

Three views on the “creativity crisis”

THE CREATIVITY CRISIS

by Po Bronson and Ashley Merryman

Back in 1958, Ted Schwarzrock was an 8-year-old third grader when he became one of the “Torrance kids,” a group of nearly 400 Minneapolis children who completed a series of creativity tasks newly designed by professor E. Paul Torrance. Schwarzrock still vividly remembers the moment when a psychologist handed him a fire truck and asked, “How could you improve this toy to make it better and more fun to play with?” He recalls the psychologist being excited by his answers. In fact, the psychologist’s session notes indicate Schwarzrock rattled off 25 improvements, such as adding a removable ladder and springs to the wheels. That wasn’t the only time he impressed the scholars, who judged Schwarzrock to have “unusual visual perspective” and “an ability to synthesize diverse elements into meaningful products.”

The accepted definition of creativity is production of something original and useful, and that’s what’s reflected in the tests. There is never one right answer. To be creative requires divergent thinking (generating many unique ideas) and then convergent thinking (combining those ideas into the best result).

In the 50 years since Schwarzrock and the others took their tests, scholars—first led by Torrance, now his colleague, Garnet Millar—have been tracking the children, recording every patent earned, every business founded, every research paper published, and every grant awarded. They tallied the books, dances, radio shows, art exhibitions, software programs, advertising campaigns, hardware innovations, music compositions, public policies (written or implemented), leadership positions, invited lectures, and buildings designed.

Nobody would argue that Torrance’s tasks, which have become the gold standard in creativity assessment, measure creativity perfectly. What’s shocking is how incredibly well Torrance’s creativity index predicted those kids’ creative accomplishments as adults. Those who came up with more good ideas on Torrance’s tasks grew up to be entrepreneurs, inventors, college presidents, authors, doctors, diplomats, and software developers. Jonathan Plucker of Indiana University recently reanalyzed Torrance’s data. The correlation to lifetime creative accomplishment was more than three times stronger for childhood creativity than childhood IQ.

Like intelligence tests, Torrance’s test—a 90-minute series of discrete tasks, administered by a psychologist—has been taken by millions worldwide in 50 languages. Yet there is one crucial difference between IQ and CQ scores. With intelligence, there is a phenomenon called the Flynn

effect—each generation, scores go up about 10 points. Enriched environments are making kids smarter. With creativity, a reverse trend has just been identified and is being reported for the first time here: American creativity scores are falling.

Kyung Hee Kim at the College of William & Mary discovered this in May, after analyzing almost 300,000 Torrance scores of children and adults. Kim found creativity scores had been steadily rising, just like IQ scores, until 1990. Since then, creativity scores have consistently inched downward. “It’s very clear, and the decrease is very significant,” Kim says. It is the scores of younger children in America—from kindergarten through sixth grade—for whom the decline is “most serious.”

The potential consequences are sweeping. The necessity of human ingenuity is undisputed. A recent IBM poll of 1,500 CEOs identified creativity as the No. 1 “leadership competency” of the future. Yet it’s not just about sustaining our nation’s economic growth. All around us are matters of national and international importance that are crying out for creative solutions, from saving the Gulf of Mexico to bringing peace to Afghanistan to delivering health care. Such solutions emerge from a healthy marketplace of ideas, sustained by a populace constantly contributing original ideas and receptive to the ideas of others.

It’s too early to determine conclusively why U.S. creativity scores are declining. One likely culprit is the number of hours kids now spend in front of the TV and playing videogames rather than engaging in creative activities. Another is the lack of creativity development in our schools. In effect, it’s left to the luck of the draw who becomes creative: there’s no concerted effort to nurture the creativity of all children.

Around the world, though, other countries are making creativity development a national priority. In 2008 British secondary-school curricula—from science to foreign language—was revamped to emphasize idea generation, and pilot programs have begun using Torrance’s test to assess their progress. The European Union designated 2009 as the European Year of Creativity and Innovation, holding conferences on the neuroscience of creativity, financing teacher training, and instituting problem-based learning programs—curricula driven by real-world inquiry—for both children and adults. In China there has been widespread education reform to extinguish the drill-and-kill teaching style. Instead, Chinese schools are also adopting a problem-based learning approach.

Plucker recently toured a number of such schools in Shanghai and Beijing. He was amazed by a boy who, for a class science project, rigged a tracking device for his moped with parts from a cell phone. When faculty of a major Chinese university asked Plucker to identify trends in American education, he described our focus on standardized curriculum, rote memorization, and nationalized testing. “After my answer was translated, they just started laughing out loud,” Plucker says. “They said, ‘You’re racing toward our old model. But we’re racing toward your model, as fast as we can.’ ”

Overwhelmed by curriculum standards, American teachers warn there’s no room in the day for a creativity class. Kids are fortunate if they get an art class once or twice a week. But to scientists, this is a non sequitur, borne out of what University of Georgia’s Mark Runco calls “art bias.” The age-old belief that the arts have a special claim to creativity is unfounded. When scholars gave creativity tasks to both engineering majors and music majors, their scores laid down on an identical spectrum,

with the same high averages and standard deviations. Inside their brains, the same thing was happening—ideas were being generated and evaluated on the fly.

Researchers say creativity should be taken out of the art room and put into homeroom. The argument that we can't teach creativity because kids already have too much to learn is a false trade-off. Creativity isn't about freedom from concrete facts. Rather, fact-finding and deep research are vital stages in the creative process. Scholars argue that current curriculum standards can still be met, if taught in a different way.

To understand exactly what should be done requires first understanding the new story emerging from neuroscience. The lore of pop psychology is that creativity occurs on the right side of the brain. But we now know that if you tried to be creative using only the right side of your brain, it'd be like living with ideas perpetually at the tip of your tongue, just beyond reach.

When you try to solve a problem, you begin by concentrating on obvious facts and familiar solutions, to see if the answer lies there. This is a mostly left-brain stage of attack. If the answer doesn't come, the right and left hemispheres of the brain activate together. Neural networks on the right side scan remote memories that could be vaguely relevant. A wide range of distant information that is normally tuned out becomes available to the left hemisphere, which searches for unseen patterns, alternative meanings, and high-level abstractions.

Having glimpsed such a connection, the left brain must quickly lock in on it before it escapes. The attention system must radically reverse gears, going from defocused attention to extremely focused attention. In a flash, the brain pulls together these disparate shreds of thought and binds them into a new single idea that enters consciousness. This is the "aha!" moment of insight, often followed by a spark of pleasure as the brain recognizes the novelty of what it's come up with.

Now the brain must evaluate the idea it just generated. Is it worth pursuing? Creativity requires constant shifting, blender pulses of both divergent thinking and convergent thinking, to combine new information with old and forgotten ideas. Highly creative people are very good at marshaling their brains into bilateral mode, and the more creative they are, the more they dual-activate.

Is this learnable? Well, think of it like basketball. Being tall does help to be a pro basketball player, but the rest of us can still get quite good at the sport through practice. In the same way, there are certain innate features of the brain that make some people naturally prone to divergent thinking. But convergent thinking and focused attention are necessary, too, and those require different neural gifts. Crucially, rapidly shifting between these modes is a top-down function under your mental control. University of New Mexico neuroscientist Rex Jung has concluded that those who diligently practice creative activities learn to recruit their brains' creative networks quicker and better. A lifetime of consistent habits gradually changes the neurological pattern.

A fine example of this emerged in January of this year, with release of a study by University of Western Ontario neuroscientist Daniel Ansari and Harvard's Aaron Berkowitz, who studies music cognition. They put Dartmouth music majors and nonmusicians in an fMRI scanner, giving participants a one-handed fiber-optic keyboard to play melodies on. Sometimes melodies were

rehearsed; other times they were creatively improvised. During improvisation, the highly trained music majors used their brains in a way the nonmusicians could not: they deactivated their right-temporoparietal junction. Normally, the r-TPJ reads incoming stimuli, sorting the stream for relevance. By turning that off, the musicians blocked out all distraction. They hit an extra gear of concentration, allowing them to work with the notes and create music spontaneously.

Charles Limb of Johns Hopkins has found a similar pattern with jazz musicians, and Austrian researchers observed it with professional dancers visualizing an improvised dance. Ansari and Berkowitz now believe the same is true for orators, comedians, and athletes improvising in games.

The good news is that creativity training that aligns with the new science works surprisingly well. The University of Oklahoma, the University of Georgia, and Taiwan's National Chengchi University each independently conducted a large-scale analysis of such programs. All three teams of scholars concluded that creativity training can have a strong effect. "Creativity can be taught," says James C. Kaufman, professor at California State University, San Bernardino.

What's common about successful programs is they alternate maximum divergent thinking with bouts of intense convergent thinking, through several stages. Real improvement doesn't happen in a weekend workshop. But when applied to the everyday process of work or school, brain function improves.

So what does this mean for America's standards-obsessed schools? The key is in how kids work through the vast catalog of information. Consider the National Inventors Hall of Fame School, a new public middle school in Akron, Ohio. Mindful of Ohio's curriculum requirements, the school's teachers came up with a project for the fifth graders: figure out how to reduce the noise in the library. Its windows faced a public space and, even when closed, let through too much noise. The students had four weeks to design proposals.

Working in small teams, the fifth graders first engaged in what creativity theorist Donald Treffinger describes as fact-finding. How does sound travel through materials? What materials reduce noise the most? Then, problem-finding—anticipating all potential pitfalls so their designs are more likely to work. Next, idea-finding: generate as many ideas as possible. Drapes, plants, or large kites hung from the ceiling would all baffle sound. Or, instead of reducing the sound, maybe mask it by playing the sound of a gentle waterfall? A proposal for double-paned glass evolved into an idea to fill the space between panes with water. Next, solution-finding: which ideas were the most effective, cheapest, and aesthetically pleasing? Fiberglass absorbed sound the best but wouldn't be safe. Would an aquarium with fish be easier than water-filled panes?

Then teams developed a plan of action. They built scale models and chose fabric samples. They realized they'd need to persuade a janitor to care for the plants and fish during vacation. Teams persuaded others to support them—sometimes so well, teams decided to combine projects. Finally, they presented designs to teachers, parents, and Jim West, inventor of the electric microphone.

Along the way, kids demonstrated the very definition of creativity: alternating between divergent and convergent thinking, they arrived at original and useful ideas. And they'd unwittingly mastered Ohio's

required fifth-grade curriculum—from understanding sound waves to per-unit cost calculations to the art of persuasive writing. “You never see our kids saying, ‘I’ll never use this so I don’t need to learn it,’ ” says school administrator Maryann Wolowiec. “Instead, kids ask, ‘Do we have to leave school now?’ ” Two weeks ago, when the school received its results on the state’s achievement test, principal Traci Buckner was moved to tears. The raw scores indicate that, in its first year, the school has already become one of the top three schools in Akron, despite having open enrollment by lottery and 42 percent of its students living in poverty.

With as much as three fourths of each day spent in project-based learning, principal Buckner and her team actually work through required curricula, carefully figuring out how kids can learn it through the steps of Treffinger’s Creative Problem-Solving method and other creativity pedagogies. “The creative problem-solving program has the highest success in increasing children’s creativity,” observed William & Mary’s Kim.

The home-game version of this means no longer encouraging kids to spring straight ahead to the right answer. When UGA’s Runco was driving through California one day with his family, his son asked why Sacramento was the state’s capital—why not San Francisco or Los Angeles? Runco turned the question back on him, encouraging him to come up with as many explanations as he could think of.

Preschool children, on average, ask their parents about 100 questions a day. Why, why, why—sometimes parents just wish it’d stop. Tragically, it does stop. By middle school they’ve pretty much stopped asking. It’s no coincidence that this same time is when student motivation and engagement plummet. They didn’t stop asking questions because they lost interest: it’s the other way around. They lost interest because they stopped asking questions.

Having studied the childhoods of highly creative people for decades, Claremont Graduate University’s Mihaly Csikszentmihalyi and University of Northern Iowa’s Gary G. Gute found highly creative adults tended to grow up in families embodying opposites. Parents encouraged uniqueness, yet provided stability. They were highly responsive to kids’ needs, yet challenged kids to develop skills. This resulted in a sort of adaptability: in times of anxiousness, clear rules could reduce chaos—yet when kids were bored, they could seek change, too. In the space between anxiety and boredom was where creativity flourished.

It’s also true that highly creative adults frequently grew up with hardship. Hardship by itself doesn’t lead to creativity, but it does force kids to become more flexible—and flexibility helps with creativity.

In early childhood, distinct types of free play are associated with high creativity. Preschoolers who spend more time in role-play (acting out characters) have higher measures of creativity: voicing someone else’s point of view helps develop their ability to analyze situations from different perspectives. When playing alone, highly creative first graders may act out strong negative emotions: they’ll be angry, hostile, anguished. The hypothesis is that play is a safe harbor to work through forbidden thoughts and emotions.

In middle childhood, kids sometimes create paracosms—fantasies of entire alternative worlds. Kids revisit their paracosms repeatedly, sometimes for months, and even create languages spoken there. This type of play peaks at age 9 or 10, and it's a very strong sign of future creativity. A Michigan State University study of MacArthur “genius award” winners found a remarkably high rate of paracosm creation in their childhoods.

From fourth grade on, creativity no longer occurs in a vacuum; researching and studying become an integral part of coming up with useful solutions. But this transition isn't easy. As school stuffs more complex information into their heads, kids get overloaded, and creativity suffers. When creative children have a supportive teacher—someone tolerant of unconventional answers, occasional disruptions, or detours of curiosity—they tend to excel. When they don't, they tend to underperform and drop out of high school or don't finish college at high rates.

They're quitting because they're discouraged and bored, not because they're dark, depressed, anxious, or neurotic. It's a myth that creative people have these traits. (Those traits actually shut down creativity; they make people less open to experience and less interested in novelty.) Rather, creative people, for the most part, exhibit active moods and positive affect. They're not particularly happy—contentment is a kind of complacency creative people rarely have. But they're engaged, motivated, and open to the world.

The new view is that creativity is part of normal brain function. Some scholars go further, arguing that lack of creativity—not having loads of it—is the real risk factor. In his research, Runco asks college students, “Think of all the things that could interfere with graduating from college.” Then he instructs them to pick one of those items and to come up with as many solutions for that problem as possible. This is a classic divergent-convergent creativity challenge. A subset of respondents, like the proverbial Murphy, quickly list every imaginable way things can go wrong. But they demonstrate a complete lack of flexibility in finding creative solutions. It's this inability to conceive of alternative approaches that leads to despair. Runco's two questions predict suicide ideation—even when controlling for preexisting levels of depression and anxiety.

In Runco's subsequent research, those who do better in both problem-finding and problem-solving have better relationships. They are more able to handle stress and overcome the bumps life throws in their way. A similar study of 1,500 middle schoolers found that those high in creative self-efficacy had more confidence about their future and ability to succeed. They were sure that their ability to come up with alternatives would aid them, no matter what problems would arise.

When he was 30 years old, Ted Schwarzrock was looking for an alternative. He was hardly on track to becoming the prototype of Torrance's longitudinal study. He wasn't artistic when young, and his family didn't recognize his creativity or nurture it. The son of a dentist and a speech pathologist, he had been pushed into medical school, where he felt stifled and commonly had run-ins with professors and bosses. But eventually, he found a way to combine his creativity and medical expertise: inventing new medical technologies.

Today, Schwarzrock is independently wealthy—he founded and sold three medical-products companies and was a partner in three more. His innovations in health care have been wide ranging,

from a portable respiratory oxygen device to skin-absorbing anti-inflammatories to insights into how bacteria become antibiotic-resistant. His latest project could bring down the cost of spine-surgery implants 50 percent. “As a child, I never had an identity as a ‘creative person,’ ” Schwarzrock recalls. “But now that I know, it helps explain a lot of what I felt and went through.”

Creativity has always been prized in American society, but it’s never really been understood. While our creativity scores decline unchecked, the current national strategy for creativity consists of little more than praying for a Greek muse to drop by our houses. The problems we face now, and in the future, simply demand that we do more than just hope for inspiration to strike. Fortunately, the science can help: we know the steps to lead that elusive muse right to our doors.

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AMERICA'S LOOMING CREATIVITY CRISIS

by Richard Florida

The United States of America—for generations known around the world as the land of opportunity and innovation—is on the verge of losing its competitive edge. It is facing perhaps its greatest economic challenge since the dawn of the industrial revolution. This challenge has little to do with business costs and even less with manufacturing prowess. And, no, the main competitive threats are not from China or India.

Even though the United States led the world into the era of high-tech industry and constant innovation, it is by no means the nation's manifest destiny to stay on top. In fact, the great majority of U.S. business and political leaders, academics, and economic analysts fail to grasp the true reason behind American success in innovation, economic growth, and prosperity. It is not the country's generous endowment of natural resources, the size of its market, or some indigenous Yankee ingenuity that has powered its global competitiveness for more than a century. America's growth miracle turns on one key factor: its openness to new ideas, which has allowed it to mobilize and harness the creative energies of its people.

As Stanford University economist Paul Romer has long argued, great advances have always come from ideas. Ideas do not fall from the sky; they come from people. People write the software. People design the products. People start the new businesses. Every new thing that gives us pleasure or productivity or convenience, be it an iPod or the tweaks that make a chemical plant more efficient, is the result of human ingenuity.

True, the United States is still the world's center of ingenuity. Its GDP tops \$10 trillion, and it is home to great universities, Silicon Valley, and many of the most dynamic companies in information technology, biotech, entertainment, and countless other fields. But the global talent pool and the high-end, high-margin creative industries that used to be the sole province of the U.S., and a crucial source of its prosperity, have begun to disperse around the globe. A host of countries—Ireland, Finland, Canada, Australia, New Zealand, among them—are investing in higher education, cultivating creative people, and churning out stellar products, from Nokia phones to the *Lord of the Rings* movies. Many of these countries have learned from past U.S. success and are shoring up efforts to attract foreign talent—including Americans. If even a handful of these rising nations draws away just 2% to 5% of the creative workers from the U.S., the effect on its economy will be enormous. The United States may well have been the Goliath of the twentieth-century global economy, but it will take just half a dozen twenty-first-century Davids to begin to wear it down.

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To stay innovative, America must continue to attract the world's sharpest minds. And to do that, it needs to invest in the further development of its creative sector. Because wherever creativity goes—and, by extension, wherever talent goes—innovation and economic growth are sure to follow.

The Dawn of the Creative Age

There's a whole new class of workers in the U.S. that's 38 million strong: the creative class. At its core are the scientists, engineers, architects, designers, educators, artists, musicians, and entertainers, whose economic function is to create new ideas, new technology, or new content. Also included are the creative professions of business and finance, law, health care, and related fields, in which knowledge workers engage in complex problem solving that involves a great deal of independent judgment. Today, the creative sector of the U.S. economy, broadly defined, employs more than 30% of the workforce (more than all of manufacturing) and accounts for nearly half of all wage and salary income (some \$2 trillion)—almost as much as the manufacturing and service sectors together. Indeed, the United States has now entered what I call the Creative Age.

The roots of the Creative Age in the U.S. can be traced to the years surrounding World War II. After the war, federal funding for basic research jumped considerably, and so did the number of people pursuing higher education, thanks in part to the GI Bill. In the private sector, the newly formed venture capital industry provided an avenue for bringing research ideas to market. The social movements of the 1960s popularized the idea of openness; to be different was no longer to be an outcast but to be admired. Freedom of expression allowed new technologies and cultural forms to flourish—from biotechnology to alternative rock.

But the United States doesn't have some intrinsic advantage in the cultivation of creative people, innovative ideas, or new companies. Rather, its real advantage lies in its ability to attract these economic drivers from around the world. Of critical importance to American success in this last century has been a tremendous influx of talented immigrants. Immigrants have, of course, helped power American growth since the dawn of the Republic. But since the 1930s, the U.S. has welcomed a stream of scientific, intellectual, cultural, and entrepreneurial talent, as Europeans fled fascism and communism. This talent has helped make the U.S. university system and innovative infrastructure second to none.

The stream surged to historic levels in the 1980s and 1990s, thanks to more liberal immigration policies and a booming economy. In the 1990s alone, U.S. census figures reveal, more than 11 million people came to America. The largest wave of immigration in U.S. history, it brought with it talent from all corners of the globe. Think of high-tech luminaries Sergey Brin, the Moscow-born cofounder of Google, and Hotmail cofounder Sabeer Bhatia, who grew up in Bangalore. The foreign-born population of the United States currently numbers more than 30 million, or some 11% of the population.

The Creativity-Competitiveness Connection

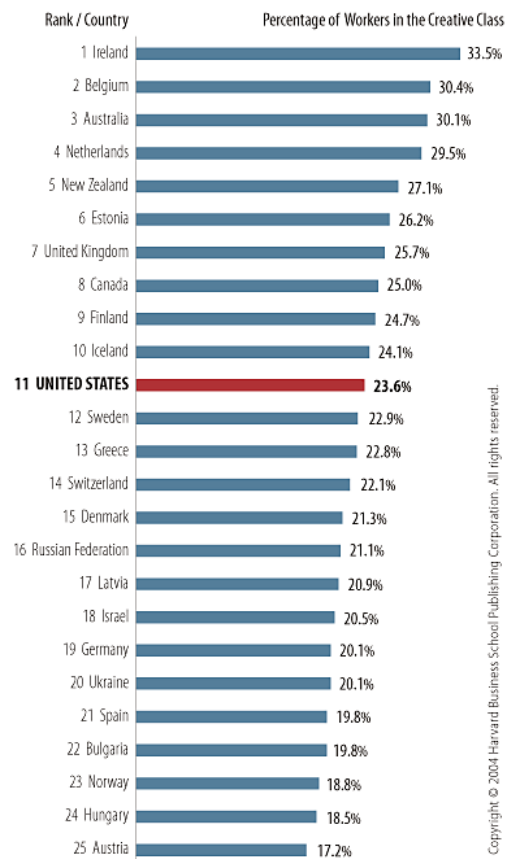
But already the percentage of the population represented by immigrants is higher in Canada (18%) and Australia (22%) than in the United States. These countries understand that today's global

economy centers on competition for people rather than for goods and services. As Pete Hodgson, New Zealand's minister for research, science, and technology, recently explained to me, "We no longer think of immigration as a gatekeeping function but as a talent-attraction function necessary for economic growth."

A close look at international statistics shows that the creative class represents a larger percentage of the workforce in many other countries than it does in the United States. Along with Irene Tinagli, a doctoral student at Carnegie Mellon, I set out to compare the size of the creative class in different countries by establishing the "Global Creative-Class Index" (GCCCI). Using employment data and the job classifications established by the International Labour Organization (ILO), the index is a straightforward calculation of the number of people employed in creative job categories in each country divided by the country's total number of workers. In the exhibit, "The Global Creative-Class Index," we compare the percentage of workers in the creative classes in 25 nations.

The Global Creative-Class Index

America may be the land of opportunity, but it no longer has a lock on the best and the brightest jobs—the ones that create new ideas, new technology, or new content. When we calculated the number of people engaged in such jobs as a proportion of the general workforce in scores of countries, the United States wasn't even in the top ten.



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Note: Data for the Russian Federation refer to 1999; for the Netherlands and Bulgaria, 2001; for the United States, 2003. All other figures refer to 2002, the latest year for which those data are available.

Source: Compiled by Irene Tinagli from International Labour Organization and U.S. Bureau of Labor Statistics data.

The Global Creative-Class Index

Far from being the leader, the United States is not even in the top ten. The creative class constitutes around a third of the workforce in Ireland, Belgium, Australia, and the Netherlands; it accounts for roughly a quarter of the workforce in six other countries: New Zealand, Estonia, the United Kingdom, Canada, Finland, and Iceland. When our U.S. data are adjusted to be comparable to the ILO figures (which use a narrow definition of creative job categories that excludes “technicians”), the United States comes in, with 23.6%, at 11th, worldwide. Of course because the overall workforce in America is so large, that translates into a sizable group in absolute numbers—some 30 million people.

Still, if technicians *are* included in the international analysis, the creative class rises to more than 40% in some eight countries: the Netherlands (47%), Sweden (42.4%), Switzerland (42%), Denmark (42%), Norway (41.6%), Belgium (41.4%), Finland (41%), and Germany (40%). It constitutes more than 30% of the workforce in virtually all the remaining countries. What’s more, the growth rate of the creative class in several nations has been phenomenal over the past decade or so. Since 1991, for instance, New Zealand’s creative class has jumped from 18.7% to 27.1%, and Ireland’s has nearly doubled, starting from the same 18.7% and rising to 33.5%.

In today’s economy, creativity and competitiveness go hand in hand. It’s not surprising, then, that our GCCI rankings correlate closely with results from other studies of international competitiveness. Harvard Business School’s Michael Porter, for instance, ranked the United States as the world’s most competitive nation in his initial 1995 global Innovation Index. According to Porter’s projections, by 2005, the U.S. will have tumbled to sixth among the 17 member countries of the Organisation for Economic Co-operation and Development (OECD)—trailing (in order) Japan, Finland, Switzerland, Denmark, and Sweden. The 2004 Globalization Index developed by A.T. Kearney and published in *Foreign Policy* ranks the United States seventh, behind Ireland, Singapore, Switzerland, the Netherlands, Finland, and Canada.

Rankings of individual companies’ competitiveness yields similar results. According to *BusinessWeek*’s 2004 Information Technology 100, for instance, only six of the world’s 25 most competitive high-tech companies are based in the United States, while 14 are in Asia.

In the area of patents and publications, America’s formidable lead has been eroding, as well. Today, foreign-owned companies and foreign-born inventors account for nearly half of all patents issued in the United States. A study by CHI Research found that inventors in Japan, Taiwan, and South Korea alone account for more than a quarter of all U.S. industrial patents awarded each year. In terms of publications, the National Science Board reports that back in 1988, U.S. scientists produced 178,000 scientific papers, or 38% of all scientific and engineering papers worldwide. But by 2001, the European Union nations were the largest producers of scientific literature. In the field of physics, the U.S. lead fell from 61% of all publications in 1983 to 29% in 2003, according to *Physical Review*.

Taken individually, none of those facts would be cause for concern about the future of the United States. It is, after all, a very rich country with diverse strengths. Cumulatively, though, the data create an unsettling picture of a nation that’s allowing its creativity infrastructure to decay. Add to that

greater security concerns and a highly politicized scientific climate, and it's easy to see why the nation is becoming less and less attractive to the world's brightest minds.

The Talent Gap

Today, virtually the entire public dialogue about jobs in the United States revolves around outsourcing and unemployment. But these are the short-term issues. The real long-term predicament facing the United States and the world is the looming shortage of creative talent.

Economists like Lawrence Summers, president of Harvard University and a former Treasury secretary, and Edward Montgomery, a former Labor Department deputy secretary, view the shortage of skilled and talented workers as all but inevitable. A 2003 National Association of Manufacturers report concurs, predicting that a skilled-worker gap will start to form in 2005, widening to 5.3 million workers by 2010 and 14 million by 2020. The labor shortages that plagued high-tech companies in the halcyon days of 1999 and 2000 will look like a "minor irritation" in comparison, contends labor market expert Anthony Carnevale, the report's author.

The cause of this labor squeeze is easy to see: Baby boomers now constitute about 60% of the prime-age workforce—that is, workers between the ages of 25 and 54. In the coming decades, boomers will retire in massive numbers, and there simply aren't enough younger workers to take their places. The talent shortage will hit every sector of the U.S. economy, but it will be felt most acutely at the cutting edges of science and engineering. Since 1980, the number of jobs in those segments has grown four times faster than the overall employment rate, and the Bureau of Labor Statistics expects that number to swell by nearly 50% again by 2010—adding a further 2.2 million new jobs. At the same time, the average age of the scientific and technological worker is rising. More than half are 40 or older, and many will leave the workforce in the next two decades.

You don't have to be a rocket scientist to figure out that there is only one way for the United States to fill this gap: foreign talent. Former director of the U.S. Census and Columbia University professor Kenneth Prewitt says that the United States will increasingly depend on these "replacement people" to provide vital skills and grow new industries. But that may not be as easy as it once was.

The Canaries of the Talent Mine

Students are a leading indicator of global talent flows. The countries and regions that attract them have a leg up on retaining them and also on attracting other pools of foreign talent—scientists, researchers, inventors, entrepreneurs.

For decades, international students have flocked to the United States to take advantage of the world-class education offered there. In the 2002–2003 academic year alone, according to the Institute of International Education (IIE)—the body that grants the Fulbright scholarships—roughly 585,000 foreign students attended U.S. colleges and universities, up from less than 50,000 in 1960, and international education contributed \$12.9 billion to the U.S. economy. But in 1999, well before anyone had heard the phrase "dot-com collapse," the Council on Competitiveness had

warned that the nation should not count on keeping the international students who come to study at elite universities.

More recently, a March 2004 report by the Council of Graduate Schools found that international student applications for fall 2004 admission had dropped sharply at 90% of the graduate schools responding to its survey. The total decline was 32%. Applications fell off most from the countries that have traditionally sent the most students: More than half of all foreign-born graduate students hailed from Asia, including 14% from India and 10% from China. The figures show that the number of Chinese students applying to U.S. graduate schools declined by 76%, and the number of Indian students was 58% lower than it was the previous year. Signs don't point to a turnaround anytime soon. The Educational Testing Service found that one-third fewer international students applied to take the Graduate Record Examinations (GREs) for the 2004 academic year than they did for 2003. The number of Chinese test takers was down 50%; Taiwanese, 43%; Indians, 37%; and Koreans, 15%.

One reason for this is good news from a global perspective. Several major economies—most notably India's and China's—have grown to the point where they can offer great opportunities for people who stay or return home. Both of those countries are investing heavily to build excellent university systems of their own. Peter Drucker said recently that India may already have the greatest engineering and medical schools in the world.

Foreign students are not only finding attractive educational opportunities in other countries, they are also facing obstacles to studying in the United States. A survey of educators at 276 U.S. campuses conducted by the IIE found a significant drop in enrollment to U.S. universities in fall 2003 from students whose home countries have large Islamic populations, especially United Arab Emirates, Saudi Arabia, and Pakistan. Fifty-nine percent of respondents cited the visa application process as a reason for the decline.

The *New York Times* reports that the rejection rate for "cultural exchange" visas, used by many medical students, rose from 5.1% in fiscal year 2001 to 7.8% in fiscal 2003. And the number of students whose visas were rejected rose from 27.6% in FY2001 to 35.2% in FY2003, according to the National Science Board's *Science & Engineering Indicators—2004*.

Having taught at several major universities—Ohio State, Harvard, MIT, and Carnegie Mellon—I've known many foreign students. They have always been quick to point out the benefits of studying and conducting research in the United States. But their impressions have changed dramatically over the past year. They complain of being hounded by immigration agencies as potential threats to security, and they feel that the war on terror is leading America to abandon its commitment to an open society. Many have told me they are thinking of leaving the U.S. for graduate education and professional positions in other nations. They also report that growing numbers of their friends and colleagues back home are no longer interested in coming to America for their education.

James Langer, vice president of the National Academy of Sciences, spoke plainly about what the drop in foreign students could mean. At a May 2004 luncheon for the United States Senate Science and Technology Caucus, he commented: "Applications to many leading U.S. graduate schools from

students in China, India, Russia, and elsewhere are already down by 30% or more, and there is evidence that these students are going elsewhere for advanced degrees. International scientific organizations, such as the International Union of Pure and Applied Physics, are refusing to hold conferences here.” As one oceanographer from the University of California at San Diego recently quipped, it may be time for academics in that part of the country to “have our scientific meetings in Tijuana,” because at least there international experts can get in. In short, as Langer concluded, “American science is being isolated from the rest of the world.”

Sadly, restricting foreign immigration will not open up more places for homegrown talent in the top American graduate programs and research facilities. The U.S. has many brilliant young people but not nearly enough to satisfy the demand the nation’s powerhouse economy has created.

Other countries are taking full advantage of America’s fading allure. English-speaking Canada, the United Kingdom, and Australia are particularly well placed to capitalize on this opportunity. In June 2003, an eminent Oxford professor told me that the university had “never seen so many applications from top international students,” adding that these students seem to be “looking for alternatives to top American universities” like Harvard, Chicago, MIT, and Stanford. In fact, together, the United Kingdom, Germany, France, Australia, and Japan attracted 650,000 foreign students—some 11% more than the United States—according to the 2003 *Atlas of Student Mobility*, compiled by the IIE. And the stakes are growing. In 2000, UNESCO estimates, 1.7 million students worldwide were educated abroad; by 2025, it expects that number will swell to more than 8 million. The countries that attract these students will have a huge advantage in the coming war for global talent.

The Reverse Brain Drain

For the first time in its history, then, the United States is confronting the possibility of a reverse brain drain. And students are just the tip of the iceberg. The evidence suggests that the country may be losing out on the talents of a host of foreign scientists, engineers, inventors, and other professionals. Visa delays have cost U.S. businesses roughly \$30 billion in two years, according to a June 2004 study commissioned by the Santangelo Group. The group is a consortium of leading U.S. industry organizations ranging from the Aerospace Industries Association to the National Foreign Trade Council to the Association for Manufacturing Technology, and its study was based on a survey of 734 of its member companies. Of the 141 companies that responded, 73% reported having had problems processing business visas since 2002, and the average financial impact per company was nearly a million dollars (\$925,816). Thirty-eight percent of respondents said that visa delays caused projects to be postponed, 42% said the delays prevented them from bringing foreign employees to the United States, and 20% said training events had to be relocated outside the country.

The direct-sales giant Amway, for instance, chose to hold a convention for its 8,000 South Korean distributors in Japan this year rather than in Los Angeles or Hawaii, the *Washington Post* recently reported, because the United States would require each visitor to go through an individual interview with a consular official. Amway estimated that the attendees would have spent, on average, \$1,250—translating into a \$10 million loss for the potential host city.

According to a recent *New York Times* article, 6.3 million people applied for U.S. visas between October 2000 and September 2001. But in fiscal 2003, that number dropped more than 40% to 3.7 million. And fewer of those who are applying are getting in. The rejection rate for H-1B visas (also called “high-skilled visas”), which allow professionals who are not U.S. citizens to work in the country for up to six years, increased from 9.5% to 17.8% between 2001 and 2003. Almost every major American industry from high-tech to entertainment is feeling the repercussions of these decisions. A number of prominent international music groups, such as Cuba’s Sierra Maestra, have canceled American tours because they were refused visas. (Sierra Maestra was denied a visa when the FBI failed to complete background checks fast enough to meet INS deadlines.) These cancellations in and of themselves won’t have a big impact on the U.S. economy, but think of the influence on American artists, let alone on the multibillion-dollar music business. Choking musicians and businesspeople off from those on the frontiers of this ever-evolving (and increasingly global) industry will eventually yield the same result as prohibiting scientists from carrying out potentially rewarding research. It will dull their competitive edge.

Foreign professionals already working in U.S. firms aren’t having an easy go of it either. Processing times for renewing green cards and travel documents have reached glacial proportions. As the *Times* also reports, it now takes an average of 19 months to replace a lost green card. It takes seven months for legal workers in the U.S. whose green cards are pending to get travel papers—and during that period, the applicants cannot leave the country or they risk not being able to reenter. The same article claims that the number of pending green card applications has jumped by nearly 60% since 2001 because 1,000 agents who once issued documents have been reassigned to do “extensive security checks of every applicant instead.”

There’s no denying how important foreign-born workers are to the U.S. economy. AnnaLee Saxenian, dean of the School of Information Management and Systems at the University of California, Berkeley, conducted extensive research on immigrant-run companies in Silicon Valley. She and her team pored over census data on immigrants’ education, occupations, and earnings, and they used a Dun & Bradstreet database to distill immigrant-run companies from the nearly 12,000 start-ups launched between 1980 and 1998. They found that Chinese and Indian engineers were running nearly 30% of the area’s high-tech companies in the 1990s—up from 13% in the early 1980s. Saxenian estimated that in 2000, these firms collectively accounted for nearly \$20 billion in sales and more than 70,000 jobs. And because Saxenian’s database identified only those companies that are currently headed by a Chinese or Indian chief executive, she suspects her figures are conservative.

Trends are eye-opening, but individual cases are perhaps even more important. What if, for example, Vinod Khosla, the cofounder of Sun Microsystems and venture capital luminary who has backed so many blockbuster companies, had stayed in India? Or if An Wang, founder of Wang Laboratories, had gone to university in Europe? These are people whose creative genius has affected the trajectory of entire industries; their breakthroughs and business acumen have helped set in motion what the economist Joseph Schumpeter liked to call the “gales of creative destruction” that create new companies and industries and completely remake existing ones.

This circle-the-wagons mentality is even causing some leading American scientists and engineers to leave the country. If the status quo remains, then more people may react like Roger Pedersen, a

stem cell researcher, who left the University of California, San Francisco, for Cambridge University. “I have a soft spot in my heart for America, but the UK is much better for this research. More working capital,” Pedersen told *Wired*, “They haven’t made such a political football out of stem cells.” These tendencies illustrate on a small scale how the creative economy is being reshaped—both by global competitors’ increasing savvy and by America’s shortsightedness.

Rebuilding the Creative Infrastructure

What should the United States do? First, it must recognize that the issue is nonpartisan. Republicans, Democrats, independents—everyone has a stake in keeping the country open to foreign talent. The challenges the nation must overcome are too massive for the debate about them to become overshadowed by polarizing political bickering, culture wars, or short-term economic agendas. The United States must consider its next steps carefully and deliberately. I recommend focusing on three main areas.

Calculate the true cost of security.

The United States is impeding its own progress when it makes scientific discovery pass religious tests or when it tightens visa restrictions unnecessarily. To be certain, America after September 11 does face real and vital threats to its security, and they are not going to disappear anytime soon. The departments of Defense and Homeland Security, the FBI, the Coast Guard, and the intelligence agencies naturally think in terms of security first. That is their job. But it is important for both business and political leadership to recognize the economic costs of overzealousness and to weigh carefully the serious trade-offs between current security and long-run competitiveness.

People around the world applaud America’s efforts to improve its own security. But what the world does not like is the arbitrary and sometimes brash methods the country has adopted in its own defense. Over time, terrorism is less a threat to the United States than the possibility that creative and talented people will stop wanting to live within its borders. The nation must act in concrete ways to reassure people—both Americans and global citizens—that it values openness, diversity, and tolerance. To that end, it must focus on improving the visa process immediately.

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If the government is unable or unwilling to take the lead in balancing one type of security with another, then the business and academic communities need to push for a renewed American openness. In the 1980s, Hewlett-Packard chief Jack Young spurred his colleagues to form the U.S. Council on Competitiveness, which did much to bring the country’s lagging industrial competitiveness to public attention. The private sector can similarly take the lead now by establishing a Global Creativity Commission—a coalition of world political and business leaders committed to developing strategies to ensure that global talent can move efficiently across borders.

Invest generously in research and education.

Corporate R&D funding dropped by nearly \$8 billion in 2002—the largest single-year decline since the 1950s, the National Science Foundation reports. And right now, the federal government is cutting key areas of defense R&D spending. Many state governments have slashed higher education funding for arts and culture while pumping millions into stadiums, convention centers, and other bricks-and-mortar projects. Never mind that the local economic benefits of such projects often dry up the minute the last construction worker drives off the site. These choices signal a profound failure to understand what's required to maintain an atmosphere of innovation.

The United States must invest generously in its creative infrastructure. Education reform must, at its core, make schools into places that cultivate creativity. Americans revel in the legendary stories of young creators like Michael Dell building new businesses in dorm rooms or in garages in their spare time. The question is: Why are they doing these things in their *spare* time? Isn't this the real stuff of education in the Creative Age?

What's needed is the equivalent of a GI Bill for creativity. The nation must spend radically more on research and development and on higher education, opening up universities and colleges to more Americans and to more of the world's best and brightest. In the same way it built the canals, railroads, and highways to power industrial growth, the United States has to build the creative infrastructure for the future.

Here again, business and academia may need to take the lead, at least in the short run. In response to the recent restrictions on federal funding for stem cell research, Lawrence Summers announced plans earlier this year to launch a multimillion-dollar Harvard Stem Cell Institute. Says George Q. Daley, an associate professor at Harvard Medical School and Children's Hospital, "Harvard has the resources, Harvard has the breadth, and, frankly, Harvard has the responsibility to take up the slack that the government is leaving."

Tap into more people's creative capabilities.

If the creative class in America accounts for less than a third of the workforce, then, of course, the vast majority is not part of it. Nearly 45% of the U.S. workforce falls into the service class, for instance—janitors, low-end health care workers, office clerks, food service workers, and the like. Members of this class earn, on average, less than half of what creative-class members do—around \$22,000 a year versus more than \$50,000.

Employing so many citizens in noncreative ways is a terrible waste of talent and potential. So far, the U.S. has gotten away with it because few other societies do much better. But remember what happened in the 1970s and 1980s, when Japanese auto companies leaped to global prominence with manufacturing methods that tapped the intelligence of every worker on the factory floor to make continuous improvements in quality and productivity. U.S. manufacturers—stuck in the old Taylorist model, in which the engineers made the decisions and the laborers simply carried out the rote work—nearly had their doors blown off. If other nations develop better ways to harness their societies' creativity, the U.S. economy might be blown away on an inconceivable scale.

The United States needs to substantially upgrade the pay, working conditions, and status of the huge number of service jobs its economy is generating. These are the port-of-entry jobs to the creative economy of today. During the Great Depression and the New Deal, the nation succeeded in turning a large number of formerly low-skill, low-pay, blue-collar jobs into the kind of occupations that could support families and become the launchpad for upward mobility. And many of the equivalent jobs today—hairdressing, massage therapy, and aestheticians, to name only a few—are virtually impervious to outsourcing.

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Addressing the needs of the American creative class will be important, but it won't be enough. To prevent widespread social unrest and to benefit economically from the creative input of the maximum number of its citizens, the United States will have to find ways to bring the service and manufacturing sectors more fully into the Creative Age.

The Future of Global Creativity

Maybe I'm an eternal optimist, but I think the United States can continue to be a beacon of openness for the creative class—and, indeed, for the whole of humanity. It has a long history of resourcefulness and creativity to draw on, and it has transformed itself many times before, rebuilding after the Great Depression and bouncing back after the Asian manufacturing boom of the 1980s.

Unfortunately, America's eroding access to high-level foreign talent hasn't drawn much attention from political leaders or from the media. They have seemingly bigger and more immediate problems—from the war on terrorism to the loss of manufacturing jobs to China, India, and Mexico. But the nation is overlooking the biggest threat to its economic well-being—just as it did when its obsession with the Soviet Union in the last years of the Cold War caused it to miss the economic challenge of Japan.

The role of the United States in generating creativity and human capital is a concern not only for U.S. businesses and policy makers but for all nations. American universities and corporations have long been the educators and innovators for the world. If this engine stalls—or if political decisions about immigration, visas, and scientific research put sugar in its gas tank—the whole world will have to live with the repercussions.

The Creative Age requires nothing short of a change of worldview. Creativity is not a tangible asset like mineral deposits, something that can be hoarded or fought over, or even bought and sold. The U.S. must begin to think of creativity as a “common good,” like liberty or security. It is something essential that belongs to everyone and must always be nourished, renewed, and maintained—or else it will slip away.

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THE CREATIVITY CRISIS?

WHAT CREATIVITY CRISIS?

by Michael Schrage

The most important thing to understand about America's "crisis of creativity" is that there isn't one. The notion that American business creativity is either at risk or in decline is laughable. Arguments that "Yankee ingenuity" is ebbing into oxymoron are ludicrous. They invite ridicule. So here it comes.

Yes, America's economy is awful. But so what? Hard times haven't nicked, dented or damaged this country's creative core competence. To the contrary, they've made more people more interested in being more creative. Spend serious time at research university labs. Or sit in on 10K business plan competitions. Or wander through Silicon Valley incubators and Texas industrial parks. Or listen to top-tier venture capitalists. You'll be impressed. There's no shortage of creativity and ingenuity here.

The evidence overwhelmingly suggests the only measurable "creativity crisis" America faces is an embarrassment of riches. We're spoiled for choice.

America has a creativity glut. Over two decades, I've not heard a single venture capitalist suggest any perceptible decline in the creative quality and content of the business proposals they see. If anything, their innovation buffet has expanded. Aspiring pundits shouldn't confuse macroeconomic malaise with creative constipation.

From software to telecommunications to bioinformatics to ecotech to health care, transforming novel concepts to prototype, demo or beta version has never been faster and cheaper. The pervasive rise of interoperability further assures a growing reservoir of creative options. The costs and complexity of creatively linking seeming disparate technical disciplines — microbiology and materials science, behavioral finance and computational fluid dynamics, biomedical engineering and traffic analysis — to solve problems are shrinking. These new economics of creative expression have demolished traditional barriers of entry to early-stage innovation.

These innovation infrastructures to support creative interaction have never been more accessible or more robust. They effectively invite innovators to take a chance. Just as important, individuals and institutions increasingly recognize that interdisciplinary collaboration, not just personal genius, is essential to breakthrough. Digital media now facilitate mass collaborations between thousands with the same ease and fluency that intimate collaborators — Watson & Crick, the Wright brothers, Braque & Picasso, the Curies — who depended on physical media would envy.

This point is vital: genuine creativity isn't about ideas. It's about translating ideas into ingenious products, services and solutions. Ideas are the seeds, not the substance, of creativity. Getting them to take root is easier than it's ever been.

That's why cover stories declaring creativity droughts in America feel so faux. Sure, they're provocative. But the underlying science is psuedo; the overarching solutions are silly.

Wild speculation trumps sober insight. Even if one believes, for example, that a standardized creativity test suggests American students have become less creative (I don't), it begs the question of whether such tests fairly capture the creativity that matters to markets. After all, this test was explicitly designed to measure individual prowess. There's zero assessment of the collaborative creativity and temperament. The test, in other words, inherently ignores the most powerful interpersonal dynamic now shaping contemporary corporate innovation. (Am I biased because I wrote a book about creative collaboration? Sure. Just the way most creativity research is biased by its overwhelming focus on individual psychology.)

But it's the solutions to America's creativity quotient shortfall that beggar belief. What's the recommendation for boosting America's impending underperformance? Why, put creativity classes in school curricula! Forgive me my Summerhill flashback. The same public schools producing students who underperform on standardized tests in math, science, writing and reading comprehension should be performing CPR — Creative Process Recovery — on America's schoolchildren? That doesn't even rise to the level of nonsense. Schools that can't effectively teach reading, writing and arithmetic should now champion TRIZ, de Bono and Syntectics? Please. America will truly have a "creativity crisis" when "creativity" becomes a required high school course.

My bet is that the overwhelming majority of today's children and adolescents will be getting all kinds of creative stimulation and challenge from the video-games they play and the social networks they manage via their digital devices. Needless to say, traditional tests of convergent/divergent creative thinking probably aren't well-suited for capturing these new genres and modes of creative development. Then again, any serious review of the creativity research literature and the history of creativity suggests that the very definition of creativity has evolved in rather creative ways. Particularly in business innovation, creativity, like beauty, is in the eye of the beholder. Your creative solution may be my cliché. Let's not forget that "creative" accounting is not intended as a compliment.

Which is why the greatest misconceptions around creativity crises revolve around context. If you believe in markets (as I do), then the supply of creativity overwhelmingly depends on its demand. Only experts and elitists believe that creativity is determined by creators. In markets, creativity — and its value — is determined by consumers. The most creative industries such as fashion, music, video-games, software, and animated movies tend to have audiences and customers that think of themselves as creative. Customer openness to creativity — however defined — powerfully influences creative supply.

Many wealthy people, for example, find Damien Hirst a brilliantly creative artist whose work is worth the millions they pay for it. Respectfully, I think they're idiots. Nevertheless, The Hirst brand, not unlike Picasso or Pixar, is deemed creative. Look at his skillfully dismembered formaldehyde shark or diamond skull and draw your own conclusions. Ask yourself: What does Hirst's success say about creativity?

My point is not to mock Hirst's art but to use its undeniable success to interject a different strand into the creativity crisis conversation. That is, who gets to define what creativity means in our businesses and industries? Academics? Our R&D people? Our sales folks? The CEO? Industry analysts? Competitors? Entrepreneurs? Our best customers? Our smartest customers? Our typical customers?

My view is that creativity — like any meaningful exchange of value — is not declared but negotiated. The most important innovation conversations have evolved and revolve around what kinds of people, approaches and solutions are creative. The essential difference between those conversations today and even a decade ago is that we have more ways, more tools and technologies to express ourselves both as individuals and as collaborative teams. So do our customers and clients.

What do you think is creative? Do you think there is a creativity crisis? More importantly, does your organization have healthy arguments about what creativity actually means to you and your customers?

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