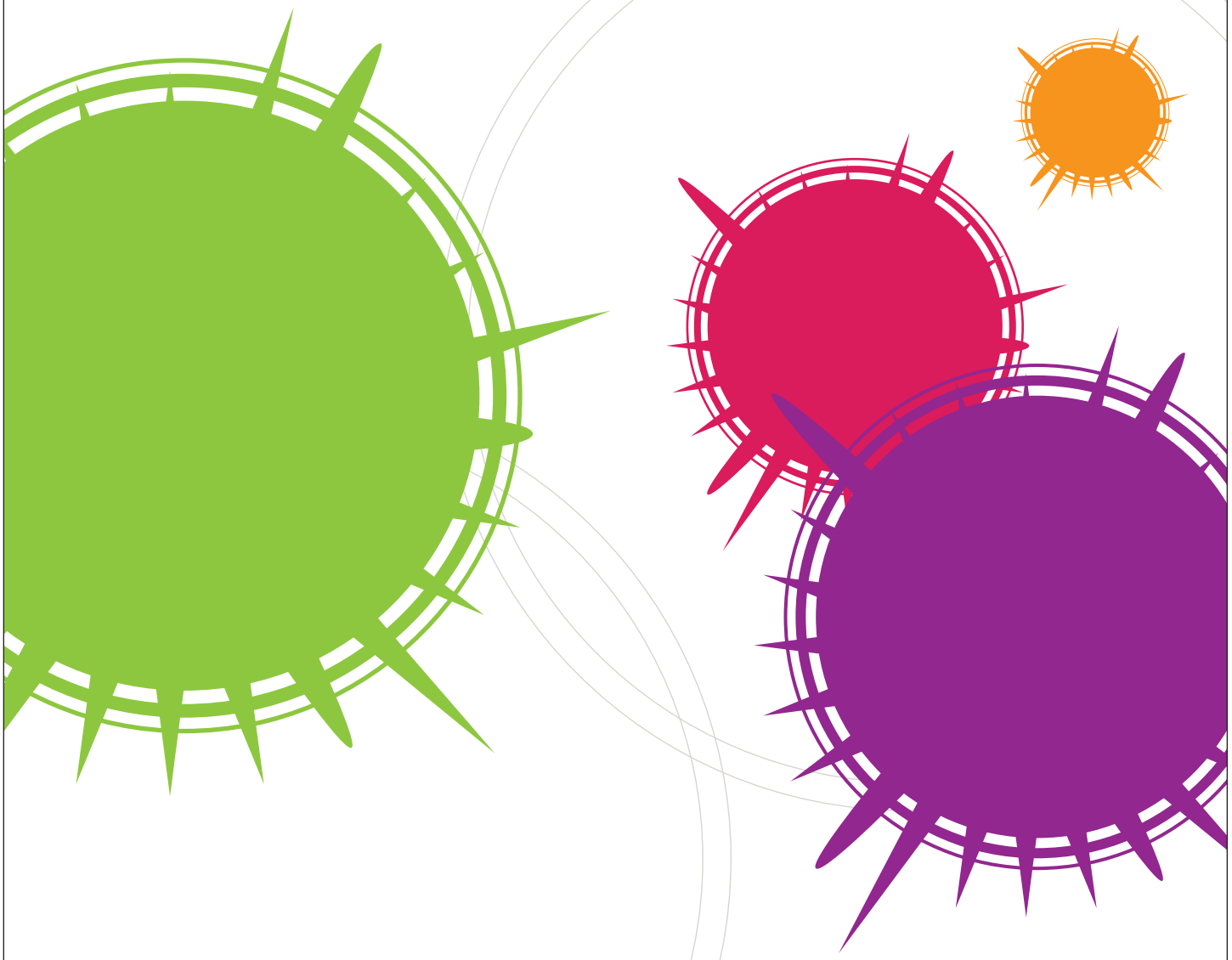

Future Work Skills 2020

Institute for the Future for
Apollo Research Institute

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about the …

INSTITUTE FOR THE FUTURE

The Institute for the Future (IFTF) is an independent, nonprofit strategic research group with more than 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide our members with insights into business strategy, design process, innovation, and social dilemmas. Our research spans a broad territory of deeply transformative trends, from health and health care to technology, the workplace, and human identity. The Institute for the Future is located in Palo Alto, California.

INSTITUTE FOR THE FUTURE

APOLLO RESEARCH INSTITUTE

Apollo Research Institute investigates the value of education for the current and future workforce. Through academic and industry partnerships, Apollo Research Institute makes research-based recommendations to help leaders ensure today's workforce is employable tomorrow. Visit www.apolloresearchinstitute.org.

Apollo Research Institute sponsored this piece of research to increase understanding of the skills workers will need over the next decade in a technologically advanced and changing world.

APOLLO RESEARCH INSTITUTE℠

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contents

INTRODUCTION

In the 1990s, IBM's Deep Blue beat grandmaster Gary Kasparov in chess; today IBM's Watson supercomputer is beating contestants on *Jeopardy*. A decade ago, workers worried about jobs being outsourced overseas; today companies such as ODesk and LiveOps can assemble teams "in the cloud" to do sales, customer support, and many other tasks. Five years ago, it would have taken years for NASA to tag millions of photographs taken by its telescope, but with the power of its collaborative platforms, the task can be accomplished in a few months with the help of thousands of human volunteers.

Global connectivity, smart machines, and new media are just some of the drivers reshaping how we think about work, what constitutes work, and the skills we will need to be productive contributors in the future.

This report analyzes key drivers that will reshape the landscape of work and identifies key work skills needed in the next 10 years. It does not consider what will be the jobs of the future. Many studies have tried to predict specific job categories and labor requirements. Consistently over the years, however, it has been shown that such predictions are difficult and many of the past predictions have been proven wrong. Rather than focusing on future jobs, this report looks at future work skills—proficiencies and abilities required across different jobs and work settings.

METHODOLOGY

Over its history, the Institute for the Future (IFTF) has been a leader in advancing foresight methodologies, from the Delphi technique, a method of aggregating expert opinions to develop plausible foresight, to integrating ethnographic methods into the discipline of forecasting, and recently to using gaming platforms to crowdsource foresights. We have used these methodologies with an illustrious roster of organizations—from *Fortune* 500 companies to governments and foundations—to address issues as diverse as future science and technology, the future of organizations, and the future of education.

IFTF uses foresight as a starting point for a process we call Foresight to Insight to Action, a process that enables people to take future visions and convert them into meaningful insights and actions they can take to be successful in the future.

In writing this report, we drew on IFTF's foundational forecasts in areas as diverse as education, technology, demographics, work, and health, as well as our annual Ten-Year Forecast. The Ten-Year Forecast is developed using IFTF's signals methodology—an extension of decades of practice aggregating data, expert opinion, and trends research to understand patterns of change. A signal is typically a small or local innovation or disruption that has the potential to grow in scale and geographic distribution. A signal can be a new product, a new practice, a new market strategy, a new policy, or new technology. In short, it is something that catches our attention at one scale and in one locale and points to larger implications for other locales or even globally. Signals are useful for people who are trying to anticipate a highly uncertain future, since they tend to capture emergent phenomenon sooner than traditional social science methods.

We enriched and vetted this research at an expert workshop held at our headquarters in Palo Alto, where we brought together experts in a diverse range of disciplines and professional backgrounds, engaging them in brainstorming exercises to identify key drivers of change and how these will shape work skill requirements. Finally, we analyzed and filtered all of this data in order to identify the six key drivers and ten skills areas that will be most relevant to the workforce of the future.

Many thanks to each of our workshop participants:

- **Amanda Dutra,** Right Management
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- **Devin Fidler,** IFTF
- **Humera Malik,** Electronic Arts
- **Jason Tester,** IFTF
- **Jerry Michalski,** IFTF Affiliate
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- **Leslie Miller,** Apollo Research Institute
- **Marina Gorbis,** IFTF
- **Martha Russell,** Media X at Stanford University
- **Micah Arnold,** Apollo Group
- **Natasha Dalzell-Martinez,** University of Phoenix
- **Rachel Maguire,** IFTF
- **Sonny Jandial,** Procter & Gamble
- **Steve Milovich,** The Walt Disney Company
- **Tracey Wilen-Daugenti,** Apollo Research Institute

SIX DRIVERS OF CHANGE

We begin every foresight exercise with thinking about drivers—big disruptive shifts that are likely to reshape the future landscape. Although each driver in itself is important when thinking about the future, it is a confluence of several drivers working together that produces true disruptions. We chose the six drivers that emerged from our research as the most important and relevant to future work skills.

It is estimated that by 2025, the number of Americans over 60 will increase by 70%. Over the next decade we will see the challenge of an aging population come to the fore. New perceptions of what it means to age, as well as the emerging possibilities for realistic, healthy life-extension, will begin take hold.

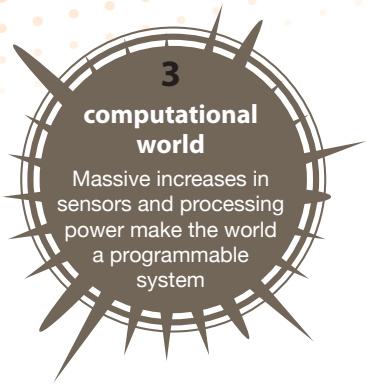
Individuals will need to rearrange their approach to their careers, family life, and education to accommodate this demographic shift. Increasingly, people will work long past 65 in order to have adequate resources for retirement. Multiple careers will be commonplace and lifelong learning to prepare for occupational change will see major growth. To take advantage of this well-experienced and still vital workforce, organizations will have to rethink the traditional career paths in organizations, creating more diversity and flexibility.

Aging individuals will increasingly demand opportunities, products, and medical services to accommodate more healthy and active senior years. As we move toward to a world of healthier lifestyles and holistic approaches to what we eat, how we work, and where we live, much of daily life—and the global economy as a whole—will be viewed through the lens of health.

We are on the cusp of a major transformation in our relationships with our tools. Over the next decade, new smart machines will enter offices, factories, and homes in numbers we have never seen before. They will become integral to production, teaching, combat, medicine, security, and virtually every domain of our lives. As these machines replace humans in some tasks, and augment them in others, their largest impact may be less obvious: their very presence among us will force us to confront important questions. What are humans uniquely good at? What is our comparative advantage? And what is our place alongside these machines? We will have to rethink the content of our work and our work processes in response.

In some areas, a new generation of automated systems will replace humans, freeing us up to do the things we are good at and actually enjoy. In other domains, the machines will become our collaborators, augmenting our own skills and abilities. Smart machines will also establish new expectations and standards of performance. Of course, some routine jobs will be taken over by machines—this has already happened and will continue. But the real power in robotics technologies lies in their ability to augment and extend our own capabilities. We will be entering into a new kind of partnership with machines that will build on our mutual strengths, resulting in a new level of human-machine collaboration and codependence.

SIX DRIVERS OF CHANGE



The diffusion of sensors, communications, and processing power into everyday objects and environments will unleash an unprecedented torrent of data and the opportunity to see patterns and design systems on a scale never before possible. Every object, every interaction, everything we come into contact with will be converted into data. Once we decode the world around us and start seeing it through the lens of data, we will increasingly focus on manipulating the data to achieve desired outcomes. Thus we will usher in an era of "everything is programmable"—an era of thinking about the world in computational, programmable, designable terms.

The collection of enormous quantities of data will enable modeling of social systems at extreme scales, both micro and macro, helping uncover new patterns and relationships that were previously invisible. Agencies will increasingly model macro-level phenomena such as global pandemics to stop their spread across the globe. At a micro level, individuals will be able to simulate things such as their route to the office to avoid traffic congestion based on real-time traffic data. Micro- and macro-scale models will mesh to create models that are unprecedented in their complexity and completeness.

As a result, whether it is running a business or managing individual health, our work and personal lives will increasingly demand abilities to interact with data, see patterns in data, make data-based decisions, and use data to design for desired outcomes.

New multimedia technologies are bringing about a transformation in the way we communicate. As technologies for video production, digital animation, augmented reality, gaming, and media editing, become ever more sophisticated and widespread, a new ecosystem will take shape around these areas. We are literally developing a new vernacular, a new language, for communication.

Already, the text-based Internet is transforming to privilege video, animation, and other more visual communication media. At the same time, virtual networks are being integrated more and more seamlessly into our environment and lives, channeling new media into our daily experience. The millions of users generating and viewing this multimedia content from their laptops and mobile devices are exerting enormous influence on culture.

New media is placing new demands on attention and cognition. It is enabling new platforms for creating online identity while at the same time requiring people to engage in activities such as online personal reputation and identity management. It is enabling new ways for groups to come together and collaborate, bringing in new levels of transparency to our work and personal lives. At the same time, our sensibility toward reality and truth is likely to be radically altered by the new media ecology. We must learn to approach content with more skepticism and the realization that what you see today may be different tomorrow. Not only are we going to have multiple interpretations of recorded events, but with ubiquitous capture and surveillance, events will be seen from multiple angles and perspectives, each possibly telling a different story of individual events.

New technologies and social media platforms are driving an unprecedented reorganization of how we produce and create value. Amplified by a new level of collective intelligence and tapping resources embedded in social connections with multitudes of others, we can now achieve the kind of scale and reach previously attainable only by very large organizations. In other words, we can do things outside of traditional organizational boundaries.

To "superstruct" means to create structures that go beyond the basic forms and processes with which we are familiar. It means to collaborate and play at extreme scales, from the micro to the massive. Learning to use new social tools to work, to invent, and to govern at these scales is what the next few decades are all about.

Our tools and technologies shape the kinds of social, economic, and political organizations we inhabit. Many organizations we are familiar with today, including educational and corporate ones, are products of centuries-old scientific knowledge and technologies. Today we see this organizational landscape being disrupted. In health, organizations such as Curetogether and PatientsLikeMe are allowing people to aggregate their personal health information to allow for clinical trials and emergence of expertise outside of traditional labs and doctors' offices. Science games, from Foldit to GalaxyZoo, are engaging thousands of people to solve problems no single organization had the resources to do before. Open education platforms are increasingly making content available to anyone who wants to learn.

A new generation of organizational concepts and work skills is coming not from traditional management/organizational theories but from fields such as game design, neuroscience, and happiness psychology. These fields will drive the creation of new training paradigms and tools.

At its most basic level, globalization is the long-term trend toward greater exchanges and integration across geographic borders. In our highly globally connected and interdependent world, the United States and Europe no longer hold a mono-poly on job creation, innovation, and political power. Organizations from resource- and infrastructure-constrained markets in developing countries like India and China are innovating at a faster pace than those from developed countries in some areas, such as mobile technologies. In fact, a lack of legacy infrastructure is combining with rapidly growing markets to fuel higher rates of growth in developing countries.

For decades, most multinational 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.

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.

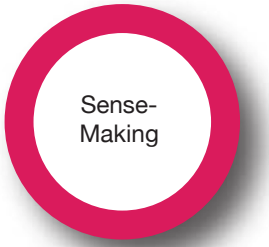
FUTURE WORK SKILLS 2020

What do these six disruptive forces mean for the workers of the next decade? We have identified ten skills that we believe will be critical for success in the workforce.

While all six drivers are important in shaping the landscape in which each skill emerges, the color-coding and placement here indicate which drivers have particular relevance to the development of each of the skills.

KEY

- Drivers—disruptive shifts that will reshape the workforce landscape
- Key skill needed in the future workforce




computational world
Massive increase in sensors and processing power make the world a programmable system
superstructed organizations
Social technologies drive new forms of production and value creation
Design Mindset
Virtual Collaboration
New Media Literacy
Cross Cultural Competency
Cognitive Load Management
Computational Thinking
globally connected world
Increased global interconnectivity puts diversity and adaptability at the center of organizational operations

TEN SKILLS FOR THE FUTURE WORKFORCE

1 SENSE-MAKING

DEFINITION: *ability to determine the deeper meaning or significance of what is being expressed*

As smart machines take over rote, routine manufacturing and services jobs, there will be an increasing demand for the kinds of skills machines are not good at. These are higher-level thinking skills that cannot be codified. We call these sense-making skills, skills that help us create unique insights critical to decision making.

When IBM's supercomputer, Deep Blue, defeated chess grandmaster Gary Kasparov, many took this of a sign of its superior thinking skills. But Deep Blue had won with brute number-crunching force (its ability to evaluate millions of possible moves per second), not by applying the kind of human intelligence that helps us to live our lives. A computer may be able to beat a human in a game of chess or Jeopardy by sheer force of its computational abilities, but if you ask it whether it wants to play pool, it won't be able to tell whether you are talking about swimming, financial portfolios, or billiards.

As computing pioneer Jaron Lanier points out, despite important advances in Artificial Intelligence (AI) research it is still the case that, "if we ask what thinking is, so that we can then ask how to foster it, we encounter an astonishing and terrifying answer: we don't know."[1] As we renegotiate the human/machine division of labor in the next decade, critical thinking or sense-making will emerge as a skill workers increasingly need to capitalize on.

IBM's latest supercomputer, Watson, recently took on human contestants at game-show Jeopardy.

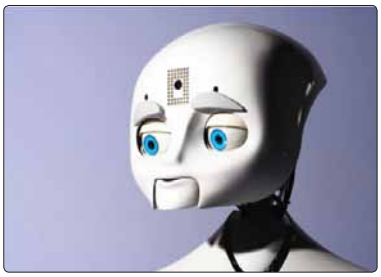
http://www-943.ibm.com/innovation/us/watson/

2 SOCIAL INTELLIGENCE

DEFINITION: *ability to connect to others in a deep and direct way, to sense and stimulate reactions and desired interactions*

While we are seeing early prototypes of "social" and "emotional" robots in various research labs today, the range of social skills and emotions that they can display is very limited. Feeling is just as complicated as sense-making, if not more so, and just as the machines we are building are not sense-making machines, the emotional and social robots we are building are not feeling machines.

Socially intelligent employees are able to quickly assess the emotions of those around them and adapt their words, tone and gestures accordingly. This has always been a key skill for workers who need to collaborate and build relationships of trust, but it is even more important as we are called on to collaborate with larger groups of people in different settings. Our emotionality and social IQ developed over millennia of living in groups will continue be one of the vital assets that give human workers a comparative advantage over machines.



MIT Media Lab's Personal Robots Group is developing a robot that can generate some human-like expressions.

http://robotic.media.mit.edu

DRIVERS

- extreme longevity
- rise of smart machines and systems
- new media ecology
- computational world
- superstructed organizations
- globally connected world

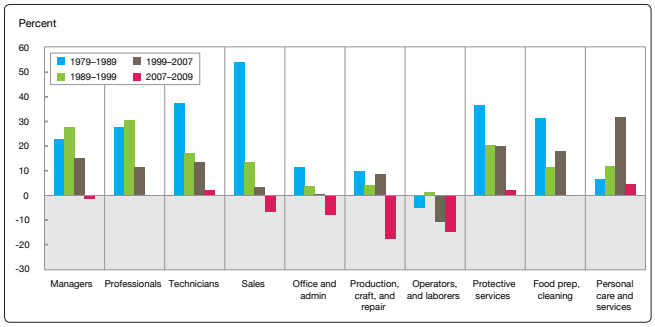
3 NOVEL & ADAPTIVE THINKING

DEFINITION: *proficiency at thinking and coming up with solutions and responses beyond that which is rote or rule-based*

Massachusetts Institute of Technology Professor David Autor has tracked the polarization of jobs in the United States over the last three decades. He finds that job opportunities are declining in middle-skill white-collar and blue-collar jobs, largely due to a combination of the automation of routine work, and global offshoring.[2] Conversely, job opportunities are increasingly concentrated in both high-skill, high-wage professional, technical and management occupations and in low-skill, low-wage occupations such as food service and personal care. Jobs at the high-skill end involve abstract tasks, and at the low-skill end, manual tasks.

What both of these categories of tasks have in common is that they require what Autor terms "situational adaptability"—the ability to respond to unique unexpected circumstances of the moment. Tasks as different as writing a convincing legal argument, or creating a new dish out of set ingredients both require novel thinking and adaptability. These skills will be at a premium in the next decade, particularly as automation and offshoring continue.

Change in employment by occupation, 1979-2009



Employment growth in the United States is polarizing into high-skill and low-skill jobs, both of which require capacity for novel thinking.

David Autor, *The Polarization of Job Opportunities in the US Labor Market.* Center for American Progress and The Hamilton Project, April 2010

4 CROSS-CULTURAL COMPETENCY

DEFINITION: *ability to operate in different cultural settings*

In a truly globally connected world, a worker's skill set could see them posted in any number of locations—they need to be able to operate in whatever environment they find themselves. This demands specific content, such as linguistic skills, but also adaptability to changing circumstances and an ability to sense and respond to new contexts.

Cross-cultural competency will become an important skill for all workers, not just those who have to operate in diverse geographical environments. Organizations increasingly see diversity as a driver of innovation. Research now tells us that what makes a group truly intelligent and innovative is the combination of different ages, skills, disciplines, and working and thinking styles that members bring to the table. Scott E. Page, professor and director of the Center of the Study of Complex Systems at the University of Michigan has demonstrated that groups displaying a range of perspectives and skill levels outperform like-minded experts. He concludes that "progress depends as much on our collective differences as it does on our individual IQ scores."[3]

Diversity will therefore become a core competency for organizations over the next decade. Successful employees within these diverse teams need to be able to identify and communicate points of connection (shared goals, priorities, values) that transcend their differences and enable them to build relationships and to work together effectively.

Professor Scott E. Page has shown how diverse groups yield superior outcomes when compared to homogeneous groups.

http://press.princeton.edu

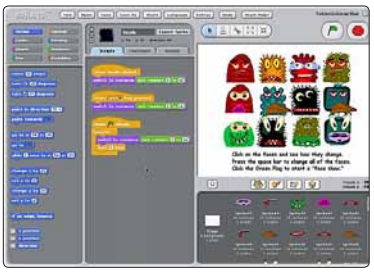
TEN SKILLS FOR THE FUTURE WORKFORCE

5 COMPUTATIONAL THINKING

DEFINITION: *ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning*

As the amount of data that we have at our disposal increases exponentially, many more roles will require computational thinking skills in order to make sense of this information. Novice-friendly programming languages and technologies that teach the fundamentals of programming virtual and physical worlds will enable us to manipulate our environments and enhance our interactions. The use of simulations will become a core expertise as they begin to feature regularly in discourse and decision-making. HR departments that currently value applicants who are familiar with basic applications, such as the Microsoft Office suite, will shift their expectations, seeking out resumes that include statistical analysis and quantitative reasoning skills.

In addition to developing computational thinking skills, workers will need to be aware of its limitations. This requires an understanding that models are only as good as the data feeding them—even the best models are approximations of reality and not reality itself. And second, workers must remain able to act in the absence of data and not become paralyzed when lacking an algorithm for every system to guide decision making.



Scratch is an interactive learning environment developed by Lifelong Kindergarten Group at the MIT Media Lab. It teaches young people the fundamentals of computational methodology in a fun, low risk environment.

http://scratch.mit.edu

6 NEW-MEDIA LITERACY

DEFINITION: *ability to critically assess and develop content that uses new media forms, and to leverage these media for persuasive communication*

The explosion in user-generated media including the videos, blogs, and podcasts that now dominate our social lives, will be fully felt in workplaces in the next decade. Communication tools that break away from the static slide approach of programs such as PowerPoint will become commonplace, and with them expectations of worker ability to produce content using these new forms will rise dramatically.

The next generation of workers will need to become fluent in forms such as video, able to critically "read" and assess them in the same way that they currently assess a paper or presentation. They will also need to be comfortable creating and presenting their own visual information. Knowledge of fonts and layouts was once restricted to a small set of print designers and typesetters, until word processing programs brought this within the reach of everyday office workers. Similarly, user-friendly production editing tools will make video language—concepts such as frame, depth of field etc—part of the common vernacular.

As immersive and visually stimulating presentation of information becomes the norm, workers will need more sophisticated skills to use these tools to engage and persuade their audiences.

Howard Rheingold's Social Media Classroom teaches viewers the vernacular of video.

http://socialmediaclassroom.com

DRIVERS

- extreme longevity
- rise of smart machines and systems
- new media ecology
- computational world
- superstructed organizations
- globally connected world

7 TRANSDISCIPLINARITY

DEFINITION: *literacy in and ability to understand concepts across multiple disciplines*

Many of today's global problems are just too complex to be solved by one specialized discipline (think global warming or overpopulation). These multifaceted problems require transdisciplinary solutions. While throughout the 20th century, ever-greater specialization was encouraged, the next century will see transdisciplinary approaches take center stage. We are already seeing this in the emergence of new areas of study, such as nanotechnology, which blends molecular biology, biochemistry, protein chemistry, and other specialties.

This shift has major implications for the skill set that knowledge workers will need to bring to organizations. According to Howard Rheingold, a prominent forecaster and author, "transdisciplinarity goes beyond bringing together researchers from different disciplines to work in multidisciplinary teams. It means educating researchers who can speak languages of multiple disciplines—biologists who have understanding of mathematics, mathematicians who understand biology."[4]

The ideal worker of the next decade is "T-shaped"—they bring deep understanding of at least one field, but have the capacity to converse in the language of a broader range of disciplines. This requires a sense of curiosity and a willingness to go on learning far beyond the years of formal education. As extended lifespans promote multiple careers and exposure to more industries and disciplines, it will be particularly important for workers to develop this T-shaped quality.

The California Institute for Telecommunications and Information Technology (Calit2) at the University of California's San Diego campus brings together researchers from STEM fields of science and engineering with art, design, and myriad other disciplines to tackle large scale societal problems.

http://socialmovement.org

8 DESIGN MINDSET

DEFINITION: *ability to represent and develop tasks and work processes for desired outcomes*

The sensors, communication tools and processing power of the computational world will bring with them new opportunities to take a design approach to our work. We will be able to plan our environments so that they are conducive to the outcomes that we are most interested in. Discoveries from neuroscience are highlighting how profoundly our physical environments shape cognition. As Fred Gage, a neurobiologist who studies and designs environments for neurogenesis (the creation of new neurons), argues, "change the environment, change the brain, change the behavior."[5]

One recent study found that ceiling height has a consistent impact on the nature of participants' thinking.[6] Participants in the study were asked to rate their current body state or feeling. Those who were in the room with higher ceilings responded more favorably to words associated with freedom, such as "unrestricted" or "open". Those in the lower-ceiling room tended to describe themselves with words associated with confinement. This impact on mood was directly transferred to mental processes; those in the high-ceiling group were more effective at relational thinking, creating connections and the free recall of facts.

Workers of the future will need to become adept at recognizing the kind of thinking that different tasks require, and making adjustments to their work environments that enhance their ability to accomplish these tasks.

Ceiling height can encourage open, expansive thinking.

http://scienceblogs.com/mixingmemory/2007/05/does_ceiling_height_affect_the.php

TEN SKILLS FOR THE FUTURE WORKFORCE

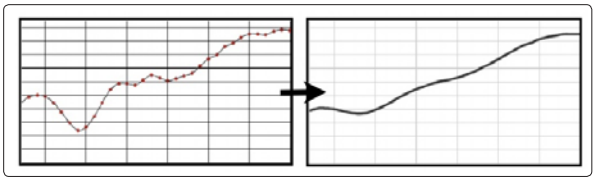
9 COGNITIVE LOAD MANAGEMENT

DEFINITION: *ability to discriminate and filter information for importance, and to understand how to maximize cognitive functioning using a variety of tools and techniques*

A world rich in information streams in multiple formats and from multiple devices brings the issue of cognitive overload to the fore. Organizations and workers will only be able to turn the massive influx of data into an advantage if they can learn to effectively filter and focus on what is important.

The next generation of workers will have to develop their own techniques for tackling the problem of cognitive overload. For example, the practice of social filtering—ranking, tagging, or adding other metadata to content helps higher-quality or more relevant information to rise above the "noise."

Workers will also need to become adept at utilizing new tools to help them deal with the information onslaught. Researchers at Tufts University have wired stockbrokers—who are constantly monitoring streams of financial data, and need to recognize major changes without being overwhelmed by detail. The stockbrokers were asked to watch a stream of financial data and write an involved email message to a coll-eague. As they got more involved in composing the email, the fNIRS (functional near-infrared spectroscopy, which measures blood oxygen levels in the brain) system detected this, and simplified the presentation of data accordingly.[7]



Adaptive interfaces, developed by researchers at Tufts, can reduce the level of detail in the market information stockbrokers see when sensors detect that they are experiencing high mental workload.

http://www.cs.tufts.edu

10 VIRTUAL COLLABORATION

DEFINITION: *ability to work productively, drive engagement, and demonstrate presence as a member of a virtual team.*

Connective technologies make it easier than ever to work, share ideas and be productive despite physical separation. But the virtual work environment also demands a new set of competencies.

As a leader of a virtual team, individuals need to develop strategies for engaging and motivating a dispersed group. We are learning that techniques borrowed from gaming are extremely effective in engaging large virtual communities. Ensuring that collaborative platforms include typical gaming features such as immediate feedback, clear objectives and a staged series of challenges can significantly drive participation and motivation.

Members of virtual teams also need to become adept at finding environments that promote productivity and well-being. A community that offers "ambient sociability" can help overcome isolation that comes from lack of access to a central, social workplace. This could be a physical coworking space, but it could also be virtual. Researchers at Stanford's Virtual Human Interaction Lab exploring the real-world social benefits of inhabiting virtual worlds such as *Second Life* report that the collective experience of a virtual environment, especially one with 3D avatars, provides significant social-emotional benefits. Players experience the others as co-present and available, but they are able to concentrate on their own in-world work.

Online streams created by micro blogging and social networking sites can serve as virtual water coolers, providing a sense of camaraderie and enabling employees to demonstrate presence. For example, Yammer is a Twitter-like micro blogging service, focused on business—only individuals with the same corporate domain in their email address can access the company network.

Yammer asks employees to provide updates on the question, "What are you working on?"

www.yammer.com

IMPLICATIONS

The results of this research have implications for individuals, educational institutions, business, and government.

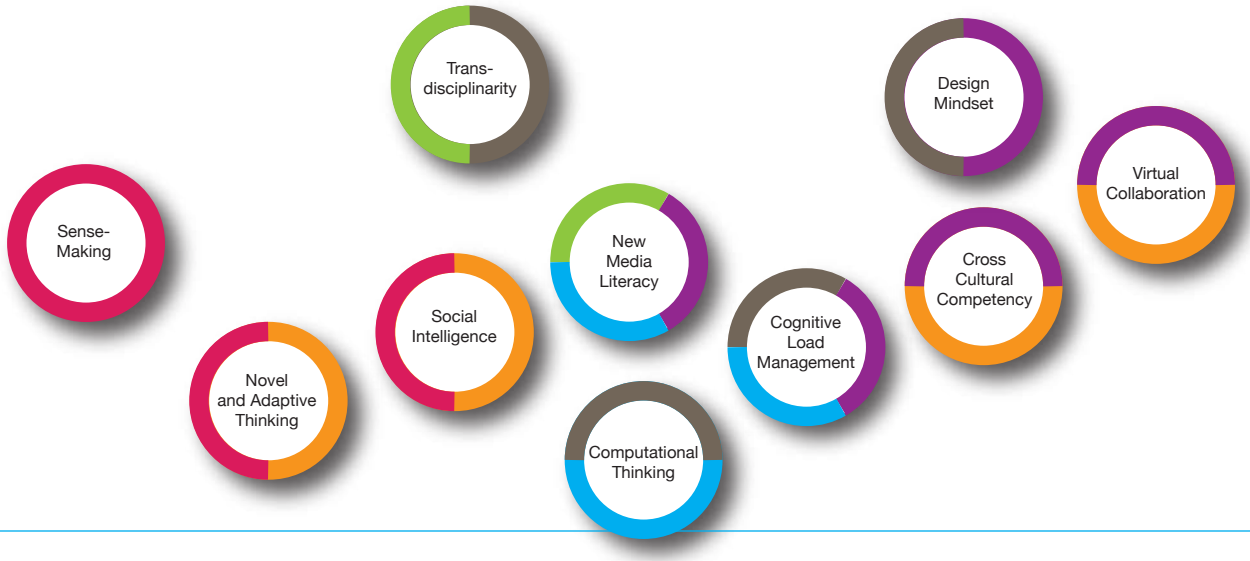
To be successful in the next decade, **individuals** will need to demonstrate foresight in navigating a rapidly shifting landscape of organizational forms and skill requirements. They will increasingly be called upon to continually reassess the skills they need, and quickly put together the right resources to develop and update these. Workers in the future will need to be adaptable lifelong learners.

Educational institutions at the primary, secondary, and post-secondary levels, are largely the products of technology infrastructure and social circumstances of the past. The landscape has changed and educational institutions should consider how to adapt quickly in response. Some directions of change might include:

- Placing additional emphasis on developing skills such as critical thinking, insight, and analysis capabilities
- Integrating new-media literacy into education programs
- Including experiential learning that gives prominence to soft skills—such as the ability to collaborate, work in groups, read social cues, and respond adaptively
- Broadening the learning constituency beyond teens and young adults through to adulthood
- Integrating interdisciplinary training that allows students to develop skills and knowledge in a range of subjects

Businesses must also be alert to the changing environment and adapt their workforce planning and development strategies to ensure alignment with future skill requirements. Strategic human resource professionals might reconsider traditional methods for identifying critical skills, as well as selecting and developing talent. Considering the disruptions likely to reshape the future will enhance businesses' ability to ensure organizational talent has and continuously renews the skills necessary for the sustainability of business goals. A workforce strategy for sustaining business goals should be one of the most critical outcomes of human resource professionals and should involve collaborating with universities to address lifelong learning and skill requirements.

Governmental policymakers will need to respond to the changing landscape by taking a leadership role and making education a national priority. If education is not prioritized, we risk compromising our ability to prepare our people for a healthy and sustainable future. For Americans to be prepared and for our businesses to be competitive, policy makers should consider the full range of skills citizens will require, as well as the importance of lifelong learning and constant skill renewal.



ENDNOTES

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