeed in management science, where behavior patterns were recognized and identified in interactions between just three or four people. “When you’ve got a recognizable, repeatable behavior pattern, you’ve got the basis for a mathematical discipline,” Devlin says.

Drawing from the cognitive sciences, some large companies are wielding mathematical tools to identify the best job candidates before ever meeting them. Indeed, long surveys often containing unusual questions are used to gather “biodata,” quantitative information about a person’s background, to determine early if they might be a good fit not only for the job but also the corporate culture. Completing biodata surveys may become an ongoing job requirement, perhaps akin to annual reviews but more quantitative. Of course, the mathematization of people will infuriate many individuals who feel that they “just don’t test well.”

Everything designed. Bringing these two disciplines—mathematics and neuroscience—into the organizational realm will result in their growing use when designing various organizational processes. Once we can decode and understand phenomenon, the natural impulse is to pre-design for various desired outcomes. For example, understanding flows of people through an office will allow us to design simulations of various types of workspaces.

In addition to physical space and organizational processes, visibility of behavioral patterns will aid in individual skill enhancement. Researchers in industrial engineering and operations research are moving their practice beyond the factory floor. Drawing from esoteric mathematics to develop algorithms and computer simulations to validate their theories, researchers will tease out general “rules-of-thumb” to help managers train employees, efficiently distribute a company’s workload, and smartly prioritize projects.

Neuroscience Gets a Job

Future thinking and problem solving

As our Foresight-Insight-Action mantra suggests, IFTF believes that a strong practice of futures thinking is essential for a business to thrive in today's volatile, unpredictable, complex, and ambiguous (VUCA) world. Neuroscience is beginning to shed some light on the cognitive activities underlying this process.

Earlier this year, researchers from Washington University in St. Louis used fMRI scans to pinpoint the brain region that "sees the future." Interestingly, the process of imagining oneself in some future event occurs in the same part of the brain from which autobiographical memories are retrieved. The activity patterns observed by psychology professor Kathleen McDermott and her colleagues suggest that the visual and spatial context of the future we imagine are based on travels in our past through similar settings that we've stored in memory.

"It may just be that the reason we can recollect our past in vivid detail is that this set of processes is important for being able to envision ourselves in future scenarios," McDermott says. "This ability to envision the future has clear and compelling adaptive significance."

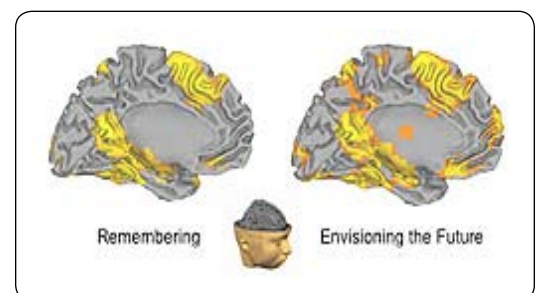
In May of 2007, UCLA research psychiatrist Dr. Jeffrey Schwartz and management consultant David Rock hosted the First Global NeuroLeadership Summit in Italy. One of the scheduled presenters was Mark Jung-Beeman, a Northwestern University professor at the Institute for Neuroscience, who used fMRI and EEG technologies to study how the brain produces insight. Along with collaborators, Jung-Beeman and Drexel University professor John Kounios observed their subjects' neural activity when faced with word puzzles that had "Aha!" solutions.

According to their experiments, the pattern of brain activity just before solving a problem using insight suggests three things: that they are focusing their attention inwardly, almost like closing their eyes; they're mentally primed to switch to new trains of thought; and they may be actively silencing irrelevant or distracting thoughts. "We have begun to understand how the brain prepares for creative insight," Kounios says. "This will hopefully lead to techniques for facilitating it."

Scientist Louis Pasteur once said that, "Chance favors only the prepared mind." Perhaps this preparation would be good on-the-job training.



Comparing images of brain activity in response to "self-remember" and "self-future" cues, Washington University researchers discovered a complete overlap between regions of the brain used for remembering the past and imagining the future.



Source: www.news-info.wustl.edu/news/page/normal/8448.html



Mathematics of Work

Scenario probability and hiring

Probability has long been used to estimate possible outcomes. However, Monte Carlo simulations are a different approach to probability that could prove invaluable to businesses. Based on methods created by physicists working on the atomic bomb, these stochastic, or nondeterministic, methods emphasize random sample paths—collections of different possible scenarios—instead of outcomes alone. In his book *Fooled by Randomness: The Hidden Role of Chance in Life and the Markets*, Nassim Nicholas Taleb writes, “Monte Carlo simulations are closer to a toy than anything I have seen in my adult life. One can generate thousands, perhaps millions, of random sample paths, and look at the prevalent characteristics of some of their features.”¹⁴

The simulations may seem like toys, but they are proving indispensable as tools for risk assessment when it comes to everything from financial portfolios to exploration ventures. Stanford professor Sam Savage believes that the adoption of the Monte Carlo simulations will drive managers to take on roles equivalent to the idea of a “Chief Probability Officer.”¹⁵ Businesses could benefit greatly when it comes to partnerships, investments, process implementation, and more by looking at a variety of potential scenarios instead of just possible outcomes.

The application of mathematical theories, models, and algorithms has begun to revolutionize human resources practices as well, particularly when it comes to hiring. Every month, more than 100,000 people apply for a job at Google. According to Laszlo Bock, the Google’s vice president for “people operations,” the company was worried that with traditional hiring methods they will overlook some of the best candidates. So they came up with an algorithm to sift through the candidates. Job applicants must fill out a long survey asking questions meant to draw out data about your aptitude, attitude, personality, and other factors. Google’s mathematicians wrote custom algorithms to analyze the data and rate each applicant on a scale of zero to 100. Only then do humans enter the loop.

To create the questionnaire, the company had all of its employees complete a 300-question survey. The answers were integrated with performance measures, resulting in a total of two million data points. Google analyst Todd Carlisle, an organizational psychologist by training, used the information to generate surveys for several areas, such as engineering, sales, and finance.

University of Oklahoma psychology professor Michael Mumford claims that these kinds of quantitative methods to assess talent can be accurate, but should be taken with a grain of salt.

“You have to know or at least have a hypothesis why having a dog makes a good computer programmer,” he says. “If you ask whether someone started a club in high school, it is a clear indicator of leadership.”

Google uses a hiring algorithm, based on a survey of their employees, to weed through the pile of applications they receive for open positions.



Source: www.flickr.com/photos/laughingsquid/260176034

Everything Designed

Process and personal optimization

Researchers using mathematical models are identifying approaches to workflow that may be ubiquitous, but not because they're good. For example, a common policy in almost every industry is for a single employee to follow one task from beginning to end. While this may seem logical, the math proves that it's actually not efficient. A better approach, according to UC Berkeley engineering professors Ronda Righter and Hyun-soo Ahn, may be "last-buffer, first-served" (LBFS), a process where employees prioritize projects that are closest to being completed even when a project had been another employee's responsibility.

"If you have people coming and going in a company or getting sick during the course of a large project, there are often many unfinished tasks," Righter explains. "Under certain circumstances, it's better for someone else to pick up where something was left off rather than waiting for the first person to come back and finish it."

LBFS may seem like common sense, but it's often underutilized, Righter says. Take the process a bank uses to approve a loan. Typically, one employee follows a loan from start to finish. In reality though, there may be ways to dramatically speed things along by assigning various components to a number of employees. Perhaps, Righter says, certain individuals may be trained to float through the office, helping those who are bogged down at certain stages in the approval process.

Professor Hyun-soo Ahn also conducts research on supply chain and service operation management. To mathematically prove their rules-of-thumb theories, Righter and Ahn employ stochastic models—mathematical models that contain random variables representing random factors. Specifically, they look at so-called Markov chains—models of a sequence of events where the probability of one event depends on whether the preceding event occurred or not.

"By using these models to prove theorems, we can determine that a particular workflow policy is optimal, the best you can do in that situation," Righter says.

In 2004, Schwartz and Rock coined the term "neuroleadership" to describe efforts to integrate recent advances in neuroscience into the business world. Together, they draw on scientific research, from cognitive psychology to quantum physics, to explain what they see as the biological basis underlying certain organizational challenges. While some of their inferences are still in the realm of theory, their efforts to bridge the gap between business and brain science points toward a new trend in management style.

One of the most interesting focal points of their research is the way change in a company impacts its employees and how mergers, layoffs, and other kinds of upheaval can be designed to cause the least stress for employees. For instance, Rock and Schwartz believe that getting the undivided attention of employees is the best way to introduce new ideas. As such, they suggest an offsite meeting free of computer distractions as an ideal venue so that employees will





pay attention and focus on the new ideas presented. The next step is to present a “compelling vision of what will occur when their new idea has been implemented” in order to encourage the kind of insight necessary to help people alter their expectations and attitudes. Schwartz and Rock write, “During the moment of insight, cognitive scientists believe, the brain is undergoing a complex set of new neural connections that can help the brain enhance its mental resources and overcome resistance to change.”¹⁶ The final step is the continuing process of maintaining people’s attention and pushing them to remain focused on the new vision so that it becomes the context in which they make all decisions. By following this design of process, leaders will help to essentially train their employees’ brains to think in this new context, thus lessening the stressful transition from old to new.

Membership in online “brain fitness centers” may start as a perk, but participation in a custom-designed mental training program could become a requirement for some jobs. SharpBrains is a start-up that develops software tools for mental training, or “brain gyms.” The company was co-founded by Elkhonon Goldberg, a clinical professor of neurology at New York University School of Medicine. From the SharpBrains Web site:

The “mental muscles” we can train include attention, stress and emotional management, memory, visual/ spatial, auditory processes and language, motor coordination and executive functions like planning and problem solving.

Programs that fit specific, individual needs could be personalized for employees and enterprises based on patterns identified through the practical application of neuroscience and mathematics in the workplace. From there, technology can even close the feedback loop, monitoring your brain and altering your work environment in response to best suit your “frame of mind.”

Neuroscientists and business leaders gathered in Asolo, Italy in May 2007 at the first Neuroleadership Summit.



Source: www.flickr.com/photos/velvetjam/502323210/

5 sustainable enterprise FROM FINANCIAL BURDEN TO OPPORTUNITY

From marginal activity to core of business operations, sustainability is evolving into a set of tools and concepts that can help generate innovative designs, products, and practices; set priorities; or help an organization express its deeper goals. This is a conceptual shift as much as strategic or technological one: the enterprise of the future may be “sustainable” in the way that today’s are “economical.”

DILEMMA

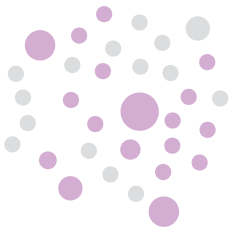
knowledge ▶
◀ action

Advocates of sustainability share the rationalists’ assumption that more information will equal more sustainable factories, workplaces, households, and lives. But will more real-time data about resource use and cost and more transparency in energy markets and pricing inspire and guide consumers and companies to see how to shrink their energy budgets and ecological footprints? Pushing too much information onto users may leave them less able to make decisions, not more.

A decade ago, most companies’ sustainability programs were extensions of environmental activities or exercises in regulatory compliance. They were often seen as a drag on business, a necessary evil to avoid trouble from government regulators or environmental activists. Today, a growing number of organizations are bringing sustainability from the edge to the center of their enterprise, a phenomenon that impacts industry, organizations, and people.

Of course, government mandates continue to be an important driver for corporate sustainability programs in North America and Europe, and environmental disasters in China illustrate what can happen in the absence of regulatory and enforcement mechanisms. But some companies are now working to marry sustainability and profitability. For them, sustainability is no longer just about recycling; it’s about designing so that your process doesn’t pollute in the first place, recognizes the real cost of pollution, or finds a buyer for what was formerly considered “waste.” Consequently, this is a fractal, multidimensional movement: arguments for “sustainability” appear in everything from business strategy to travel to process engineering. Sustainability is also becoming a concern for companies in services and knowledge work, not just those in extremely energy and resource-intensive fields like agriculture and manufacturing. Finally, sustainability is no longer only an organizational imperative; it’s becoming a personal one, as individuals begin assess their activities—everything from travel to what products they use—through the sustainability lens. Indeed, one of the most interesting things to watch is how organizational and personal sustainability might interact, compete, or work together to affect workplace design, human resources, new product and service development, and other areas.

Sustainability moves to the core of enterprise strategy. At a recent IFTF conference, Gil Friend, President and Chief Executive Officer of Natural Logic, Inc., said that there has been a sea change in corporate attitudes toward sustainability in the last year: sustainability is no longer a dirty word in business. This is due, in part, to growing public awareness of climate change and a sense on the part of American businesses that they need to act to become more environmentally responsible. Sustainability is no longer just about compliance with governmental



5 SUSTAINABLE ENTERPRISE: SUSTAINABILITY MOVES TO THE CORE OF ENTERPRISE

standards, although political pressure remains a driver (some of the highest visibility government activities are ones that mandate environmentally friendly practices—like proposals in the United Kingdom for a national carbon credit system—or create large-scale incentives for cleaner behavior, like carbon markets). Pressure comes from the bottom up as people begin to pay attention to global climate change and take steps to measure their carbon footprints. Sustainable products have evolved from trendy to mandated. Companies have begun to construct entire marketing campaigns around sustainability in order to meet increasing consumer demand for responsible business practices and green products.

Growing emphasis on personal sustainability. Interest in individual sustainability is growing. Consumer products that are (or claim to be) environmentally friendly are increasingly popular, but more significant is the growing availability of products or services designed to monitor and reduce personal energy consumption and carbon generation. “Carbon footprint” has grown from environmental movement buzz phrase to something that more of the population thinks about every day. Given the holistic character of personal sustainability, it is logical that individual concerns would affect workplace behavior. A company’s environmental policy and green benefits programs are more and more likely to factor into peoples’ decisions to join an organization, just as they consider things like health insurance and 401(K) plans today.

Better tools for and increased rigor in the measurement of sustainability. After more than a decade of working on sustainable business, there is now a large body of case studies—in industries ranging from agriculture, to flooring manufacturing to tourism—demonstrating that sustainability programs can generate value for companies. These studies show that sustainability is no longer just an act of charity; it’s an act of economic self-interest. As Sun Microsystems chief sustainability officer Dave Douglas puts it, “The ‘eco’ in my title is as much for economics as for ecology.” Additionally, the growth of tools to more rigorously model energy expenditures and resource use by enterprises, and to measure and report these expenditures in real time, are making it easier to benchmark company performance. These tools range from sensors that continuously sample air and water, or monitor the energy use of individual devices rather than buildings, to software that analyzes real-time data, compares it to historical data, and suggests ways to improve performance.

Sustainability Moves to the Core of Enterprise

Evolution of industrial ecology

A new discipline, industrial ecology, seeks to make factories and manufacturing processes more efficient by making manufacturing sustainable—and ultimately redefining the principles of factory work. Many factories—particularly those in the more stringent regulatory worlds of the United States, European Union, and Australia—are reducing the amount of pollution they generate in a variety of ways, by putting scrubbers on smokestacks to remove particulates, for instance. Other sites are being renovated to be more energy efficient and environmentally friendly. In the United States, one of the most spectacular examples is Ford Motor Company’s famed River Rouge. The 1920s-era complex now sports a “living roof,” a 500,000 square foot rooftop garden that absorbs water and provides insulation, solar panels and fuel cells, and local plants that absorb industrial toxins out of the soil. More ambitious are attempts to redesign manufacturing processes to completely eliminate pollution. In the Danish industrial park of Kalundborg, for example, an oil refinery’s flare gas heats a power plant, a drywall factory consumes the plant’s waste gypsum, and its excess steam is used to sterilize machinery in a pharmaceutical plant.

These efforts illustrate one notable shift in the way some engineers and companies are thinking about manufacturing, pollution, and efficiency. Pollution reduction efforts used to be motivated by a desire to avoid bad press or regulatory sanctions; now, however, they are embedded in a view of industrial processes that holds that there really is no such thing as “waste,” just goods that are used inefficiently. While industrial engineers saw pollution as an economic externality and an unavoidable consequence of manufacturing, industrial ecologists see it as a sign of inefficiency and poor planning.

Factory-driven industry isn’t the only place where organizations are starting to realize that minimizing their waste stream can help maximize their profits. As sustainability comes to the core of enterprise, companies and organizations increasingly assess every aspect of their organization. The Zero Waste Alliance works closely with corporations in the United States to reduce their waste streams toward a goal of producing zero waste. According to the Zero Waste Alliance’s case studies, waste reduction has also resulted in cost savings for companies like HP, Epson, and Xerox ranging from hundreds of thousands to millions of dollars. In fact, in March 2000, Epson Portland reached their goal of sending zero waste to landfills.

In April 2007, the University of California released a Policy on Sustainable Practices, which covers building renovations, climate protection practices, sustainable operations, recycling and waste management, and environmentally preferable procurement. The policy includes measures such as only buying products rated highly in the Electronic Product Environmental Assessment Tool (EPEAT) registry, takeback recycling in purchasing contracts, and a “ban on export and prison labor.” The comprehensive policy takes the idea of sustainability to a new level by creating a sustainability contract that spans a variety of day-to-day functions and decision-making practices.





Industrial ecologists are also working to develop products that are safer to manufacture, less toxic to use, and can be easily broken down, recycled, or restored. Several textile, carpet, and office furniture companies have created products made only from environmentally benign chemicals. Computer and electronics manufacturers have long struggled to create more energy-efficient devices, both to satisfy the demands of governments and to meet rising consumer expectations; now they are working to eliminate long-used but toxic metals like lead and mercury from their products.

But using more benign chemicals is only part of the drive to create sustainable products. Companies are also under pressure to take responsibility for their products at the ends of their lives, by developing takeback and recycling programs. In some industries, takeback programs are fairly standard. Indeed, visionary companies like commercial flooring manufacturer Interface see themselves as providing flooring services rather than selling carpets. In others, such programs are still fairly restrictive, requiring that consumers upgrade to new products before accepting old ones, or offering narrow windows of opportunity for recycling old equipment. Goal setting and transparent reporting of the success of environmental policies is another strategy adopted by companies like Hewlett-Packard and Dell.

In the Danish industrial park of Kalundborg, an oil refinery's flare gas heats a power plant, a drywall factory consumes the plant's waste gypsum, and its excess steam is used to sterilize machinery in a pharmaceutical plant.



Source: [www.statoil.com/StatoilCom/svg00990.nsf/Attachments/kalundborg.jpg/\\$FILE/kalundborg.jpg](http://www.statoil.com/StatoilCom/svg00990.nsf/Attachments/kalundborg.jpg/$FILE/kalundborg.jpg)

Growing Emphasis on Personal Sustainability

Seeking sustainable careers, company support, and sustainable workplaces

Sustainability isn't just a concept for factories and products. The phrase "sustainable careers" now appears in business magazines, career advice columns, job fairs, and government white papers. In different contexts, it means two different things.

First, it can refer to careers that are long lived. European consulting company DIAFORA runs workshops on "Composing a Sustainable Career," which provide advice on developing personal brands, surviving during downturns, keeping skills up to date, and other traditional career-building activities. This usage, while borrowing the term "sustainability," does not engage with environmental issues, or link sustainability at the individual and corporate levels.

These issues continue to be important for workers in volatile, fast-moving industries. A second, newer use of the term sustainability, however, reflects a growing importance of environmental issues as a factor in career choices. For example, the Sustainable Careers Institute, a nonprofit founded in upstate New York in 2001, defined sustainable careers as "careers that contribute to sustainability goals," that are "viable and coherent," "vital and meaningful," "socially responsible," and "environmentally restorative."

While the first meaning of sustainable careers is found in literature aimed at anxious, mid-career professionals, this second, more expansive meaning is found in projects aimed at younger workers, particularly college students and recent graduates. The University of Waterloo in Canada runs a "Sustainable Career Night" devoted to identifying jobs and industries that support sustainability. The Graduation Pledge Alliance promotes a "Pledge of Social and Environmental Responsibility," in which students promise to "explore and take into account the social and environmental consequences of any job I consider" and "to improve these aspects of any organizations for which I work." A recent BT survey found that "corporate social responsibility (CSR) policy can be the deciding factor in whether a young professional takes up a position with the organization, with one-third believing an employer's stance on CSR is more important than the salary offered."



The Graduation Pledge Alliance promotes a "Pledge of Social and Environmental Responsibility," which states:
"I pledge to explore and take into account the social and environmental consequences of any job I consider and will try to improve these aspects of any organizations for which I work."



Source: www.graduationpledge.org/



The varied definitions of “sustainability” effects human resources administration as well. Just as older workers may see a sustainable career as a bulwark against economic uncertainty while younger workers see it as an expression of values, human resources professionals use the term in two contrasting ways. On one side, economists working in human resource sustainability describe their field as promoting “the capacity of organizations to create and regenerate value through the sustained application of participative policies and practices,” and pay little attention to broader conceptions of sustainability.

Environmentally conscious HR managers and companies, in contrast, see a more direct link between human resources and sustainability. The World Business Council for Sustainable Development argued in a 2005 report that involving HR is essential for demonstrating a company’s commitment to real sustainability. They note that a good track record of corporate social responsibility is increasingly important in the war for talent.

As the best and brightest increasingly demand support for personal sustainability, a growing number of companies are responding with programs. As Liz Gerber, a doctoral student at Stanford’s Center for Work, Technology and Organizations, noted:

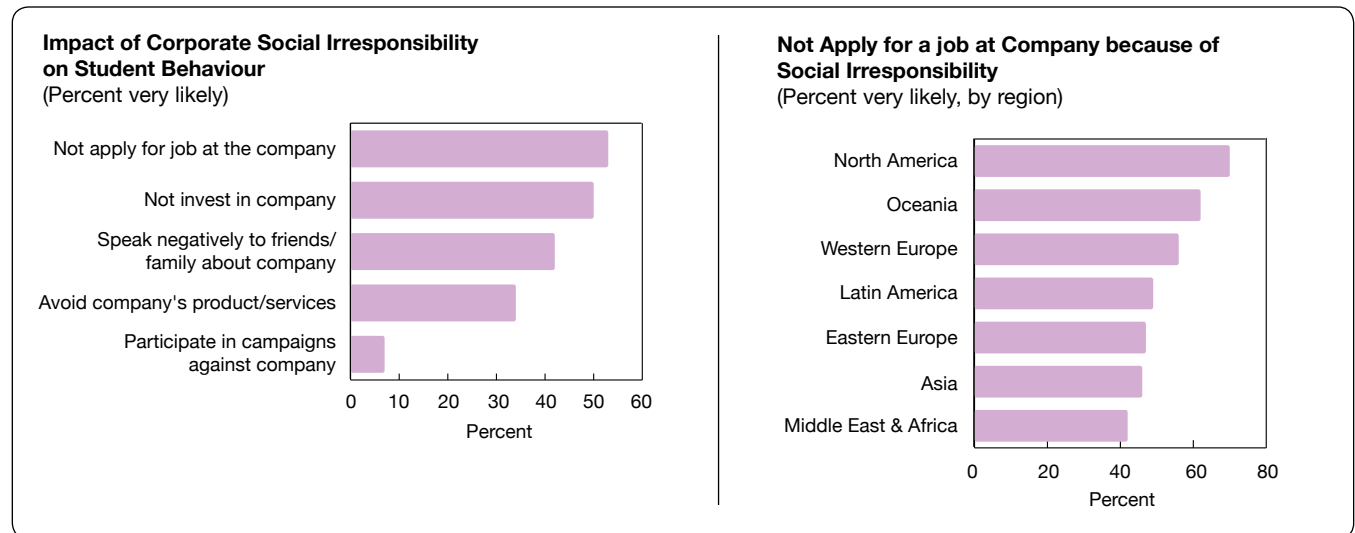
An illustration of human resource sustainability.
Note the absence of environmental factors.



Source: Paul J. Gollan, “High Involvement Management and Human Resource Sustainability,” *Asia Pacific Journal of Human Resources*

Businesses are seeing a demand for mass transit reimbursement, shuttle buses, car pools, bike racks, and flexible work schedules. Employees are increasingly interested in programs that can reduce transportation costs.

Most companies justify these programs as “positively impacting a company’s productivity,” by increasing worker satisfaction and retention levels. “Companies also view their program offerings as directly benefiting the companies’ sustainability efforts,” Gerber believes. Google’s personal sustainability programs illustrate these various aims. It recently began offering subsidies to employees who buy hybrid cars, and its employee shuttle service that is now one of the largest public transportation systems in California. The company is also working to reduce the energy usage of its server farms, so that employee-focused programs fit in a broader campaign to reduce the company’s carbon footprint and energy usage; but Google also hopes to reduce the departure of high-value employees whose options are starting to vest. Menlo Park-based Terrapass, established in 2005 to sell carbon offsets to consumers, now has a fast-growing corporate business, driven in part by employee requests for offsets for business travel. Work-from-home options and flexible hours are even more basic examples of support from the corporate side.



Source: Driving Success: Human Resources and Sustainable Development, 2005

5 SUSTAINABLE ENTERPRISE: BETTER TOOLS FOR AN INCREASED RIGOR IN MEASURING SUSTAINABILITY

the details

Sustainable workplaces are another way companies can support employee demands for sustainability. Designing healthy workplaces is partly an exercise in avoiding problems, but it's also a way to create spaces that are more inviting and better support workers. European Union office design rules, for example, require workers to have access to natural sunlight, circulating air, and mandate green spaces (often rooftop or terrace gardens). These are justified in part in terms of occupational safety, but also on the grounds that they increase worker productivity.

Norman Foster's Commerzbank tower, in Frankfurt, Germany (below), embodies the new, integrated approach to sustainable workplaces. The building's central core features nine four-story "sky gardens"; all employees are within seven meters of either the gardens or a window looking outside. The windows can be opened, allowing natural ventilation and reducing cooling costs in the summer. (More generally, architects have discovered that despite its inhuman associations, the skyscraper design itself can be more sustainable than low-rise office buildings.)

**Norman Foster's
Commerzbank tower
in Frankfurt, Germany
embodies the new,
integrated approach to
sustainable workplaces.**



Source: www.flickr.com/photos/re-ality/808329105

Better Tools for and Increased Rigor in Measuring Sustainability

Making sustainability v-isible

There are different tools to measure the sustainability of products, but the one that best exemplifies the trend toward measuring sustainable performance and the one likely to be widely adopted in the United States is the EPEAT,¹⁸ created by the Zero Waste Council with a grant from the EPA, and managed by the Green Electronics Council. EPEAT rates computer systems bronze, silver, or gold based on their compliance with a list of criteria that considers environmentally sensitive chemicals, toxicity of plastics, design for “end life,” packaging, takeback programs, and corporate performance in regard to the environment. Institutional purchasers can use EPEAT to evaluate the environmental “friendliness” of desktops, laptops, and other electronics for offices and organizations. Manufacturers use EPEAT to measure their environmental policy and performance against other companies and also to promote their products as environmentally sound. For instance, in a recent clash with Greenpeace, Apple used the silver ranking of their product line to contest Greenpeace’s bottom-of-the-list ranking.

While EPEAT focuses on electronics, companies looking to analyze and optimize their environmental performance require different tools. Surya Strategies makes software called Supply-Chain Environmental Analysis/Optimization Tool (SEAT), as well as web-based tools that allow businesses to analyze the “footprints of business activities.”

The Dow Jones Sustainability Index measures a company’s sustainability in five areas: strategy, financial, customer and product, governance and stakeholder, and human. From the DJSI website¹⁹:

Corporate Sustainability is a business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental, and social developments. Corporate sustainability leaders achieve long-term shareholder value by gearing their strategies and management to harness the market’s potential for sustainability products and services while at the same time successfully reducing and avoiding sustainability costs and risks.

In the assessment, conducted by Sustainable Asset Management, they look at human capital development, talent attraction and retention, and corporate citizenship/philanthropy as well as environmental activities. Thus, corporate support for sustainability is not an immeasurable fad but can provide commensurable value for employees, potential employees, investors, and organizations alike.



6 health as a workplace value

FROM INSTITUTIONAL RESPONSIBILITY TO STRATEGIC ASSET

With new tools and access to information related to our health, people are evolving from passive participants to active managers of their own health. In fact, health is becoming a key filter for decision making in people's lives that also shapes expectations of employees, including how and where to work. As empowered "biocitizens" enter workplaces, they will exert increasing pressure on employers to make workplaces healthy and support health as a value.

DILEMMA

healthism ▶
◀ **choice**

As health becomes a strategic asset for organizations and growing a cost driver in the United States, the temptation to promote healthy behaviors on the part of employees will grow. Navigating the fine line between encouraging healthy behaviors—exercise, healthy eating, non-smoking, etc.—and intruding upon what many perceive as private domains of life will be tricky.

We are on the threshold of transition when it comes to our understanding and the delivery of health. Health costs continue to skyrocket in industrialized countries. Populations are living longer everywhere and many more people will be living with chronic diseases, making health the primary focus of their lives and daily activities. Meanwhile, advances in information, communication, and sensor technologies are giving us more information about our environments and our own bodies, promoting heightened awareness of risk in our environments—including workplaces, homes, places of leisure—and their connection to personal health. They are also enabling us to form dispersed communities in support of common health interests such as diabetes, cancer, or diseases and conditions that are not recognized or are neglected by the medical establishment. Such communities are ushering the age of biocitizens—informed, activist individuals who understand themselves as biological entities with affinities to others who share similar genetic or biological afflictions, and who, in turn, have organized to change funding agendas, research priorities, and the relationships among capital, ethics, science, and access to therapies.

As our understanding of health expands and new tools and treatments become available to manage health at a personal level, people are engaging in the management of their own health at a new level of intensity. For some it means not just being well but being "better than well." Such individuals use a variety of tools, supplements, and latest biological information to empower themselves with enhanced capabilities—greater endurance, vitality, greater strength. Rather than relying on "experts" and traditional health providers like doctors, nurses, and clinics, these individuals have a broad understanding of health and create and manage their own personal health ecologies. In addition to traditional pharmaceutical products and health providers, such ecologies include consumer goods, food, beauty and fitness products, alternative medicine, supplements, and more.



6 HEALTH AS A WORKPLACE VALUE

Health is becoming, and will continue to be, a major focus of people's lives, whether one has to navigate the complicated healthcare landscape in the United States, care for aging parents, or deal with the increasing number of infectious diseases throughout the world. It is no longer something that is given but something individuals can shape and will demand from their employers and work environments as well as products and services they purchase. Every company, including those not in traditional health care and pharmaceutical businesses, will become a health company as individuals gain more access and control over their health information and health becomes a filter for their decision making.

New tools and a proliferation of biodata will make information about health visible and tangible. From the household scale to sensors that can transmit real-time data about an individual's physiological well being, information about our health will continue to become more visible to us. New and old technologies will fuel the drive towards transparency. Combining the reach of the Internet with strategically located air-quality or noise-level sensors and diagnostics makes the causes of environmental harm far more tangible. Such technologies go a long way toward reconfiguring debates on the environment and health, as they are doing in London and other parts of the United Kingdom. These technologies will enable us to know more about the world around us and receive the information in a way that is easy to synthesize and act upon.

Disease management will also change as we are able to better understand what is happening with our bodies in real time. Developments in sensor technology will allow individuals to monitor their own health in ways not yet possible. Just as diabetes patients regularly test their blood sugar, so will individuals be able to monitor a variety of biological functions and, subsequently, the efficacy of treatments.

Health becomes a strategic organizational value and asset. As people are bombarded with messages and peer pressure to exercise, to eat healthy, to have balanced schedules, to not be fat, to age successfully, and so on, health is becoming a key value in society and within organizations. A new healthism is emerging and it's likely to be divisive, as one side will see poor individual behavior as a risk to overall community health, and another other side will see individual behavior as a matter of choice and privacy. Regardless of how this plays out, incentives and disincentives—"carrots and sticks"—will become more widespread as employers and communities struggle with health care costs and the broader economic, social, and safety consequences of unhealthy communities.

Health has traditionally been a part of the compact with workers in most European countries. Increasingly, companies in the United States, under pressure of rising health costs, are turning "healthy living" into a corporate value and demand adherence to such values as a part of the contract with employees. In some ways this is reminiscent of Henry Ford's paternalism, when in exchange for granting workers high wages (\$5/hr in 1914!), he instituted home inspections to make sure that workers were living in hygienic conditions and pursuing "moral" lifestyles. The justification was that these morally upstanding and clean workers would have higher productivity, thus justifying exorbitantly high wages for their time. The same is happening with health today when some companies mandate workers' healthy lifestyles. Healthy workers are more productive and they decrease corporate overhead costs. Globally, corporate athletic programs,



financial incentives, even medical exams prior to employment, or discounts to employees living healthy are all examples both of new “healthism” in the workplace and the emergence of health as a corporate value, whether driven by health concerns, societal values, or individual demands for health. We may yet see a world where hiring one qualified employee over another who is equally qualified may come down to who is healthiest.

Workers will engage in multiple forms of do-it-yourself health practices. Whether by choice or force, individuals empowered with new levels of access to health data are taking more responsibility for managing their own health. People will be able to do more themselves and build do-it-yourself health practices, turn to their social networks, and tap the collective intelligence of new health collectives. They’ll have to look to the broader marketplace of the global health economy, not just the health care industry, for resources and solutions to manage their health and well being.

Several do-it-yourself (DIY) behaviors are emerging as a part of their personal health strategies:

- **Self-agency**, or acting on one’s own behalf, which can be seen in the way individuals will engage with media and health information expanding their own sense of self-efficacy.
- **Self-customization**, the use of products beyond their intended use and in combination with each other, will result in user-generated health and wellness solutions.
- **Self-organization**, or ability to tap into the collective intelligence in social networks for information, strategies, and practices, will shape responses to this burden of empowerment.

Indeed, individuals are quickly learning to leverage the trust in their social networks’ collective intelligence to identify, reduce, and avoid risk. With the proliferation of online information, affinity-based social networks quickly form to guide people through the complex healthcare maze. Expect more patient-to-patient strategies to emerge, like disease management or self-organizing markets from the bottom up. In the case of affinity sites and other social health networking technologies, these collectives are not nationally exclusive. “Biocitizens”—people banding together based on biological and health affinities—are global and their health relationships easily cross borders. As these communities of interest transform into communities of action, they will exert market influence but also pressure employers and governments for change.

Additionally, with the rise of the global health economy, biocitizens will proactively seek the best treatment across national boundaries. Health tourism—seeking operations in other countries that may be cheaper or of better quality than what’s available in an individual’s own country—is not a new concept. However, due in large part to the current health care climate in the United States, health tourism stands to create a truly competitive global health marketplace driven by individuals making the best choices for themselves. Finding out what treatment is best and most affordable where will become easier and easier. We will see the health care industry move from a top-down infrastructure to one controlled by consumers from the bottom up.

6 HEALTH AS A WORKPLACE VALUE: NEW TOOLS/HEALTH BECOMES A STRATEGIC ORGANIZATIONAL VALUE



New Tools and a Proliferation of Biodata Will Make Information About Health Visible and Tangible

Personal health ecologies

As we learn more about nutrition, fitness, and other health-related issues, we are able to take more control over the management of our health. Instead of needing to make tedious calculations about calories and other nutritional information, we will see things like scanners for the grocery store that are able to compare our own dietary needs to what we're seeing on a shelf and help us make better decisions about what to eat.

Thinking more broadly about health—where it's not just about nutrition or sickness, but also about the conditions of an individual's surrounding environment—exemplifies the development of personal health ecologies. Feral Robotic Dogs, a project started by New York University professor and researcher Natalie Jeremijenko, involves a do-it-yourself hack of a novelty product: robotic dogs. The dogs were hacked and equipped with sensors that measure the levels of certain pollutants. When unleashed outdoors, they draw together in packs like bloodhounds to places where pollution levels are the highest. Jeremijenko worked on the project with youth in the Bronx, New York, where they were able to really see the impact of the environment on their health. This kind of visual representation of real data is engaging and effective in making sense of health information. Jeremijenko also runs an environmental clinic at NYU, where students can get “prescriptions” for things that will make them healthier in regard to their surroundings, like the Green Light, which combines plants, LED light, and solar power in a chandelier that improves the quality of the air in the room.

Natalie Jeremijenko's Green Light combines plants, LED light, and solar power in a chandelier that improves the quality of the air in the room where it's hung.



Source: www.flickr.com/photos/diametrik/503826520

Our health records, historically one of the most out-of-our-hands aspect of personal health, have for decades been confined to dusty folders on doctor office shelves. Thanks to Google Health, however, individuals will be able to maintain their own health records online. It will also allow doctors and other caregivers to, with a patient's consent, leave notes at a patient's “Health URL” and share information that may be valuable to other caregivers and physicians working with the same patient. The key to this is the digitization of medical data, which has been a slow process thus far. However, with widespread user adoption, physicians would

be forced to adjust their processes to work with the Google system. Microsoft is also on the verge of releasing software that allows individuals to manage their health records. This shift in control over information is a major step in making health information more meaningful for individuals.

Health Becomes a Strategic Organizational Value

Carrots and sticks and healthy workplaces

The re-emergence of onsite health clinics in the workplace peaked in the 1970s but it's on the rise again, as employers look to reduce premium expenditures and cut down on the time employees spend at off-site medical appointments. But these are not like the work-injury-oriented clinics we once saw. Today's onsite clinics are popping up as comprehensive medical facilities that include everything from pharmacies to dentists to fitness centers. According to *Managed Care Week*, some employers incentivize employees to take advantage of on-site health care instead of seeking advice and treatment outside of the company's walls. Sometimes the on-site center is directly engaged with a company's insurance provider, particularly in cases where the company actually is an insurance provider, like New Jersey-based Horizon Health.

In addition to incentives for using on-site clinics, more and more employers are using health or fitness reimbursement programs to encourage healthy behaviors. Many companies, like International Data Group (owners of *PC World* and *Macworld*) offer employees a set amount of money for fitness reimbursement each year. That money can be used to reimburse gym expenditures, fitness equipment, and specialized programs like yoga classes. This may seem like a neat perk to many, but for the employers it is a strategy that will not only enable more employees to pay for the gym, but also position fitness and healthy behavior as something worthy of rewards. Alternative medicine is also becoming more popular—and more acceptable. While traditional United States health insurance companies have yet to cover alternative and foreign medical practices like acupuncture, many multi-national corporations provide discounts and support for employees who want to seek non-traditional health options.

Scott's Miracle-Gro takes the carrots and sticks approach to another level. They link up employees with "health coaches," who serve as enforcers of wellness on behalf of the company. Based on information fed to them by the company's medical specialists, the health coaches contact employees regularly and give them advice—lose weight, see a doctor, exercise more, etc. And the coaches are tenacious.

It wasn't positive encouragement of healthy behavior that put Scott's in the headlines, however. That happened when the company fired an employee for failing a drug test. But the employee didn't test positive for an illicit substance, at least according to legal standards. He was fired after a test found nicotine in his system, a violation of the company's new smoke-free employee policy. The employee filed a lawsuit against the company for civil rights issues that has yet to be decided. Despite the outcome, though, it's clear that companies will look at healthy behavior as something to be valued. The idea of "corporate nannies" is not far-fetched, but companies will have to work within the framework of civil rights and employment laws in their mission to exert pressure on individuals to break harmful habits and embrace healthy behavior.

The trend toward designing healthy office spaces and buildings exemplifies the valuation of health. Simply put, healthy workplaces make for healthier workers. Two decades ago, the idea of a "healthy workplace" was still a novelty. At best, a healthy workplace was one that was not obviously dangerous. But the discovery of the long-term consequences of asbestos exposure,



6 HEALTH AS A WORKPLACE VALUE: HEALTH BECOMES A STRATEGIC ORGANIZATIONAL VALUE



the emergence of the concept of “sick buildings”—buildings that vent unhealthy gases or toxins—and the growing cost of work-related injuries in offices (exemplified by repetitive stress injuries) have changed that. Today, as environmental psychologist Sally Augustin, Ph.D. notes, “There is a crush to obtain LEED [Leadership in Energy and Environmental Design] certification for homes [constructed by commercial developers] and commercial (office) spaces.” Much of this awareness has been driven by the development of sophisticated air sensors, monitors, and inexpensive field-testing equipment that makes it easier to detect workplace toxins.

Touting a Platinum LEED certification, the Genzyme Center in Cambridge, Massachusetts, showcases health as a value through its exemplary healthy workplace design.



Source: www.flickr.com/photos/kingdafy/723459576

Workers Will Engage in Multiple Forms of DIY Health Practices Biocitizens emerge

Medical information on the Internet has come a long way from Web MD. Individuals have begun to use new media technologies like blogs, social networking sites, and forums to construct a patient-to-patient network of information dissemination. As the cost of health care continues to rise and the burden of decision making falls on the individual, these communities and P2P strategies will only become more prevalent—and necessary.

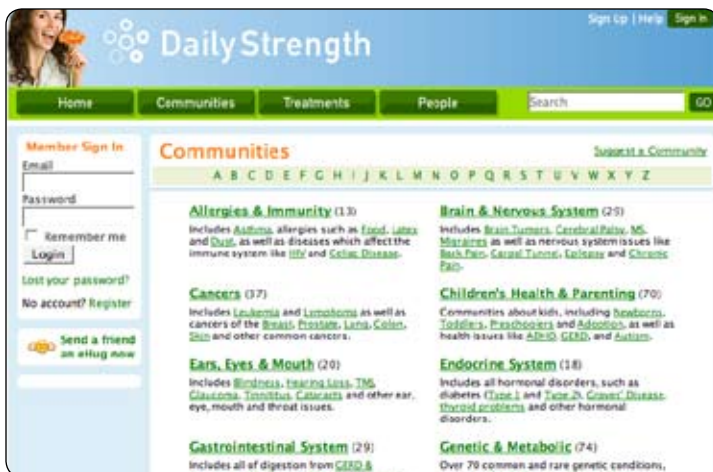
A good example is user-generated content on health affinity web sites facilitated by social technologies and media such as YouTube, MySpace, and other Web 2.0 tools. Already, information preferences have evolved away from physicians to “people like me.” This is not surprising, since stories of shared experiences and strategies exchanged in these communities help provide clarity in a fragmented information environment. Harnessing collective intelligence for health and health care decisions for individuals and their families will be a key DIY practice for health management in the future.

Outside of traditional social networking sites, health-specific sites are on the rise. DailyStrength and Revolution Health are set up like MySpace or Facebook. But instead of profiles populated with just taste and habit interests, users join for specific communities able to provide experiential information specific to their health concerns. They input the treatments they’re currently using, assign the treatments levels of efficacy, and include short descriptions of how those treatments affect their lives. For instance, one user in the “Smoking Addiction” community on DailyStrength lists both “Cold Turkey” and “Prayer” under Treatments, with “Working” in parentheses next to both. Users can also utilize the Journal features to update friends or simply document for themselves how things are going.

These collectives will not just continue to be useful to patients on an experiential level. As collectives grow, so does their power, and with increased power comes the ability to influence change in policy.



Users join health affinity sites like DailyStrength to connect with their people willing to share experiential information specific to health concerns.



Source: www.dailystrength.org

7 implications

Organizational Culture and Design: Plan for Transparency

The evolution of technologies for ubiquitous, detailed, real-time reporting on everything—product lifecycles, employees’ locations, individual tastes and preferences, online contributions, and resource use—means that almost every aspect of organizational life can be exquisitely documented and tracked. Rather than anyone else telling your story, organizations should plan for transparency from the outset in order to stay ahead. Concealing anything— incompetent leadership, abuse and mismanagement of resources, bad labor practices, etc.—will become increasingly difficult. Avoiding accountability will also get harder, and moving operations somewhere else in order to avoid accountability is not likely to provide a long-term solution. Companies that have tried to hide pollution by “outsourcing” polluting activities to subcontractors are likely to have to account for them, just as companies whose subcontractors use child labor or engage in illegal practices are being raked over the coals by various citizen groups that document such activities. Organizations would be well advised to err on the side of transparency, resorting to secrecy only when absolutely necessary and as a last resort. Now is the time to examine all aspects of your operations—from human resources to manufacturing and distribution—through the transparency lens.

Tools: Physical Place Is A Part Of The Toolkit

An important outcome of the visible world will be the convergence of computational tools and the physical workplace. Organizations need to think about how to use the physical place itself as a part of the information toolkit along with laptops, mobile phones, and printers. The need to manage large volumes of complex visual information will lead to workplace designs that expand the size and scope of digital displays, while also spreading access to “windows” on data into non-traditional spaces for computing—hallways, social spaces like water coolers, and outdoors. Plan for workplaces that enable “progressive disclosure,” i.e., the ability to reveal higher-level functionality, as users are ready for them.

Physical Space: Designing for Health

Healthy workplaces are no longer just about a lack of harmful toxins. The world of fluorescent lights and cubicles is giving way to one of green spaces and sunlight. Biocitizens will expect workplaces that reflect their understanding of health as a value. Spaces designed for healthy airflow, an abundance of natural light, and more will become a great way for companies to attract biocitizens to their organizations. Ergonomic consultations will go from optional to mandatory as employers strive to ensure that their employees are healthy and thus productive. Sensors and other advanced technology will help to make the “healthiness” of the work environment visible to employees and employers alike. Offering incentives for healthy behavior could also prove a good way to attract biocitizens, but watch out for making such incentives coercive and thus perceived as paternalistic and intrusive. Successful future workplace design will bring together large-scale architectural understanding of the workplace community, anthropological understanding of small group dynamics, and information science.



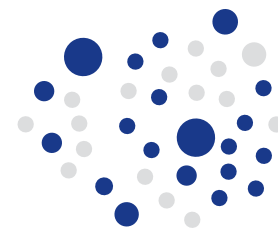
7 IMPLICATIONS

Recruitment: Attracting—But Not Necessarily Hiring—The Best

Achieving the diversity required to amplify organizations means tapping into multiple intelligences, multiple work styles, skills, media choices, and geographies. What makes the products of collective intelligence successful—Wikipedia being the best example—is precisely the fact that each person is making contributions in the area she chooses and in the manner that suits her best. Although there are general principles for how to use the platform, the rest is left to the individual contributor. It is likely that many of the best Wikipedia contributors would not make great employees by traditional standards. For an organization to amplify itself, it must tap the external network of non-employees and entice them to contribute in the areas of their expertise. The trick is managing that process without attempting to exercise the same level of control that an organization has over its actual employees. Thus, in addition to having strategies for recruiting the best employees, organizations need to develop strategies for making themselves attractive to the best of the amplified contributors. They need to think in ways that suit these individuals rather than traditional promotions and compensation packages. In addition to monetary rewards, such things could include connections with others, increased freedom, ability to work on projects of their choosing, ability to publish outside, etc. Instead of hiring, the goal must be to attract, engage, and connect amplified individuals to the organization so that they view it as the most important and powerful node in their highly networked and distributed career paths.

Skills: Training in Visual Literacy

The only way organizations and individuals will be able to take advantage of massive amounts of data flooding the workplace is through new types of highly sensory-rich interfaces. These include new types of artistic visualizations, simulations, and ambient and other types of sensory-rich interfaces utilizing sound, movement, colors, etc. Just like previous generations of workers had to be literate in text media, the next generations will need to possess visual literacy. They will need to have the ability to present, analyze, and interact with visual information. Visual acumen is a survival skill in the workplace in the next ten years and beyond. Younger workers who have grown up in the world of video games and virtual reality will naturally be more adept at this. However, don't take it for granted that just because someone is younger they will naturally possess such skills. Think about how to promote visual literacy standards for your organization, how to identify those with best visual skills, and how to train employees beyond proficiency in PowerPoint to become proficient in more dynamic, image-moderated collaborative exploration of data.



Human Resources: Mathematicians and Neuroscientists?

Hiring practices, training, and management will increasingly draw from a deeper understanding of neuroscience and complex behavioral algorithms. Already, startups have emerged that promise to train individuals to increase their mental acuity, focus, and efficiency based on brain science. Company-specific algorithms will be developed for software systems that vet new applicants based on detailed questionnaires. As science comes to work, human resource managers will need to become versed in these new sciences. While most HR personnel will likely not be scientists, they will need to be able to understand the language of these disciplines and collaborate with scientists in order to assess and implement some of the new tools. For example, a manager may not know how to design Monte Carlo simulations to optimize workflow, but in order to understand the theory behind suggested methods to increase productivity and efficiency, they must be able to speak the language of mathematicians.

Leadership: Giving Voice to the Commons

Clearly the world of amplified individuals calls for a different type of leader—not the ones who dictate and make pronouncements, not necessarily those with most charisma and unitary vision. Rather than assuming absolute authority, effective leaders in amplified organizations must work to understand the values and opinions of their followers to enable a productive dialogue with followers about what the group embodies, what it stand for, and, thus, how it should act. Good leaders of amplified organizations will need to see themselves as “speakers for the commons”—those who are able to give voice to what the commons members, including non-employees, want, and to provide the infrastructure and resources for accomplishing this. It doesn’t mean the end of vision; the vision of amplified organizations is not enforced from the top but emerges in dialogue and conversations of the members from the bottom up. It is the vision and strategy that depend on cooperation and support of constituents.

endnotes

The Amplified Individual

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