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About This Issue

Since the time of Benjamin Franklin, when he harnessed electricity using a simple kite and a key in the 1700s, Americans have embraced the power of imagination, ingenuity, and creativity. Each year the United States issues more than180,000 patents to scientists, students, corporations, and everyday people so that they can protect and build on their idea and introduce it to the world.

There is no typical American innovator. Innovators come in all shapes and sizes; they might work in large office buildings, laboratories, or even the smallest garages attached to their homes. What unites these innovators is the knowledge that the road to innovation might be long and checkered with failure, but success will come to those who believe in an idea and have the passion to follow through.

The pages that follow are merely a sampling of the many innovative ideas and people that are making this world a better, easier, more interesting place to live. What is most fascinating is that innovations can affect something as simple as the way you play or as life altering as curing diseases that each year harm millions of people. What is most encouraging is that everyone, from students to scientists to you, the reader, has the ability to innovate. Ask yourself: What don't I like about the world? What could work better? Why hasn't anyone thought of this? What can I do? Then go out and dream, build, and innovate.

The Editors

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By Scott Berkun

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How to Innovate, Right Now

Scott Berkun

The biggest secret of innovation is that anyone can do it. The reason is simple: It's just not that hard. Look up the word "innovate" in any dictionary and see what it actually means, instead of what you think it means. You'll find something like this: To innovate is "to introduce something new." That's it. It doesn't say you need to be a creative genius, a workaholic, or even have on clean underwear. It's just three little words: introduce something new. And I promise that by the end of this essay, you'll have all the secrets needed to do it yourself.

Scott Berkun

Courtesy of Scott Berkun

The key word in the definition is "new." The common trap about newness is the assumption that new means something the universe has never seen before. This turns out to be the third most ridiculous assumption in the history of mankind (you'll have to figure out the other two for yourself). Here's proof: Name any great innovator, and I guarantee they borrowed and reused ideas from the past to make whatever it is they are famous for.

The Wright brothers, the inventors of powered flight in the United States, spent hours watching birds. As boring as it seems, we have bird-watching to thank for the supersonic jet planes we have today. Picasso's development of cubism, one of the great artistic movements of the last two centuries, was heavily influenced by his exposure to African painting styles, as well as the work of an older French painter, Cezanne. And Thomas Edison did not create the concept of powered light: You'd have to talk to the thousands of people who died before Edison was born who turned wood, wax, oil, and other fuels into controllable and portable light sources (not to mention Joseph Swan, who patented the electric light before Edison).

Even in today's high-technology world you can find easy connections between what we call "new" and ideas from the past. The World Wide Web and the Internet get their names from things thousands of years old. The first webs were made by spiders, and the first nets were used to catch fish by indigenous people around the world, thousands of years before the first computer. Google, the wonderful search tool, is often called a search engine, in reference to concepts of physical mechanics, not digital bits.

All these examples prove that the trick to innovation is to widen your perspective on what qualifies as new. As long as your idea, or your use of an existing idea, is new to the person you are creating it for, or applies an existing concept in a new way, you qualify as an innovator from their point of view, and that's all that matters.

Even with these improved definitions, it takes more to make innovation happen. The tool kit of every innovator typically includes three things: questions, experiments, and self-reliance.

Ask Questions. The easiest place to start is with things you do every day. Simply ask: Who else does this, and how do they do it differently? If you only know one way to do something, you're making a big assumption. You're betting that of the infinite ways there are to do it, the single one you know is the best. I'm a gambling man myself, but I wouldn't make that bet, as those odds, one against infinity, are embarrassingly bad. Even simple things like washing dishes or tying shoelaces have dozens or hundreds of alternative approaches in use by different people around the world. Those methods are all potential innovations for you and everyone you know. The problem is that people have to go out of their way to find those alternatives and bring them back.

Not sure how to start? It's with more questions. Useful questions for innovators include:

- Why is it done this way?
- Who started it and why?
- What alternatives did they consider, and what idea did their new idea replace?
- What are my, or my friend's, biggest complaints with how we do this thing, and what changes might make it better?

- How is this done in other towns, countries, cultures, or eras of time?
- What different assumptions did they make or constraints did they have?
- How can I apply any of the above to what I do?

Many great innovators asked better questions than everyone else, and that's part of why they were successful. It wasn't genius, whatever that means, special top-secret brain exercises they did every morning, or even how much money they had. It was through the dedicated pursuit of answers to simple questions that they found ideas already in the world that might be of use.

Isaac Newton asked how could the force of gravity affect apples as well as the moon? And by framing the question that way, he made observations and developed mathematics related to gravity, something no one else had done to his level of satisfaction. Many of Leonardo da Vinci's inventions started with him asking the question: How does water flow? It was his many studies of rivers, streams, and the way water moved that led to his inventions for water-powered wheels, ways to move water in aqueducts and canals, and pumps for wells. Without asking questions and looking around, even at obvious everyday things like water and gravity, Newton's and da Vinci's creative talents would never have had a chance to surface.

Try Things Yourself. Asking questions is one thing, but trying to answer them is another. There is no substitute for firsthand experience when creating things. The unique aspects of who you are, including qualities you may not like about yourself, are an asset when it comes to creative thinking. No one can see the world exactly the way that you do.

This means that if you can experience, watch, or make something yourself, you may discover lessons and make observations that other people failed to notice. Those observations are the seeds of innovation: You might see an old idea or tool in a way no one else in your family, business, or city has before, and if you follow it, an innovation might be yours.

Remember that the knowledge we have today about the universe did not come from magic books that have been sitting around waiting for us since the dawn of time. It came from curious people who not only asked questions, but followed them to places others weren't willing to go.

Francis Crick and James Watson, the discoverers of DNA, followed hunches and made guesses to answer their questions, spending hours in labs doing things their professors thought were not only unscientific, but a giant waste of time. Even Socrates, the greatest philosopher of the Western world, was against the idea of writing things down in books. Had his pupil Plato not picked up on the innovation known as writing, and written down Socrates's story himself, we wouldn't know either of their names, much less the Socratic method for learning that many universities base their teachings on today.

Progress depends on people thinking independently and following their curiosity as far as they can, including doing things others around them refuse to try.

Attempt, Learn, and Attempt Again. The last step is not to expect success the first time. If you're doing something new for yourself or your friends, it's hard to predict what the outcome will be. And the bigger the innovation, the more risk — and work — there is: Making innovative cookies is one thing, but changing the way people think or work is another.

Since long hours of work might be required to satisfy your curiosity, what's important is how you respond to failure. Can you find the courage to respond not with embarrassment or regret, but with more questions: Why did this fail? What can I learn now? What will I do differently next time? If you can, like most great inventors and creators throughout history did, you'll be well on your way. ■

Scott Berkun is the author of the bestseller The Myths of Innovation *(O'Reilly Media, Inc., 2007). He writes about creative thinking and innovation at* http://www.scottberkun.com.

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Innovations for a Healthier You

Robin L. Yeager

Scientists and health researchers are making discoveries and advancing knowledge at an ever-increasing rate, with each advancement inspiring still more exploration. New knowledge about health, advances in data analysis, integrated technology, and new materials, plus an amazing synergy created by the ability to collaborate with a wide variety of colleagues around the globe, have all contributed to the flurry of discovery. Here are some inspiring examples of current research.

"Cool" New Treatment for Spinal Injury

In September of 2007, millions of television viewers were horrified to watch American football player Kevin Everett suffer a terrible injury. His neck was broken, with vertebrae crushed and the spinal cord intact but compromised by the injury, and further threatened by post-traumatic swelling. The prognosis would almost certainly have been permanent paralysis.

But a new, aggressive combination of immediate cooling of the body to prevent swelling, injection of steroids, and emergency surgery to decompress the nerve may have given Everett a much more promising future. Following a new protocol, his doctors used a saline solution to quickly reduce his body temperature by 8 degrees Fahrenheit (-13.33 degrees Celsius). Within a week, he'd gained some sensation and was making voluntary movements in his hands and legs. A month later, there were reports that he was standing briefly while using a walker, moving himself in a wheelchair, and able to open and close both hands. It's not yet clear what Everett's ultimate recovery will be, but he's already made amazing progress.

The treatment Everett received is still experimental and not yet widely available — there are still too few hospitals with the level of trauma care needed to treat these injuries, and the cooling therapy has not been 100 percent effective. But progress such as Everett's offers hope and encouragement for researchers and their patients.

© AP Images/David Duprey

© AP Images/David Duprey

The photo at left shows U.S. football player Kevin Everett being taken off the field by medical personnel after he suffered a serious spinal injury during a game. At right, only three months later, innovative spinal cord injury treatment enables Everett to walk into his team's locker room.

A patient wears a six-motor "bionic arm" — a neuro-controlled prosthetic arm — developed by researchers at the Rehabilitation Institute of Chicago and the Johns Hopkins Applied Physics Laboratory.

Just Like in the Movies

Candace Lombardi, writing for c/net News, recently reported a breakthrough in the design of artificial arms and other limbs. The Johns Hopkins University Applied Physics Laboratory in Maryland, working as part of a team that includes universities, private firms, and government agencies, is developing a mechanical arm that more closely duplicates the movement and sensory perception of a biological arm. In recent lab tests, a wearer was able to direct a mechanical arm to do intricate tasks, such as maneuver a small object with precision or handle fragile objects without breaking them. The arm was attached to the healthy nerves of the chest and was able to give the wearer a sense of contact and enough control to allow for the minute adjustments necessary to carry out the tasks.

Lombardi likened the new prosthetic to the one worn by Luke Skywalker in the film *The Empire Strikes Back*. But instead of helping future heroes save the galaxy, today's prosthetics, with funding from the U.S. Department of Defense, are being designed for injured war veterans.

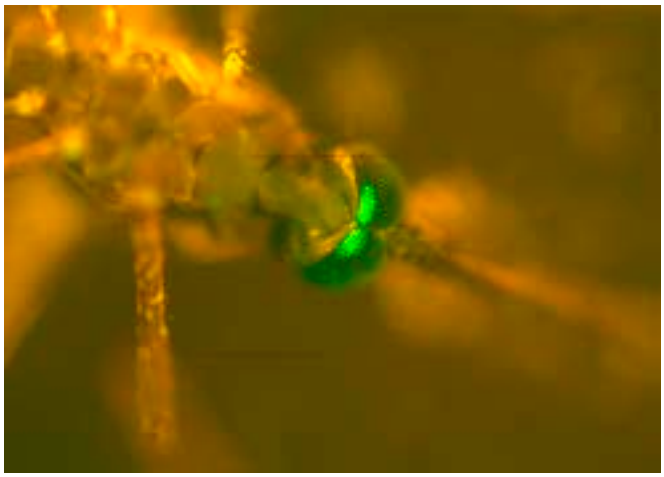
Taking the Sting Out of a Mosquito Bite

If mosquitoes could not get or transmit the plasmodium pathogen, people would not get malaria, saving millions of lives each year. But how to build a better mosquito?

In the past, genetic researchers treated mosquito eggs by changing the genes so the resulting insects were blocked from getting the infection. However, the mosquitoes failed to pass along the gene reliably enough to offer hope that this approach would result in a practical solution.

A group of researchers at Johns Hopkins University recently conducted a second test during which mosquitoes were fed infected blood instead of healthy blood, and therefore passed along the gene more reliably. Still, the rate at which the new trait spread in the mosquito population was not enough to make this approach seem really useful.

But *Smithsonian* magazine recently reported that the California Institute of Technology has identified a "driver" gene in fruit flies that seemed to make a trait dominant and help it spread more quickly in subsequent generations. Now the researchers are looking for a way to add a driver gene to the mosquito treatment. They hope perhaps within five years to have an improved and genetically influential mosquito ready to go.



Courtesy of Marcelo Jacobs-Lorena Laboratory

This green-eyed mosquito is one of many genetically modified mosquitoes that American researchers hope will hold the key to stopping the spread of malaria.

Changing Health Care Roles

Adult children increasingly are facing a new dilemma — how to care for aging parents who want to remain independent, but who may have physical and/or mental conditions that make continued independence a challenge. Medical advances have helped aging parents live longer and, in many cases, more active lives, but these advances have also added to the worries of adult children who need to somehow monitor their parents' safety and medical condition while respecting their dignity and desire to remain in their own home.

Courtesy of QuietCare

This home health system is one of many new technologies to help caretakers electronically monitor the health and safety of others, even while away.

Several companies and researchers at a number of universities, both in the United States and in other countries, are working on packaging new technologies to address this very issue. These technologies include motion detectors; cameras connected to the Internet; "smart phones" that can relay information to monitors, whether at a health care agency or directly to the caregivers; panic buttons; and monitors that record blood pressure and other vital signs into integrated systems that help detect problems or danger as soon as possible, send the appropriate help, and allow both seniors and their caregivers to relax from the worry of medical concerns such as debilitating falls. ■

Robin L. Yeager is a State Department foreign service officer currently assigned to the Bureau of International Information Programs. Her writing assignments have covered a broad range of topics, as have her overseas assignments, which have taken her from Transylvania to Timbuktu.

Young Innovator Profile: John Wherry

As a child, John Wherry enjoyed taking apart machines, including his father's treasured toy train. Now, as an immunologist, he's dismantling perhaps the most intricate machine of all — the human immune system — to develop a vaccine that provides lifelong immunity against influenza. There's no time to waste, given the threat of a global pandemic triggered by mutations in the deadly bird flu virus that have emerged in Asia, Africa, and Europe. Wherry and co-workers are racing to create a prototype for the vaccine by 2011.

Wherry, 36, knew by high school that he wanted to be a biologist. During college, he became fascinated with immunology, and went on to study memory T cells as a graduate student. During a postdoctoral fellowship, he helped discover why some memory T cells, after being activated by an infection or vaccination, grow weaker: they sprout a receptor that blocks a signal telling them to fight.

The drawback of current flu vaccines is evident every fall and winter when people have to line up for a flu shot. Current vaccines typically use killed or inactivated flu viruses to stimulate the immune system to generate antibodies against proteins on the surface of those viruses; the antibodies recognize the virus as an invader and clear it from the bloodstream. But because two or three different influenza virus strains are usually circulating around the world at any time, and because their external proteins evolve rapidly, public health specialists have to formulate new flu vaccines every year.

Wherry, based at the Wistar Institute in Philadelphia, Pennsylvania, hopes to overcome those problems with a vaccine made in part from a live virus — a disabled common cold virus with pieces of cloned flu virus inserted into it. In theory, it will stimulate a deep, long-lasting defense called cellular immunity, which involves something called a memory T cell, a kind of white blood cell partially formed in the thymus gland in response to a foreign virus or bacterium. Unlike current vaccines, a T cell reacts to the stable proteins inside an influenza virus, as well as to its ever-changing surface proteins. And once a T cell has formed, it perpetuates itself for generations. Unlike antibodies, T cells are capable of destroying cells that have been invaded and colonized by viruses.

"If we can train the T cells to effectively recognize the internal proteins for influenza virus and be maintained long term," Wherry says, "it might be possible to create a vaccine that protects against all strains of flu. We're enthusiastic," he says. "We're starting to see promising hints in mice. But translating these things to humans takes a tremendous amount of time and effort."

"Eighty percent of these approaches fall flat," says Wistar's immunology chief, Hildegund Ertl. "Some people get discouraged by failure. What has impressed me about John is not only that he is a good scientist, he also clearly has the temperament to deal with setbacks." ■

Courtesy of James Hayden/The Wistar Institute

This article is excerpted from "Flu Fighter" by Arthur Allen, which originally appeared in SMITHSONIAN, *October 2007. Arthur Allen, of Washington, D.C., is the author of* Vaccine: The Controversial Story of Medicine's Greatest Lifesaver.

NANOTECHNOLOGY

It Really Is A Small, Small World

Domenick DiPasquale

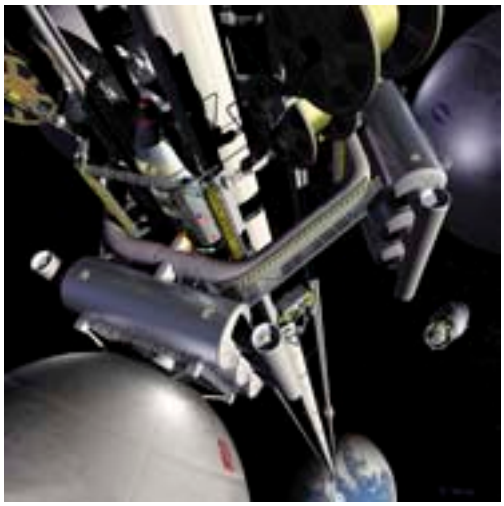
The amazing potential of nanotechnology, the scientific process of creating materials and products that are molecular or even atomic in size, promises to revolutionize life in the future. Working at this infinitesimally small scale — where the basic unit of measurement, the nanometer, is one-billionth of a meter in size — requires innovative techniques to create, manipulate, and manufacture substances visible only through instruments such as the electron microscope. The thickness of a human hair or a sheet of paper according to the nanoscale, for example, is 100,000 nanometers. Nanotechnology already has practical applications in everything from clothing to sports equipment, and U.S. scientists and researchers are working to harness the technology for additional breakthroughs.

Space Flight

Since the dawn of the Space Age a half-century ago, the weight of rocket fuel needed to lift a payload into or beyond Earth orbit has been a major limitation on space flight. Research in two revolutionary techniques employing nanotechnology offers the promise of overcoming this barrier, although their practical application is still far in the future.

At first glance, a "space elevator" — a device that literally could lift a payload some 35,000 kilometers into space via a tether extending from the Earth's surface to a satellite in geostationary orbit — sounds more like the stuff of science fiction than science. The technical hurdles in constructing such a space elevator would be immense, not least of all the need to manufacture a super-strong cable of such great length and strength.

Nanotechnology may hold the key for turning this concept into reality. Researchers are investigating the possibility of using carbon nanotubes — structures only a few nanometers in diameter but several thousand nanometers in length — to build this cable. Because the carbon atoms that form the nanotube exert extremely strong bonds on each other, a nanotube is 100 times stronger than steel. Naturally, immense engineering and scientific challenges remain in constructing any such cable out of nanotubes, but progress continues. A research team at Rice University in Houston, Texas, for example, has found that combining carbon nanotubes with sulfuric acid aligns the nanotubes in the same direction, thus giving additional strength. While a functioning space elevator based on nanotechnology is decades in the future, it holds the promise of dramatically reducing today's extremely high cost of putting a payload into orbit — estimated by the National Aeronautics and Space Administration to be $22,000 per kilo — to perhaps just a few dollars per kilo.



NASA Artwork by Pat Rawlings/SAIC

Nanotechnology could provide the very high-strength, low-weight fibers needed to build the cable of a space elevator, a concept seen here in an artist's drawing.

The payload-to-fuel ratio likewise comes into play during interplanetary flights, given the immense distances a spacecraft traveling within the solar system must cover. Brian Gilchrist, an electrical engineer at the University of Michigan, has suggested using nanotechnology to create a spacecraft powered by an array of nanoscale engines, each firing a steady stream of electrically charged nanoparticles through microscopic thrusters to propel the spacecraft

forward. Millions of these engines would be clustered together on a silicon wafer just a few square centimeters in size; several such wafers would be combined to create the spacecraft's propulsion system. Although this system would not have enough thrust to power the spacecraft's liftoff from Earth, once in the vacuum of space the nanoscale engines could gradually and efficiently accelerate the spacecraft across the solar system to its final destination.

Medicine

Biomedical applications of nanotechnology currently under development may herald a radical new approach to diagnosing and fighting disease. The key lies in the incredibly small size of nanoparticles — small enough to infiltrate bacteria or even viruses and attack these organisms from within.

At the Lawrence Livermore National Laboratory near San Francisco, scientists are studying how to construct nanoscale-sized molecules called "shals" (synthetic high-affinity ligands) that are custom designed to adhere to a specific site on the surface of a human cell. Although shals were first envisioned as a bioterrorism defense tool that would detect and neutralize such pathogens as anthrax, biochemists at Lawrence Livermore and the University of California-Davis Cancer Center soon conceived a much broader medical use for them. By constructing shals specifically designed to adhere to the unique receptor sites on the surface of a cancer cell's proteins, scientists hope to employ a new weapon in the fight against cancer. When combined with a radioactive isotope or anticancer drug, shals would not only seek out but also destroy the target cancer cells by releasing these disease fighters directly into the tumor. Experimental work is already under way to investigate shals as a treatment for prostate cancer and non-Hodgkins lymphoma.

While such a nanotechnology-based approach against cancer is still in the development stage, some medical applications of nanotechnology are already here. A U.S. drug firm, Nucryst Pharmaceuticals, is producing medical coatings infused with nano-sized crystals of silver, an element that possesses antimicrobial properties. Medical dressings coated with these silver nanocrystals, which range in size from 1 to 100 nanometers, deliver a fast-acting and sustained release of silver ions into wounds to speed healing. The technology is already in use in burn centers throughout the United States. Nucryst believes that this nanocrystal-based technology also will be useful in treating other types of infection and inflammation.

Environmental Science

The utility of nanotechnology often lies in the fact that, at the nanoscale level, material can exhibit markedly different physical and/or chemical properties compared to the characteristics the same material possesses in larger size. Nanotechnology's atom-sized dimension in and of itself also offers unique possibilities. Scientists are studying whether these nanoscale advantages can be employed to create a healthier environment.

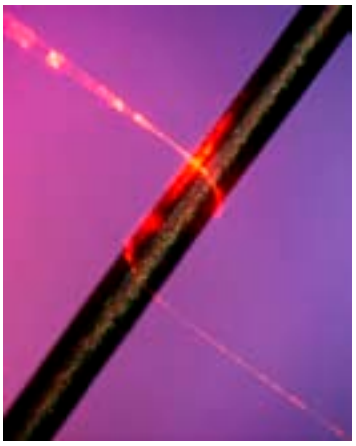
Drinking water in many parts of the world is contaminated with toxic substances, including metals such as arsenic. Removing these contaminants requires not only sophisticated equipment but also a steady source of energy to power this equipment — both of which may be in short supply in much of the developing world. Researchers at Rice University are investigating a low-tech approach to this problem using nanocrystals of magnetite, a compound of iron and oxygen that can absorb arsenic. When these magnetite nanocrystals are added to a solution of arsenic-contaminated water, they combine with the arsenic. A simple magnet then pulls the arsenic-coated nanocrystals to the bottom of the solution, where they subsequently can be removed. The particular benefit of this technique is that it works with common, everyday magnets, whereas using larger particles of magnetite would require much more powerful magnets. This research offers a simple new approach to providing clean drinking water to populations living in remote areas.

Nanotechnology's very size by itself opens up possibilities. At Lehigh University in Pennsylvania, environmental scientist Wei-xian Zhang has been studying the use of nanoscale iron particles to clean up soil and groundwater polluted by heavy metals, pesticides, and organic solvents. When these iron nanoparticles are injected via a slurry mix directly into a contaminated site, their size allows them to slip in between soil particles. As the iron nanoparticles oxidize, they break down chemical contaminants such as dioxins or PCBs into less toxic carbon compounds. Heavy metals such as lead and mercury are likewise rendered less harmful as the oxidation process reduces them to an insoluble form less likely to leach into groundwater. Tests have shown that contamination levels begin to drop dramatically around the injection site within 48 hours, and that the toxic pollution is all but eliminated within several weeks.

Energy

The convergence of several factors — the pressure that continuous growth in the world's population and economy is exerting on traditional fossil fuels supplies, concern over global warming, and the sharp increase in the price of oil — is making the development of alternate energy sources ever more critical. Current U.S. research in nanotechnology offers intriguing leads that may revolutionize the extraction of energy from clean, renewable sources, in particular solar.

Scientists at Harvard University, for example, have developed solar cells from "nanowires" that are just 300 nanometers in diameter. As described by the periodical *MIT Technology Review*, such a solar cell has a core of crystalline silicon and several concentric layers of silicon with different electronic properties. Each layer performs the same function that the semiconductor layers in traditional solar cells do of absorbing light and capturing electrons to generate electricity. While these microscopic solar cells may first be used to power other nanodevices, eventually it may be possible to bundle them together in large numbers to replace conventional solar panels in use today. Obstacles to commercializing this technology remain, however; researchers will need to develop ways to produce these solar nanowires in a denser array than at present and to improve their present low level of efficiency (less than one-fifth that of conventional solar panels) at converting sunlight into electricity.



© Limin Tong and Eric Mazer/Harvard University

A light-conducting silica nanowire wraps a beam around a strand of hair.

Some 35 kilometers away from Harvard in the old textile town of Lowell, Massachusetts, a private high-tech company named Konarka is taking a different approach to using nanotechnology for solar power. The company has invented a process to apply nanoscale-sized particles of the semiconducting chemical titanium dioxide to a plastic film that is then coated with a light-sensitive dye. When sunlight or even artificial indoor light strikes the dye, the titanium dioxide particles produce electricity. Although this technology is still in the developmental stage, Konarka envisions a multitude of practical applications for this flexible plastic solar cell strip where traditional, rigid photovoltaic panels are impractical. These power-generating strips could, for example, be wrapped around devices such as cell phones or laptop computers to recharge them, placed on structures of any kind (even tents) as stand-alone power generators, or even woven directly into clothing to provide the ultimate power on the go for personal consumer electronics. ■

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Young Innovator Profile: Michael Wong

Describing his idea to use gold to clean up toxic waste, Michael Wong says, "I admit it does sound crazy." Wong plans to combine gold with palladium — an even more precious metal — to treat polluted groundwater beneath waste dumps and contaminated factories and military sites. "It not only works faster [than current methods], but a hundred times faster," Wong says, "and I bet it will be cheaper too."

A golden detergent? Here is Wong's trick: He creates nanoparticles of gold. In his realm, the work product is measured not in carats but in atoms. A thimbleful of coffee-colored solution contains 100 trillion gold spheres — each only 15 atoms wide, or about the width of a virus. Upon every golden nanosphere, Wong and his team dust a dash of palladium atoms. Think of an infinitely small ice cream scoop flecked with sprinkles.

The 35-year-old graduate of the California Institute of Technology and the Massachusetts Institute of Technology saysWong had not given toxic waste much thought until three years ago, when one of his colleagues at Rice University (where he is a recently tenured professor of chemical engineering) came to him and said, "I have a problem," meaning something interesting to work on.

The problem concerned the suspected carcinogen trichloroethene, or TCE, "one of the most ubiquitous pollutants out there," says Wong, and "a really nasty molecule." The clear, sweet-smelling solvent has been used for decades to degrease metal parts in factories and government facilities.

TCE lingers like a bad houseguest, especially if handled carelessly. It accumulates in soil and can persist for years in groundwater. In a report last year, the National Research Council found that TCE was a potential cause of kidney cancer; it's also associated with liver problems, autoimmune disease, and impaired neurological function.

Currently, the most common method of removing TCE from groundwater is to "pump and treat," Wong says — to pump the water out of the ground and run it through a filter made of activated carbon. The carbon grains soak up TCE like a sponge, but the process leaves behind TCE-laden filters that have to be stored or burned. "So you haven't really gotten rid of anything," Wong says. "You've just moved it from one place to another."

This is where Wong comes in. He began thinking about using nanoparticles as a catalyst to react with the TCE and break it down into what he calls "happy by-products."

From the scientific literature, Wong knew that palladium had shown some promise at deconstructing TCE. So he and his team began trying various recipes, and after six months reached a eureka moment when they sculpted a palladium-covered core of gold atoms.

Wong's nanodetergent breaks down TCE into relatively harmless ethane and chloride salts. He and his team are now working with engineers to build a real-sized reactor to field-test the nanoparticles at a polluted site. They hope to be scrubbing TCE in about a year, and then they'll see whether they have the cost-efficient cleaner they seek.

Wong was born in Quebec City, Quebec, and grew up in Sacramento, California. His father owned a strip mall where a tenant's dry-cleaning business became contaminated with a chemical cousin of TCE. Wong said his father was held legally responsible and fined tens of thousands of dollars. "So my dad has a real interest in my work," said Wong. "He keeps telling me, 'Hurry up, son!'"■

This article is excerpted from "Midas Touch" by William Booth, which originally appeared in SMITHSONIAN, *October 2007. Booth is a reporter for the* Washington Post *who is based in Los Angeles.*

Social Networking 2.0

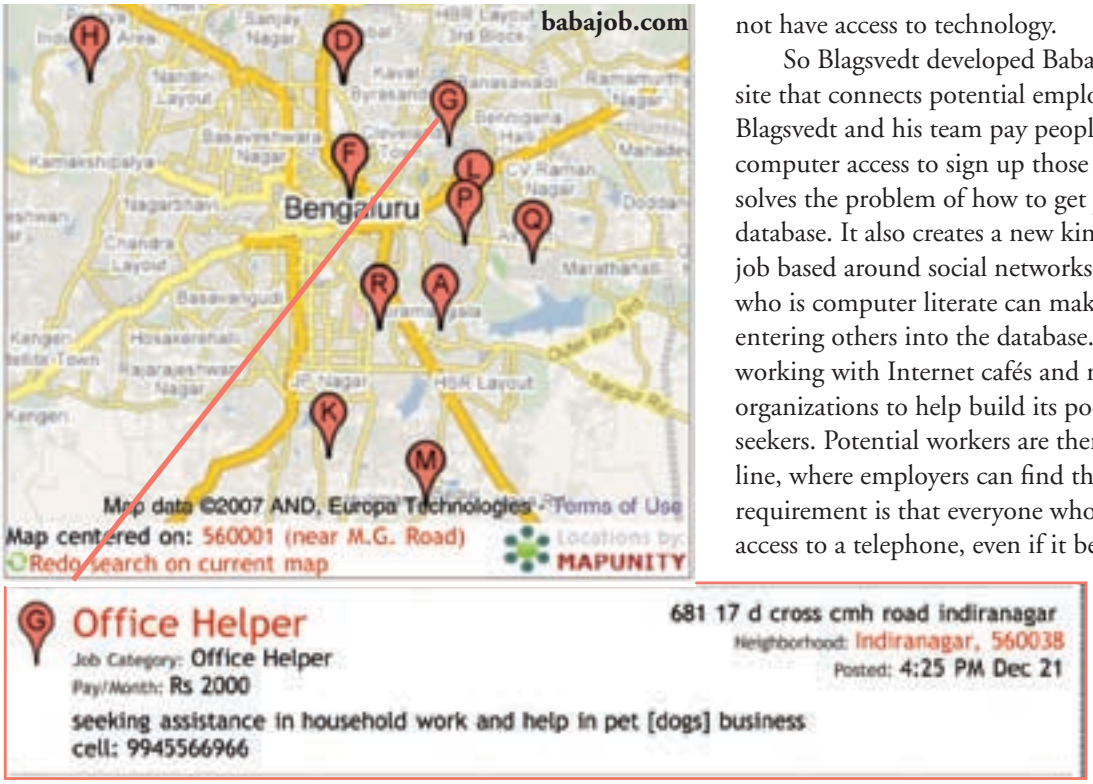
Jessica Hilberman

The term "social networking" brings to mind Web sites such as Bebo and MySpace, but the practice of making personal connections via the Internet is driving a wave of technological innovation through American companies and organizations. The new social networks don't rely on advertising revenue and rediscovering childhood friends. They are being designed with specific purposes in mind, from fighting poverty to bringing political campaign supporters together. By thinking broadly about the applications of social networks, entrepreneurs, philanthropists, and even political candidates are building connections in new and fascinating ways. Through the sites they are building, they are changing the nature of human interaction on the Internet.

Fighting Poverty

As a Microsoft employee running a lab in Bangalore, American Sean Blagsvedt became acutely aware of how lucky he was to have been born in a wealthy country. He decided to use his technological expertise to help India's poor.

While reading about the causes of poverty, Blagsvedt found a study that showed that people got out of poverty by finding jobs. More than 70 percent of the time, they found these jobs through social connections. With this information, Blagsvedt developed the idea of connecting employees and employers through a computerized system, but he had to overcome the fact that most of the poor in India did not have access to technology.



So Blagsvedt developed Babajob, an Indian Web site that connects potential employees to employers. Blagsvedt and his team pay people who have computer access to sign up those who do not, which solves the problem of how to get job seekers into his database. It also creates a new kind of intermediary job based around social networks, where someone who is computer literate can make a living entering others into the database. Babajob is also working with Internet cafés and nongovernmental organizations to help build its pool of employment-seekers. Potential workers are then profiled on line, where employers can find them. The one requirement is that everyone who signs up must have access to a telephone, even if it belongs to a remote family member.

What makes Babajob unique among networking companies,

Blagsvedt says, is that it uses "financial and social incentives to encourage a behavior that is good, namely getting poor people hired." Though Babajob has been around for only a few months, the idea has gone global. Blagsvedt has received e-mails from people who want to use his technology to implement the idea in the United States, Mexico, Peru, and the United Kingdom as a way to get workers from Eastern Europe integrated into the economy.

The Recycling Connection

When companies move, close, or downsize, they often have a lot of extra stuff. For Ken Kurtzig, that leftover stuff has become a booming green business based around the Web site iReuse.com. The iReuse site connects people with extra materials with those who need them, linking large companies including Adobe and Birkenstock with small, nonprofit organizations seeking donations of desks, fax machines, and the occasional fish pond.

There are three components to iReuse's operation: the supply side, the demand side, and the technology that links them together. Essentially, both sides make lists. Suppliers list what they have to give away — everything from koi fish, cubicles, and office plants — and those seeking items create lists of what they need. The technology behind the Web site links them together. Kurtzig has developed a lot of propriety technology for the site, but he plans to release it for use by other nonprofit organizations.

The benefits are manifold. There's a social benefit because organizations that cannot afford new materials are connected to those that have things they need to give away. Kurtzig says that when an administrator at a school creates a wish list of items the school needs, iReuse's technology can match those needs with companies that have surplus items. "Prior to iReuse," Kurtzig says, nonprofits "would get things dumped on them, and 50 percent of it they didn't want. With our wish lists, people only get or take what they want."

There's also a huge environmental benefit because the excess does not go into landfills. Rather than creating waste, materials are recycled.

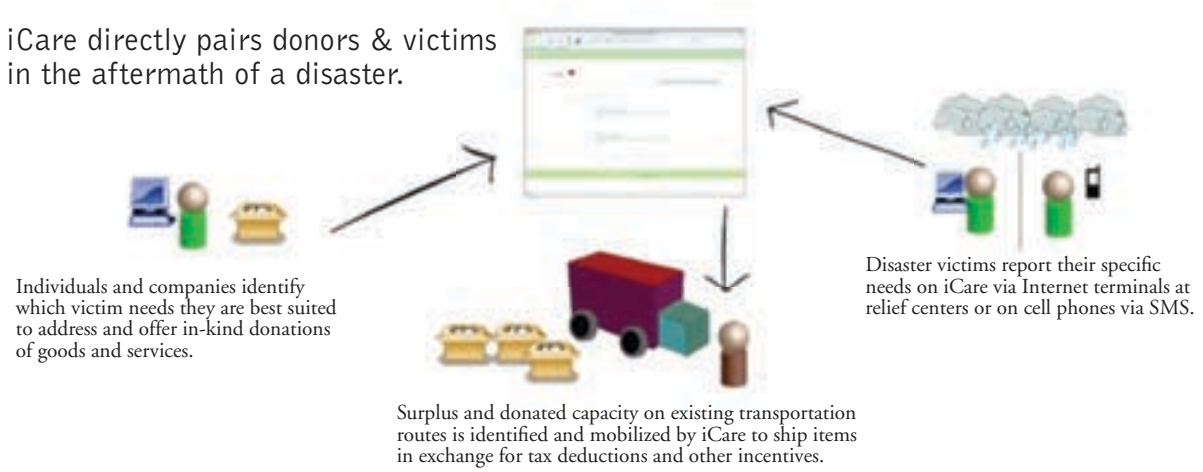
Finally, for the large donor companies involved, there's a financial benefit because they don't have to pay for waste disposal. Corporate iReuse clients, says Kurtzig, are looking to save money, time, and the environment. By connecting them directly to the organizations that can reuse their waste, iReuse supports both for-profit and nonprofit companies.

Targeting Disaster Recovery

Inspired by the difficult response to the Hurricane Katrina disaster in America's Gulf Coast in 2005, Anand Kulkarni and Ephrat Bitton, two PhD students at the University of California-Berkeley, came up with the idea of creating a person-to-person marketplace for charitable giving. The two were working on ideas for using information technology systems to resolve social problems, and they felt that one of the saddest aspects of Katrina was that so many members of the public seemed willing to help, but there was little they could do. The result is iCare, which allows survivors of disasters to report their needs so that members of the public can donate the goods and services most required by those affected.

The iCare site *[http://icare.ieor.berkeley.edu/]* is a Web application that synthesizes information from several existing databases on the Internet, including transportation providers, survivor needs databases, stockpiles of relief supplies, and commercial providers. The partially automated, decentralized response is designed to eliminate inefficiencies in disaster aid by routing aid along several different channels at once, which limits potential disruptions such as road outages and theft. Giving goods rather than money also eliminates the costs associated with running large organizations, so more of a donation reaches its intended recipient.

P2P Giving for Disaster Relief



"There was a truly massive willingness on the part of the public to personally contribute to relief efforts in any way they could, but few mechanisms for doing so," says Kulkarni about Katrina. Watching the people who drove to New Orleans to volunteer and contribute and the multitude of people who began to coordinate through Web sites for shelter and employment, Kulkarni and Bitton saw that people wanted to help in ways that went beyond writing a check. This situation led the pair to create iCare — a network designed for people to help each other and to eliminate fraud and corruption in the process.

Campaigning: Information Go-To

Web sites are the go-to location for information on the 2008 U.S. presidential candidates, just as they were in 2004. But today, most candidates are also connecting to the public via well-known social networking sites: Hillary Clinton, Mike Huckabee, John Edwards, and Rudy Giuliani are all using the professional networking site LinkedIn.com to make their policies and views known.

Only one leading candidate, Barack Obama, has developed a social networking component for his or her own Web site. At *http://my.barackobama.com*, users can enter profile information, write blog entries, see personalized event information, network with friends, and earn points to measure the impact they are having on the campaign. According to campaign literature, more than 280,000 people have created accounts on barackobama.com, and these users have created more than 6,500 volunteer groups and have organized more than 13,000 events by using the Web site.

It is also possible for users to present policy ideas through text or video uploads. While other candidates, including Fred Thompson and Hillary Clinton, have blogs and event-finders on their Web pages, the Obama site's "dashboard" system echoes successful social networking sites such as MySpace, allowing supporters to send each other messages through the site's network. As part of Obama's technology policy, he advocates deploying a high-tech, modern communications infrastructure. He started with his own campaign Web site. ■

Jessica Hilberman is a writer and editor who has published widely on the subjects of technology, health, popular culture, and urban issues. She lives in Northern California.

The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. government.

What we do
How Kiva works
Team
Supporters
Field Partners
How to become a Field Partner
Press Center
Kiva Blog
Kiva Fellows
Get Involved
About Microfinance
Help Center

Young Innovator Interview: Matt Flannery

Courtesy of Kiva

Matt Flannery, 30, co-founded the nonprofit Kiva.org, a micro-lending Web site, in 2004. Kiva operates on a people-to-people model, allowing private individuals to make loans to borrowers seeking to establish small businesses in developing countries.

Question: How does Kiva work?

Flannery: Kiva connects individual lenders from the developed world to individual borrowers in the developing world. We work with local microfinance institutions that post the loan applications they get on the Internet. Kiva raises debt capital via the Internet from thousands of lenders in the United States and Europe. The partner institutions sort and administer loans, but our lenders actually fund them.

Q: How did you get this idea?

Flannery: My wife [Jessica, co-founder of Kiva] was consulting in microfinance in East Africa, and I went along on a trip with her. We had the idea together. I thought it would be interesting to give people the chance to participate as partners, not just donors, with [small] businesses in Africa. I've always been interested in ideas about poverty. I've been sponsoring children through my church my whole life. It was part of my upbringing. What we're doing now is an extension of that personal history.

Q. Why loans rather than donations?

Flannery: Lending to somebody sends the message that you're treating them as an equal, someone who can participate with you in a business relationship. It's a really dignified way to interact with people.

Q. So far, Kiva has an excellent repayment record. How do you manage that?

Flannery: Repayment rates in the microfinance industry are much higher than for U.S. domestic loan lending. That's because microfinance institutions are lending to people for whom getting a loan is their only shot at anything. If you're given a $60 loan, your chance of getting another loan is contingent on you paying that back.

Q. You're also a lender on Kiva. Who are some of the people you've lent to personally?

Flannery: I usually lend to Eastern Europeans — a food market in Azerbaijan, a clothing store in Ukraine. Most of my portfolio is people from Azerbaijan, Moldova, Tajikistan, Bulgaria, places like that, because they are the least popular borrowers on the site and they often get overlooked by our lenders. ■

This excerpted interview originally appeared in SMITHSONIAN, *October 2007. The interviewer, Amy Crawford, is a student at Columbia University's Graduate School of Journalism and a former editorial assistant at* Smithsonian *magazine.*

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Playing Into the Future

Mike Vogel

Participating in sports and physical activity has been an important part of the American lifestyle for more than a century. During that period, sports equipment and the games themselves have evolved and improved immeasurably. But Americans aren't resting on their laurels. They continue to find ways to make equipment and games better, safer, more environmentally friendly, and more engaging to their devotees.

X Marks the Spot

The X Games — X for extreme sports — continue to push the boundaries of traditional sporting competitions each year by introducing new and exciting events while working to minimize the impact of the games on the environment. In January 2008, the Winter X Games 12 brings fans into the action, as scoring in certain events will come from live fan text voting.

Competators race to the finish line of the ultracross finals during the Winter X Games in Aspen, Colorado.

© AP Images

X Games is the largest skateboarding competition in the world, but the games have grown tremendously to include BMX (short for bicycle Motocross, a sport that includes special bicycles that have larger or smaller wheels than traditional bicycles on which riders do tricks), water sports, snowboarding, rally car racing, bungee jumping, sky surfing, ice climbing, and many other "extreme" sports competitions and disciplines. Attendance has increased every year, and the X Games are now covered around the clock via television networks ESPN, ABC, and ESPN's online and wireless entities.

The Winter X Games 12 in Colorado will introduce Snowmobile Speed and Style, which combines the air of freestyle and the speed of SnoCross into one discipline. Competitors will go head to head around the course hitting multiple jumps and obstacles. Final scores will be based on difficulty of tricks pulled and amount of time racers take to ride around the full track.

Big Air contests — in which athletes compete to fly the highest in their discipline — have also been added to the existing skiing and snowboard competitions. Featuring only four competitors in each contest, the scoring of every run will be fan interactive: Fifty percent of each competitor's score will come from live fan text voting, and 50 percent from the analysts calling the competitions live on TV.

Originally known as the Extreme Games, the X Games quickly expanded into a global

event and marketing phenomenon larger than any of its creators likely imagined.

The Extreme Games were born in 1993 when executives at the ESPN television network decided to convene international athletes for a variety of summer action sports every other year. The inaugural Extreme Games were held in New England in 1995, featuring 27 events in nine sports categories.

The response from spectators, sponsors, and athletes was so favorable that ESPN opted to make the games an annual event. The event was renamed the X Games in 1996 and became a biannual occurrence to include winter sports in 1997. The first Winter X Games were telecast to nearly 200 countries and territories in 21 different languages, and they were also telecast on ESPN's parent network, ABC.

The X Games went green in 2004, introducing X Games Environmentality (XGE), a comprehensive program that drives environmental stewardship through all facets of event planning. XGE seeks to minimize the impact of the games on the environment through waste minimization, use of renewable resources, purchase of environmentally conscious products, and pollution prevention.

Less than two decades after their inception, the X Games are a worldwide hit among athletes, sponsors, and spectators, as well as a major branch of the ESPN brand.

© AP Images/Chris Polk

A competitor in the Summer X Games in Long Beach, California, takes to the air during the finals of the women's wakeboarding competition.

© AP Images/Nathan Bilow

Snowmobilers compete in a SnoCross competition at the Winter X Games near Aspen, Colorado.

© AP Images/Reed Saxon

Winter Olympic medalist Shaun "The Flying Tomato" White practices for the Summer X Games Skateboard Men's Vert competition in Los Angeles, California. In 2007, White won an X Games gold metal in that sport.

Aesthetic Sports

Ingenuity in sports extends beyond technology and equipment to the games themselves. A handful of new hybrid, or "aesthetic," sports are beginning to make inroads into the sporting landscape.

Rutgers University graduate student Tom Russotti developed "Wiffle Hurling" as a softer variation on hurling, Ireland's fast-paced and violent national sport. Using soccer goals, hollow plastic bats, and white plastic balls with holes in them — the equipment used to play Wiffleball — Russotti invented Wiffle Hurling when he was told that the original game was too violent for the uninitiated. Russotti heats the bats over a flame to flatten them, approximating the shape of the original hurling equipment. His adjustment to hurling's original equipment enables Whiffle Hurling to retain the intensity of hurling while making the game safer for new players.

Texan Eric Heiberg invented Mojo Kickball as an outlet for exercise. The game only vaguely resembles kickball, a combination of baseball and soccer played in many U.S. school gym classes, and also contains elements of dodgeball, another staple of gym classes. Mojo Kickball employs six balls, pitchers throw balls at their own team, and players score on third base.

Street bicycle polo has made a footprint in several American cities recently, and it differs from the other aesthetics in that a greater degree of physical dexterity is required. In this sport, players must be able to maintain their balance on their bikes while opponents come at them wielding polo mallets and vying for a field hockey ball.

One of the key advantages of aesthetic sports is that participants with varying degrees of athletic ability can play and play together. Heiberg was not a fan of ultracompetitive sports, and both he and Russotti wanted sporting avenues that provided more in the way of casual fun than competitiveness. All these endeavors provide people with an outlet for physical activity beyond the well-established sports to which we've grown accustomed.

Head Tech

Within the last 20 years, the term "concussion" has crept its way into the sports vernacular at all levels. Retired players in contact sports such as football and hockey speak of playing through "headaches" during their playing days, not realizing the severity of what might have actually been undiagnosed concussions.

Advancements in protective gear could help alleviate such concerns for the athletes of today. Riddell Sports Group, an Illinois-based manufacturer of sports equipment, has designed a line of football helmets rigged with sensors that can measure the severity of impacts and help detect possible concussions.

Equipped with Head Impact Telemetry System (HITS) technology, each helmet has six accelerometers in its lining. Developed by Simbex, LLC, a New Hamphsire-based company, these sensors measure the location, magnitude, duration, and direction of the impact. The data are transmitted continuously and wirelessly to a waterproof sideline computer monitored by team medical staff. Staff can monitor the data on an ongoing basis, but a pager alert is sent whenever one of the helmets registers a collision whose severity exceeds a certain predetermined limit.

Courtesy of Riddell Sports

Riddell Sports developed the first individual "American football" sports helmet that monitors and records every significant head impact sustained by a player during a game or practice.

At that point, the profile of the affected player can be called up on the computer screen, and team staff can see instantly the impact history of that player from previous practices and games.

Prior to the start of the season, each player is given a 25-minute computer-based test that determines his baseline brain behavior. If the sensory system alerts the medical staff to a possible head injury, the staff will give the test again and compare the results to the player's baseline.

Repeat concussions are one of the heretofore hidden dangers of contact sports at all levels. Each successive concussion takes more of a toll on players, and the HITS technology will help ensure that players have proper recovery time after sustaining impacts that may produce concussions.

Gear Goes Green

Nearly 40 years after Earth Day was first celebrated in 1970, consumers have more environmentally sound choices available to them in almost every area of the marketplace. One of the more recent additions to the greening of consumer products is the sporting goods and fitness segment.

Because many surfboards have been coated with polyester resins that are harmful to the environment and the workers who handle them, some manufacturers have recently developed epoxy resins and natural composites. Not only are they more environmentally friendly, they resist bumps and scrapes better than the polyester-coated versions.

Courtesy of Craig Calfee/Photo by Paul Schraub

This bamboo bicycle is one example of the eco-friendly sports equipment that many customers are embracing.

Footballs, soccer balls, and other high-end sports balls are traditionally made with a rubber inner air bladder and covered with polyurethane or synthetic leather. But continued and repeated harvesting of rubber can diminish forests. Seattle-based Fair Trade Sports manufactures balls that have inner bladders and outer coatings that meet Forest Steward Council (FSC) standards. The FSC certification ensures that the rubber comes from a responsibly managed forest, as mandated by international rules.

Millions of kids are skateboarders, and most serious boarders break at least one board a year. Instead of using wood, skateboard makers such as Comet, Habitat, Loaded Boards, and Sector 9 have started producing green boards made from bamboo or hemp fiberglass. Many boarders find the new eco-friendly models to be better performing, stronger, and more flexible.

Calfee Design is also using hemp and bamboo to make eco-friendly bicycles. The company has made high-end racing bikes from carbon fiber for the last two decades, but began to make the bamboo bikes about a decade ago. The bamboo models weigh slightly more than the carbon-fiber vehicles, but they can be better at absorbing road impact and vibrations. Colorado-based Venture Snowboards uses sustainable harvested wood, bamboo, organic cotton, and hemp to make its boards.

As long as performance and durability aren't sacrificed, consumers seem willing to embrace equipment that is derived from ecologically friendly materials. ■

Mike Vogel is a writer and editor who has previously published on the subjects of hockey, baseball, food, and music. He lives in Maryland.

The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. government.

Young Innovator Profile: Luis von Ahn

Courtesy of Luis von Ahn

Luis von Ahn has a lofty vision and a short attention span. The 29-year-old computer scientist at Carnegie Mellon University in Pittsburgh, Pennsylvania, prefers short stories to novels, TV shows to short stories, and the Internet to all of the above. If others share his liabilities, so much the better: He plans to harness his generation's fabled impatience to change the world.

"The grandest projects of humanity took on the order of 100,000 people," he says. "The Panama Canal, the pyramids of Egypt. Now, for the first time in history, we can easily get more people than that working together. Imagine what we could do with 500 million people."

The trick is getting them all to cooperate. Like Tom Sawyer, von Ahn has found a simple and mischievous solution: Turn the task into a game. Computer solitaire eats up billions of person-hours a year, he points out, and does nobody any good. But he says his "games with a purpose" will accomplish all sorts of useful tasks. Players will translate documents from one language to another or make it easier for blind people to navigate the Web — all while having fun. And unless they pay attention to the fine print, they may not even know they're doing good.

What excites researchers about von Ahn's "human computation" work, as he calls it, is less the prospect of getting people to accomplish boring, repetitive chores than the promise of training computers to do the chores themselves. Many tasks that are easy for people are surprisingly difficult for computers, especially those that children learn easily, such as classifying objects, recognizing faces, learning verbal languages, and reading handwriting.

Michael Kearns, a computer scientist at the University of Pennsylvania, says: "There are lots of people studying the hard problem of teaching computers to learn, and lots of other people seeing the entertainment value of the Web. But it's rare to find somebody like von Ahn, who has thought deeply about how to combine the two."

His "big goal," von Ahn says, is to make computers able to do anything that people can do. "I think it'll happen, definitely. If not in 50 years, then 100."

In the meantime, von Ahn is teaming up with the Internet Archive, a digital library, to get computer users to help digitize old library books by, for example, typing out difficult-to-read words from scanned books when they apply for e-mail accounts. He's also working for the U.S. Department of Homeland Security on a game to help airport baggage screeners with their jobs by drawing their attention to important details in X-ray scans. And with graduate student Severin Hacker and programmer Michael Crawford, von Ahn is developing a game to rank pictures in a sort of aesthetic order: He plans to use the data to teach computers about beauty. So far, puppies and babies are near the top. Aesthetes might object. But von Ahn is unlikely to be deterred.

"Luis is fearless," says Carnegie Mellon computer scientist Manuel Blum, von Ahn's former adviser. "He's willing to strike out in directions that few would dare to go." ■

This article is excerpted from "The Player" by Polly Shulman, which originally appeared in SMITHSONIAN, *October 2007. Polly Shulman is a writer and editor for* Science *magazine and the author of the novel* Enthusiasm, *an Austenesque romantic comedy about two teenage girls in New York.*

Architects Look to Nature and Each Other

Bruce Odessey

The basic look and shape of American houses and business places haven't changed much for a long time. Now, however, energy and environmental challenges are encouraging new building materials, new ways to design buildings, and new respect for nature.

Multitasking Materials

Construction materials can do more than just hold a building up and look pretty. Like their human employers, construction materials are multitasking.

Still years away from marketing, SmartWrap is designed as a building material that can provide not only shelter, but also climate control, lighting, and power. The very thin material is made from the same plastic used to make soda bottles and is processed into rolls, according to the architectural firm that created it, KieranTimberlake Associates LLP.

The polyester film substrate layer is strong enough for protection from wind and rain — it can reportedly withstand a Category 3 hurricane. To control climate, a layer of film is embedded with microcapsules of change-phase materials, which absorb heat in higher temperatures and release heat in lower temperatures.

For lighting, SmartWrap uses organic light-emitting diode (LED) technology — organic molecules deposited onto the plastic film that emit light when an electric current is applied. Power comes from sunlight, absorbed by organic photovoltaic cells embedded in the film and converted into energy.

© 2007 Barry Halkin

SmartWrap is a building material that can provide a structure with several functions, including climate control, lighting, and power.

Some day, lightbulbs could be history. Incandescent bulbs, the kind Thomas Edison invented, convert only 5 percent of energy to light and release the rest as heat. Fluorescent bulbs are maybe four times more efficient, but even better choices are coming.

Chip-like light-emitting diodes are already in use in flashlights and auto taillights, using a fraction of the energy that lightbulbs use. The Rensselaer Polytechnic Institute's Lighting Research Center in New York has fitted some test rooms with a grid of low-voltage wiring across the walls and ceiling. LED panels embedded in tiles can snap in to connect with the power grid anywhere on the surface. A computer-controlled system can turn each LED panel on and off and adjust its brightness and color.

The Boston firm Kennedy and Violich Architecture is going even further. Designers there are working on yarn embedded with LEDs that can be woven into wall coverings or furniture.

Biomimetics

© Pearce Partnership/Aga Khan Trust for Culture

This building in Zimbabwe was designed to mimic a temperature efficient African termite mound, and reportedly uses 90 percent less energy than a conventional building.

How would Mother Nature design a building?

Through 4 billion years of evolution, organisms have come up with some neat designs. Architects are beginning to look to nature for clues to building sustainability.

Perhaps most famous among biologically informed buildings is the Eastgate shopping center and office building in Harare, Zimbabwe. The design was inspired by African termite mounds, where termites maintain a constant temperature of 87 degrees (to preserve a fungus that they cultivate to eat) by opening and closing flues that vent hot air.

The concrete Eastgate building has no air-conditioning system. During the night, big fans draw cool outside air up through spaces between the building's floors. During the day, smaller fans drive the warmer outside air through the same spaces, where the cool concrete moderates the temperature. As the air warms, it rises through 48 round brick funnels and out the roof. Fresh air circulates through the building twice an hour during the day. The building reportedly uses only 10 percent of the energy that a conventional building of the same size would use.

How about building materials inspired by nature? Architects and engineers are looking at the almost indestructible conch shell.

A conch grows itself by assembling bits of calcium carbonate into sheets and layers. It adds each new bit at a right angle to the finished bit. In this construction, a crack has a tough time getting anywhere, the force of any blow dissipated sheet to sheet and layer to layer.

For adaptation to changing temperatures, consider the flexible pinecone. Shut tight in the cold, pinecones open their scales to release their seeds when temperatures warm up. Researchers are looking for materials that change shape depending on the level of moisture in the air, opening to shunt warm moist air outside and closing to prevent warm moist air from getting inside.

Open Architecture Project

These days not all good building design ideas have to come from a single architect or architectural firm. Since February 2007, the charitable organization Architecture for Humanity has been letting anyone share design ideas online at the Open Architecture Network, with the aim of relieving humanitarian crises after disasters and helping poor communities in all countries, developing and developed.

Here's how it works: Designers, community leaders, government officials, and anyone else with ideas for sustainable construction share those ideas online. Or they can review ideas posted by others. With hundreds or thousands of ideas online at this open-source site, community leaders facing specific challenges can pick and choose possible design solutions and possibly even work out a way to collaborate with experts.

Architecture for Humanity had already done some good works before launching the Open Architecture Network,

helping design earthquake-resistant buildings for Turkey and refugee housing in Afghanistan. The group also helped rebuilding in places wracked by catastrophe — parts of India and Sri Lanka after the tsunami in 2004, and sites on the U.S. Gulf Coast smacked by Hurricane Katrina in 2005.

Frustrated during some of these earlier projects by the inability to share knowledge and experience, Architect for Humanity's founders came up with the idea for the open-source online site.

And this past September they went even further. The Open Architecture Network launched the Open Architecture Challenge, with the broad aim of getting Internet access to half the world's people by 2015.

The immediate aim of the challenge invites submission of plans focused on the Internet needs of three communities. One is a cooperative of indigenous chocolate producers in Ecuador; another is a group of young people in a Kenyan slum; and the third are families in a remote rural area of Nepal lacking health care. The winning design will be built for one of the three communities.

"By implementing the winning design, or designs," Cameron Sinclair, executive director of Architecture for Humanity, said in a press release, "we are not only assigning a winner, but we are helping people in underserved communities to live and grow through access to technology."

© AP Images

Green roofs, like this one in Atlanta, Georgia, are made of grasses and shrubbery and are designed to reduce energy use, filter pollutants from rainwater, and cool down cities during warm months.

Green Roofs

Actually, green roofs are not new. Plantings on top of buildings are at least as old as the Hanging Gardens of Babylon.

In recent decades, green roofs, which are vegetated roof covers for which plants take the place of materials such as shingles or tiles, have become somewhat common in parts of Europe, but for most of the world they are a new part of the landscape.

More use of green roofs could mitigate some problems for modern cities. They reduce storm-water runoff. They filter pollutants out of rainwater. Green roofs reduce energy use. Buildings with green roofs require less heating in the winter and less cooling in the summer than buildings with conventional roofs. In mass numbers they have the potential to reduce the urban-heat-island effect of entire cities.

Some U.S. cities are promoting the use of green roofs as a matter of policy. Chicago's City Hall has one. The American Society of Landscape Architects (ASLA) retrofitted its headquarters in Washington, D.C., with a green roof; the group says that from July 2006 to May 2007, "the green roof prevented 27,500 gallons of storm water — nearly 75 percent of all precipitation on the roof — from flowing into Washington, D.C.'s overburdened sewer and storm-water system. ... ASLA's green roof lowered air temperature by as much as 32 degrees in the summer when compared to a neighboring tarred roof."

Green roofs require strong structural support to carry a heavy load from a storm. They use wedding-cake layers of waterproofing membranes and root barriers to prevent leaks.

They come in different depths. Extensive green roofs use just a few inches of growing medium, typically expandable slate or clay mixed with a little compost; they are planted with alpine plants such as sedums. Intensive green roofs use deep soil and irrigation systems to grow grasses, shrubs, even trees. ■

Bruce Odessey is a staff writer with the U.S. Department of State, Office of International Information Programs. He lives in Maryland and has a green roof.

Young Innovator Profile: Christina Galitsky

Nearly three years ago, Christina Galitsky joined a team of scientists who had been asked an urgent question: Was it possible for researchers at California's Lawrence Berkeley National Laboratory (LBNL), where she is an engineer, to devise an expedient method for the displaced of war-torn Darfur to cook their meals?

For the more than 2 million people uprooted by Sudan's genocidal civil war since 2003, it is a life-and-death question. "The refugee women," says Galitsky, "had long ago exhausted supplies of wood near the [refugee] camps. As a result, they were forced to move farther and farther into the surrounding country in a search for cooking fuel."

In 2005, Galitsky and physicist Ashok Gadgil, an LBNL senior scientist, proposed a solution: a highly energy-efficient and portable cookstove, one that, Galitsky says, would "sharply reduce the need for refugees to leave the camps."

But Gadgil and Galitsky then had to persuade the refugees to use the stove — a sheet-metal cylindrical contraption 61 centimeters high and 36 centimeters in diameter. Galitsky and Gadgil went to Darfur in November 2005. Galitsky's job was demonstrating the stove to the wary women, who were used to balancing pots on stones over a wood fire, as their ancestors had done for centuries. She was able to show that in the new stove, making a pot of *assida*, the dough-like Sudanese staple of flour, oil, and water, used only half as much wood.

In 1999, after earning a master of science degree in chemical engineering from the University of California-Berkeley, Galitsky opted out of a PhD program to put her training to immediate, more practical use. "I wanted to work on problems that had a direct, profound impact on people's lives," she says, "things like clean water or clean air, things we need just to live."

The impact was even more direct in Darfur, where refugees appear to like the stoves. "We're hoping news of the stove spreads even more by word of mouth in the camps," Galitsky says, "which is the way most things like this have to work." Late last year, when 50 Sudanese families were given an opportunity to buy the stoves — at $2.50 apiece — every one of them took it. ■

This article is excerpted from "Hot Idea" by Neil Henry, a professor of journalism at the University of California at Berkely, and originally appeared in SMITHSONIAN, *October 2007.*

Photos Courtesy of Lawrence Berkeley National Laboratory

Relearning Education

David Pitts

Futurist Alvin Toffler said: "The illiterate of the 21st century will not be those who cannot read or write, but those who cannot learn, unlearn, and relearn." His admonition is instructive in a world that is changing so fast that formal educational institutions can barely keep up. The role of innovators in such a dynamic learning environment is therefore especially significant not only for what they contribute, but also through the example they set for educators and trainers.

Supporting Young Inventors

In the 21st century, the cliché that modern educational systems must teach children to think for themselves is imperative. As many experts have said, it will be necessary to learn, unlearn, and relearn many times over the course of one lifetime in the years ahead. It is not just scores on a test that count, but the ability to translate lessons learned into tangible benefits.

Courtesy of Standing With Hope

Grayson Rosenberger, shown here in Ghana, invented an inexpensive skin covering for prosthetic limbs.

Some young Americans exemplify this in a profound way. Take Grayson Rosenberger, for example. He was 15 years old when he invented a $15 skin covering for prosthetic limbs. His invention is important to amputees in countries where uncovered limbs are a taboo and where many people cannot afford the $1,000-plus for regular prosthetic coverings. Rosenberger's artificial skin is primitive — wrapped in Bubble Wrap and packing tape and molded with a heat gun — but it works. The young inventor won a $10,000 prize from the company that produces Bubble Wrap.

Another teenager with a great idea is Lisa Marie Wright. She was 16 when she invented a candle that burns itself out to prevent fires. One day, Wright returned home to find that her mother had accidentally left a candle burning all day. Although there was no fire, it inspired Wright to invent the auto/off candle — now called the Wright Candle. It took off, meeting a need that big corporations had failed to fill themselves. Wright stresses the importance of teamwork: She had help creating her invention, she says. For her efforts, Wright was inducted into the National Gallery of America's Young Inventors.

Other teenage innovators have recently created such useful gadgets as a pedal-powered lawn mower, a five-day cat feeder, and even a bendable broom — proof that young people can make a positive contribution to society long before they graduate from high school or college. The key, say experts, is providing a home and educational environment that nurtures and rewards imagination and creativity.

State-of-the-Art Playgrounds

Is the big blue ring in the center of the playground a sculpture or a merry-go-round or both? The designers of the $1 million Stapleton Central Park playground in Denver, Colorado, which opened in September 2007, hope that children and parents think it is both.

A similar sentiment has inspired the designers of a playground near the South Street Seaport in New York City — a result of a public/private partnership. The city is employing trained "play workers" to help children not only to play in, but also to understand, the specially designed objects, including zones of sand and water, ramps, blocks, and gaskets, that are a far cry from the swings and slides of the traditional playground. The purpose is to spur imagination and creativity — even a sense of mystery and wonder — in addition to exercise.

© AP Images/Tony Ding

A student plays on a new playground designed and equipped so that children with disabilities and those without can play together.

Denver and New York City are at the forefront of a nationwide playground revolution, say experts. In order to lure children away from sedentary activities such as watching television or chatting online, modern playgrounds have to be multifaceted, offering different learning experiences more in tune with today's young lifestyles. Playgrounds also must be visually more attractive to a generation accustomed to displays of spectacular color and imagery on their television and computer screens.

Modern playground designers also are more conscious of population diversity — and not only in terms of ethnicity and gender. In Logan, Utah, Angels' Landing playground was designed specifically for accessibility by architects with Utah State University's Center for Persons With Disabilities. The playground's toys are designed so that the disability or ability of the user doesn't separate who can play with them.

The Americans With Disabilities Act, signed by President George H.W. Bush in 1990, makes it illegal in the United States to discriminate against the physically challenged. As a result, all new and altered playgrounds in the United States must be accessible to the disabled. However, Angels' Landing goes beyond the standards of the act, with an emphasis on safety as well as access.

The World Simulation

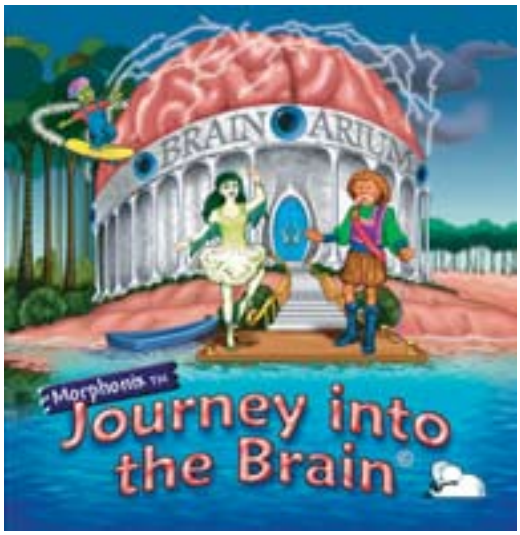
Imagine a classroom transformed into a microcosm of the world. That's what is happening at Kansas State University in a cultural anthropology class. It is called the World Simulation, a radical experiment in learning that harnesses the traditional concept of the map to digital technology.

It works like this: A map is created that mimics the geographical, biological, and environmental diversity of the real world. It is then overlaid onto a map of the actual classroom, and students are asked to imagine living in the environment indicated by the part of the world map that corresponds with the part of the classroom where they are located.

The class is divided into groups of about 12 to 20 students. Each group is asked to create its own culture to survive in its own unique environment, as the part of the map targeted to them indicates. The experiment takes about 75 to 100 minutes and covers 650 years — from 1450 to 2100. It takes place in a large room where all the groups — or "cultures" — are encouraged to interact with one another. The simulation is recorded onto five roaming digital video cameras and edited onto one "world history" video.

The idea is the brainchild of Michael Wesch, assistant professor of cultural anthropology at Kansas State University. He says the experiment grew out of his experience in dealing with disinterested and bored students who knew little about cultures other than their own. His idea is to marry digital technology to the traditional classroom.

Educational Video Games



Courtesy of Morphonix LLC/www.morphonix.com

Educational video games, such as this one about the human brain, are designed to teach children important lessons while having fun.

Video games are not just for entertainment anymore. Educators have always known that learning is most effective when students of any age enjoy the experience — even more so when it is interactive. So it was inevitable that educational innovators would harness the immense popularity of the video game to learning.

A number of companies are leading the way. Among them are Virtual Heroes, Inc., which has produced video games to help train army recruits and to teach children about math, science, and engineering. Breakaway Games has an even broader mandate — to create games to teach trainees in the hotel, banking, and even medical fields. It also has partnered with entertainment companies including Disney and ABC to produce games based on simulations of great historic events, such as the Battle of Waterloo. Morphonix sells video games that teach kids about the complicated world of the human brain. For example, "Journey Into the Brain" (for 7 to 11 year olds) asks the question: "What would you do if there was something odd going on inside your best friend's brain?"

Unfortunately, not all school systems and industry-based training programs easily embrace video games as an educational tool — some adhering to the antiquated notion that enjoyment and education are mutually exclusive. So Web Wise Kids gives games away to schools for free. That way, it says, it can reach more kids with its message of Internet safety. The nonprofit company, which is funded by donations from the U.S. Congress and a large number of private companies, creates games based on realistic scenarios involving cyber-stalking, Internet predators, pirating software, and cyber-bullying. Kids help video detectives solve real-life mysteries.

Educational institutions, like many pillars of society, tend to be conservative and resistant to change. Innovators like Web Wise Kids have learned that it is not only the quality of the games that is important — and ensuring their appeal to a broad spectrum of users across ethnic and gender lines — but also the way they are promoted and marketed. Decisions on whether a company should be profit or nonprofit and sources of funding, for example, are key decisions that can impact success. ■

David Pitts is an author and journalist whose articles about education and other topics have appeared in Education Week, *the* Washington Post, *the* Philadelphia Inquirer, *the* Christian Science Monitor, *and other major U.S. newspapers and magazines.*

The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. government.

Young Innovator Profile: Geneva Wiki

AP Images/J. Scott Applewhite

This bear mask reflects the culture of the Mad River Band of Yurok American Indians in Oregon. Students at Klamath Early College of the Redwoods in California study Yurok History and Culture in addition to school staples such as math and science.

Geneva Wiki is fighting the flu. "You're seeing me at only about 75 percent of my normal energy," says the director of the Klamath River Early College of the Redwoods, in Klamath, California. It's a formidable 75 percent. Two of her teachers are absent, so Wiki, a 30-year-old Yurok Indian, darts between the school's three classrooms, her bobbed hair swinging.

More than half of the 30 teens attending this public charter school are Yurok, and more than two-thirds are American Indians. As young as 13, they have all taken college placement exams and are co-enrolled in high school and the local community college, working simultaneously toward secondary school diplomas and college credits. The idea behind this innovative project, part of the Early College High School Initiative largely funded by the Bill and Melinda Gates Foundation, is that low-income, minority, and otherwise disadvantaged young people at risk of dropping out are encouraged to stay in school and get a free, nonintimidating taste of college. There are now 147 such schools in the United States in 23 states and Washington, D.C., 11 of which are specifically for American Indians.

"This is the front line of our civil rights movement," says Wiki. "Past generations struggled first over rights to fish and hunt, and then to govern ourselves. Now we need to work on reclaiming ourselves through education." Wiki helped establish schools for the Early Colleges for Native Youth program before she was tapped, in 2003, to be deputy executive director of the Yurok tribal council. (Settled along the Klamath River, just south of the Oregon border, the 5,000-member tribe is California's largest and poorest.) As deputy executive director, Wiki began talking to parents and community leaders about starting an early college high school on the reservation. The idea was popular — and was eligible for a Gates Foundation grant. Soon after getting one, tribal leaders and parents asked Wiki to be the school's first director. It opened in September 2005 in rooms in back of a convenience store, just off redwood-lined Highway 101.

In addition to math, science, English, and social sciences, Wiki's students study the Yurok language and such tribal skills as carving redwood canoes, catching eels, and making acorn soup. Some educators — including Wiki — believe that such knowledge can make the difference in combating an American Indian dropout rate of more than 4 in 10 nationwide.

Wiki's family are "regalia holders"— keepers of ceremonial treasures used in Yurok rituals. Her great-grandmother was famed for her basketry; her aunt was president of the National Congress of American Indians. "I always knew strongly who I was and what I was supposed to do," Wiki says.

The school has made considerable progress in the two years since it opened. Last year's daily attendance was up — to 92 percent from 70 percent the previous year — and 48 percent of students passed a placement exam making them eligible to take college-level English, up from 4 percent. "It's something you always hear about the schools on Indian lands, that we could do it better if we were in charge," says Wiki. "And as a matter of fact, we can." ■

This article is excerpted from "Making the Grade" by Katherine Ellison, which originally appeared in SMITHSONIAN*, October 2007. Katherine Ellison is a Pulitzer Prize-winning journalist and author. Her most recent book is* The Mommy Brain: How Motherhood Makes Us Smarter*, published by Basic Books.*

Musical Innovations

Carolee Walker

A country's music reflects various facets of its culture. So it's not surprising that technological advances are having a big impact on music in the United States. Traditional rock, pop, classical, and jazz have been joined on today's American musical spectrum by some 21st-century innovations. Among them: role-playing games that allow teens to become part of a virtual rock band via the Internet; electronic devices that enable persons with severely limited mobility to hold and play musical instruments; and laptop computer orchestras in which electronic musicians perform using computers as instruments.

Virtual Rock

Monica Cho, who is rehearsing Mozart's "Piano Concerto No. 15 in B flat Major" for a piano competition and Mendelssohn's "Concerto in E Minor for Violin" for a recital, has little time on school nights to relax.

But on the weekends, when the Maryland teenager has time to unwind, she plays electric guitar in a rock band with her friends. Except they don't play any actual instruments, and they meet in front of the family television set instead of in the family garage.

Cho is among millions of teens — and, increasingly, adults — around the world who play music on interactive computer game platforms in virtual rock bands.

The game controller is shaped like a guitar and is fitted with five fret buttons and one strum bar. "You just hold the fret button and strum the strum bar at the same time to produce a note," Cho explains. The game comes with a drum kit, including drumming pads as well as a pedal, a microphone for a vocalist, and a controller for bass guitar.

Depending on the quality of the players' television speakers, even without instruments the virtual rockers have the potential to wake up the neighbors.

© AP Images/D.J. Peters

A participant in the World Series of Video Games plays Guitar Hero II, a virtual game.

Rock Band, one of the newest virtual music games — also known as role-playing games (RPGs) — is a collaboration between MTV and Electronic Arts. The guitar-shaped game controller is based on the Fender Stratocaster electric guitar of the 1950s and is made by Contel Corporation, designer and manufacturer of digital media products in China. The game was developed by Harmonix Music Systems for the Playstation 2, Playstation 3, and Xbox 360 game platforms.

When the original Guitar Hero was released in 2005, the RPG appealed to "a mass of people," said Robert Kotick, chair and chief executive of Activision, the game's publisher, in newspaper reports. In the first week of its release in late November, Guitar Hero III, which, like

© AP Images/Ben Margot

New music technologies like this electronic music stand is redefining how musicians interact with their music.

Rock Band, puts players in the role of rockers, had sales of $115 million. The latest Guitar Hero game is also owned by Harmonix, which was purchased by MTV in 2006, and, like Rock Band, players can form bands connecting musicians using a high-speed Internet connection.

The games allow players to assign such characteristics as hair color and clothing accessories to themselves in order to create a virtual display of the band. They choose a name for the band and create a logo, and when the band is performing in front of a crowd of screaming fans, another player can act as the concert director by using lighting effects and interesting camera shots.

Cho says that playing music will always be an important part of her life as she looks forward to a career in politics or economics. What kind of music, though, is "TBD" (to be determined), she says — and "how" she'll play it might be virtually impossible to guess.

The Sound of Healing

Even when you've got the beat, it's hard to play music if you can't move.

For several years, companies have been equipping musical instruments with devices that make it possible for individuals with disabilities to hold and play instruments. But for people with little or no ability to move their arms or legs or to move them in a coordinated way, it has been impossible to play an instrument or to consider playing music at all.

Yet innovations in music technology are making it possible — and enjoyable — for people with severe physical disabilities to play and compose music. Research shows that music therapy is effective in promoting wellness among healthy people, but it also has been shown to alleviate pain and improve the quality of life for persons with disabilities.

Several rehabilitation centers and other organizations are working to find ways for people who are otherwise unable even to hold standard musical instruments to play music. At the REHAB school in Poughkeepsie, New York, for example, patients using tiny movements of their head are able to make music as part of a project developed by musicians and computer software designers at the Deep Listening Institute in Kingston, New York.

Instead of using instruments, physically disabled children and teenagers at REHAB have been able to play music using a computer program. A digital video camera connected to a computer displays an image of the musician on a screen. A cursor placed on some part of the screen image of the head tracks even subtle head movements electronically that translate into musical notes heard through the computer's speakers. The program can be played in two modes: In piano mode, a movement from side to side plays a piano scale; in percussion mode, the same movement creates a drum roll.

The computer program Hyperscore allows people to compose music by scoring it using line graphs comprising a broad range of instrument sounds. Hyperscore was developed by Tod Machover, a professor of music and media at the Massachusetts Institute of Technology (MIT) and director of the Opera of the Future project at MIT.

According to the American Music Therapy Association, goals of music therapy are often nonmusical, since playing an instrument can improve motor skills and coordination. In addition, clinical studies conducted by Oliver Sacks, a British neurologist on the faculty at Columbia University in New York and the author of *Musicophilia: Tales of Music and the Brain*, and Concetta Tomaino, a leading music therapist, have shown that singing word phrases such as "Hello, how

are you?" affects speech recovery by "rehearsing" speech. By putting regular speech and common phrases into a musical context, patients who have trouble speaking but are conscious and cognizant of what is being said to them are learning to say "hello" and more.

Innovations in digital music projects expand the goals of music therapy by providing a mode of creative expression for people with severe physical disabilities, said Pauline Oliveros, founder of the Deep Listening Institute, in a published news report. "Making something empowers," Oliveros said. "That can be very healing and exciting."

Turning Electronic Noise Into Music

One way people often use laptop computers is to download and play music files. Recently, some musicians have gone a step further, harnessing the ability of laptops to generate all kinds of sounds electronically to use the machines themselves as musical instruments.

Using laptops this way is not that different from the way hip-hop artists of the 1970s used turntables to "scratch" old, worn records to talk over music, creating an entirely new musical genre, according to composer and sound artist Scott Smallwood.

Smallwood is a co-director of PLOrk, the Princeton Laptop Orchestra, at Princeton University in New Jersey. The orchestra was founded in 2005 by faculty members Dan Trueman and Perry Cook with graduate students Smallwood and Ge Wang, and is a collection of musicians who perform together using computers as their instruments. The computer-generated music is based on new kinds of sounds — made up of noise and texture — rather than the traditional sounds of instruments in an orchestra.

Performances by the Princeton Laptop Orchestra differ from those by most laptop musicians because the orchestra members are working together from a musical score, or instructions to the whole group that govern what sounds are made by which musicians at what time, rather than individual musicians performing works with "their own voice."

When people hear the term "laptop orchestra" they think of a symphony orchestra and assume it is a group of people sitting around with computers mimicking such instruments as the violin or clarinet, according to Smallwood.

"It is not about this," he said. Instead, the laptop symphony makes new and unique sounds work in the same acoustical context as a traditional symphony.

Computers have had the ability to replicate individual instruments in a band or orchestra for years — in fact, many pit orchestras in live-performance theaters have been replaced by a single computer that is programmed to play an entire musical score. What distinguishes the laptop orchestra from electronic music is the role each musician plays in the group and the unique speakers designed by Trueman and connected to each laptop to enable electronic sound to become acoustic. ■

Courtesy of Princeton University

Members of PLOrk (Princeton Laptop Orchestra) rehearse with computers and traditional instruments.

Carolee Walker is a staff writer with the U.S. Department of State, Bureau of International Information Programs. As a writer on U.S. culture and values, Walker has interviewed musicians including Dolly Parton, Native Deen, and Fab 5 Freddy.

© AP Images/Mary Altaffer

The Nuyorican Poet's Café in New York City .

Young Innovator Profile: Maya del Valle

At 155 centimeters and 50 kilograms, Maya del Valle may be petite, but she has the stage presence of a Gargantua. At a recent music, dance, and spoken-word event called "Race, Rap, and Redemption," the 28-year-old poet commands the University of Southern California's Bovard Auditorium with her thunderous voice and agile moves.

Del Valle is one of the nine original hip-hop poets who form the cast of HBO's *Def Poetry*, now in its sixth season. The show went to Broadway in 2002 and promptly won a Tony Award in 2003 for Special Theatrical Event. In 2004, del Valle was among a small group of spoken-word artists invited to tour the United States with an original copy of the Declaration of Independence as part of a nonpartisan voter drive called "Declare Yourself."

"Spoken word is our democracy," says Norman Lear, the TV producer (*All in the Family*) and civic activist who created the program and who calls del Valle one of his favorite people. "All of those voices from across all ethnicities and religions and races and ages — it's our democracy writ large in poetry."

Del Valle, who lives in a one-bedroom apartment in Los Angeles's Koreatown, likens herself to a traditional West African griot, or storyteller. "If you go back historically and you look at the griots, they didn't just record the history of people or tell people what was going on," she says. "They set the vision for where society should be."

After college, del Valle headed for the Nuyorican Poets Café, a nonprofit arts organization on Manhattan's Lower East Side that holds weekly "slams" — contests between spoken-word poets judged by the audience. Del Valle quickly became a favorite, honing her craft and ultimately gaining the Individual National Poetry Slam title in 2001. This caught the notice of the HBO producers putting the *Def Poetry* jam together.

"Onstage is my favorite place to be," del Valle says, long after the lights have dimmed. "It's when I'm more of who I really am than who I am in everyday life. It's like I'm doing something that's bigger than me." ■

This article is excerpted from "Mighty Mouth" by Serena Kim, which originally appeared in SMITHSONIAN*, October 2007. Freelance writer Serena Kim reports on hip-hop and urban culture for the* Washington Post *and the* Los Angeles Times.

The Future of Travel

Martin Manning

Today, the world is entering a new golden age for travel and tourism. Along with the rise in the number of travelers, new technology such as the Internet and mobile communication devices allows for enhanced access to information, greater mobility, and shared cultural experiences on a scale never seen before. These innovations are the closing side of the arc that started centuries ago when explorers encountered dangerous seas to find new worlds and left only diaries behind, often discovered years later. It has been quite a journey!

No Suitcase, No Problem

In today's linked in world, some travelers have no need for money, airplane tickets, suitcases, or even knowledge of another language. All it takes is choosing a virtual persona, downloading a free program, and making a few clicks of a computer mouse to access the San Francisco-based Second Life — a three-dimensional world travel program available on the Internet.

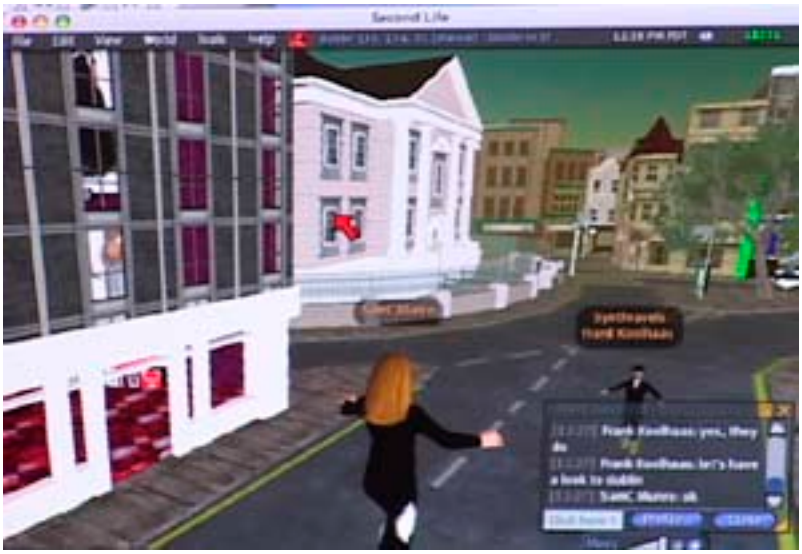
Virtual tourism in Second Life can take two forms: using a virtual world as a way of enhancing real-world tourism, or touring inside the virtual world to see locations that only exist virtually and are someone's invention. In the virtual world, people can move around without ever leaving their PCs.

Second Life — which is the brainchild of Linden Lab — provides an opportunity for those who can't travel to experience what other places might be like. According to Catherine Smith, Linden Lab's director of marketing, Second Life averages between 40,000 and 50,000 visitors at any given point in a day from all over the world, so it's a good way to explore new places and to learn about a lot of different cultures.

The places you can visit include history museums, fantasy castles, Mayan ruins, and jungles. The only restriction is the limit of your imagination. And for virtual travel, no passport is required and there is a free translation program called Babbler that does real-time translation in several languages, including Japanese, Chinese, Dutch, Portuguese, Italian, French, German, and Spanish.

Airline Innovations

Airline carriers worldwide have in recent years faced increased fuel costs, regulatory and security issues, major changes in the competitive landscape, and shifts in consumer travel behavior. Security technology is now part of the flying experience, while low-cost carriers have altered the economics of flying in Europe. Now the biggest challenge for airlines worldwide will be whether they can continue to change with the times.



© AP Images

A Second Life avatar of a New York woman travels to virtual Dublin, Ireland. With virtual tourism, a user can experience a faraway place without ever leaving the computer.

One innovative program developed by airline carriers would replace paper tickets with information sent to your cell phone. The International Air Transport Association recently announced that a new global standard will allow a passenger to check in for flights using a bar code sent directly to his or her cell phone. When you book your flight, you'll register your cell phone number and then receive a text message containing a bar code that will serve as your boarding pass. During check-in, a scanner will read the bar code directly off your cell phone screen — all part of a plan to phase out those old-time paper tickets.

Volunteer Vacations

In the past, the typical humanitarian trip focused on constructing housing or building a well, but today people are lining up to take advantage of new and innovative ways to give back while traveling.

Generous Adventures is a volunteer-based organization that travel expert Frommer's calls "the only all-travel benefit auction on the Internet." Generous Adventures gets hotel owners and tour operators around the world to donate a travel experience — a day in Panama, a week in Tuscany, six days in the Ecuadorian rainforest — then auctions off the trips on its Web site to bidders who are willing to make helping others a part of their travel experience. In addition to snagging a trip, the winning bidder gets to choose which charity will receive about 45 percent of the price he or she paid for the trip. The charities might include such organizations as Doctors Without Borders, Rainforest Action Network, National Parks Conservation Association, Habitat for Humanity, and the International Breast Cancer Research Foundation.

On any given day, Generous Adventures makes available more than 100 trips from which to choose. For example, if you go to the Galapagos Islands, you can do it with a company called Myths and Mountains: See iguanas in the morning, and teach children English in the afternoon. If you enjoy horseback riding, guides from Relief Riders International will lead you through ancient villages and breathtaking landscapes as you deliver medical supplies and food to remote villages in the Indian state of Rajasthan. If you want to escape to a Caribbean island, you can mix it up with cultural immersion in a Jamaican village through Amizade, a community-driven program that has you relaxing on the beach one day and teaching in a classroom the next.

Traveling as a short-term volunteer differs from the conventional, even romantic, adventure travel and cultural immersion experiences long immortalized in travel stories and films. Instead, a "volunteer vacation" lets you serve and learn firsthand about the host community and its people, while using your skills and interests in an unconventional setting to benefit others.

Are You a "Responsible Tourist"?

Since 1970, when U.S. President Richard Nixon proclaimed the first Earth Day, environmentalists have become a driving force steering environmental awareness around the world. Through Earth Day Network, activists connect, interact, and impact their communities, and create positive change in local, national, and global policies. Now this activism has been extended to what is called ecotourism, green travel, and "responsible tourism."

Ecotourism traces sustainability within environmentalism. It embraces goals as far ranging as Third World development and tourism and the emergence

© AP Images/Kent Gilbert

Ecotourists can enjoy the natural beauty of sites like the canopy of the cloud forest at Monteverde Cloud Forest Reserve in Costa Rica.

Courtesy of the Big Green Bus

Students from Dartmouth College in New Hampshire tour the United States in a bus modified to run on vegetable oil to promote the use of sustainable energy.

of pro-poor tourism. For travelers, it also includes the search for eco-lodges and green hotels around the world that feature accommodations that are not only environmentally friendly, but work to support local communities and celebrate the growing availability of green travel experiences. Ecotourism also tries to address some of the more difficult issues that ethical travelers face, such as questions about poverty, the politics of boycotting certain destinations, and the environmental impact of travel.

Ecotourism is now being practiced by some of the most luxurious resorts and hotels in the world. "Ecotourism affords travelers the opportunity to directly benefit the people and places they visit by supporting conservation and protecting cultural heritage as well as economic development," says Brian T. Mullis, president of the Sustainable Tourism Institute. "Taking an eco-friendly vacation provides responsible travelers with an opportunity to do their part."

The U.S. government is also doing its part. In fall 2007, the U.S. Agency for International Development's (USAID) Biodiversity Conservation and Economic Growth Project helped Bulgaria capitalize on its natural resources (mountains, beaches, extensive wilderness areas) to increase the number of tourists, the spending per tourist, and the percentage of tourism-generated revenue that stayed in Bulgaria.

In the United States, college students have also created their own innovative ecotourism projects. In the summer of 2007, a team of Dartmouth College students embarked on an unusual 11-week summer road trip to visit more than 30 destinations around the United States. They traveled on the Big Green Bus, an old school bus that has been painted green and modified to run on waste vegetable oil. The purpose of the trip, according to the students' Web site, was to promote "the use of sustainable energy through education and example" and to foster "awareness about current global energy issues and create dialogue about tangible solutions to those problems." This was the third tour of the bus, which was inaugurated in summer 2005.

For eco-friendly travelers who want to practice responsible tourism, Travelocity.com offers its customers the chance to offset travel purchased on its Web site through its partnership with the Conservation Fund.

Other useful tips:

- Go to a city that is good for the environment. In the United States, this is Portland, Oregon, ranked Number 1 by SustainLane, a green media company. Other "good" U.S. cities are San Francisco, California; Seattle, Washington; Chicago, Illinois; and Oakland, California.
- Stay at a green hotel.
- Go green when you rent a car.
- Take a vacation with an environmental focus, such as the World Wide Opportunities on Organic Farms or through Wilderness Volunteers. ■

Martin Manning is a librarian with U.S. Department of State's Bureau of International Information Programs. He loves to travel to New England.

Young Innovator Profile: Beth Shapiro

© Carolyn Djanogly

If you're trying to isolate dodo DNA, follow these steps: First, find a dodo bone that hasn't fossilized. This should be easy. Among the few known in the world are a skull and a left foot that are stored in boxes on the second floor of the Oxford University Museum of Natural History. They've been in the university's possession since 1683, around the time the last dodo died. It's not a big museum, but if you get lost, look for a small plaque next to the entrance to the storeroom, where a legendary debate over Charles Darwin's theory of evolution took place in 1860.

The hard part, as biologist Beth Shapiro discovered in 2000, will be convincing collections manager Malgosia Nowak-Kemp to let you take a drill to the ultimate nonrenewable resource. True, you won't need to destroy much — a fragment the size of a pinkie fingernail should suffice — but it's safe to say you won't get a second chance. Try not to let the pressure get to you. "Here's this very famous specimen, a very finite resource, and a short American comes in and wants to take a chunk out of it," Shapiro says. "[Nowak-Kemp] wasn't nearly as scared as I was."

The next step is a polymerase chain reaction. Used for everything from paternity tests to cloning, a PCR requires a well-equipped lab. Before you step inside, put on a clean suit, like those found in computer chip factories, to avoid contaminating your sample with modern DNA.

Ready? OK: Grind the dodo bone to a fine powder. Dissolve it in a water-based solution. Mix in magnesium and DNA polymerases — enzymes that help genes make copies of themselves. Heat the mixture to about 150 degrees Fahrenheit (65.5 degrees Celsius) to break DNA chains into two strands. Cool it, letting the polymerase enzymes latch on to the dodo's DNA and build copies of it. Repeat at least 30 times. By morning, you should have a test tube with about a million copies of a dodo gene or gene fragment.

For Shapiro, 31, this deceptively simple-sounding procedure has proved to be a recipe for success. When she arrived at Oxford as a Rhodes scholar in 1999, she apprenticed herself to Alan Cooper, a pioneer in the brand-new field of ancient DNA. In the eight years since, Shapiro has risen to the top of the tiny, high-profile, overwhelmingly young community of ancient-DNA researchers.

Ancient DNA research analyzes the genes of long-dead plants and animals — letting scientists trace the evolution, and extinction, of species with a precision unimaginable just five years ago. By comparing dodo DNA with the genes of five other species, for example, Shapiro's research established that the flightless bird was a distant relative of the pigeon.

Shapiro has traveled the world in search of DNA samples, ancient and otherwise. Last summer, she flew to the Indian Ocean island of Mauritius to search for unfossilized dodo bones to compare with the Oxford specimen — to no avail.

DNA tends to come in lots of tiny fragments, and without a living animal, there's no way to reconstruct which genes come into play at which stages of the dodo's development. In short: No dodo mama, no dodo baby.

Shapiro hopes her research can help prevent modern species from going the way of the dodo. ■

This article is excerpted from "How to Make A Dodo" by Andrew Curry, which originally appeared in SMITHSONIAN, *October 2007. Curry wrote about Romania's painted monasteries in the June issue of* Smithsonian. *He lives in Berlin.*

An Innovation Nation

From small towns to big, bright metropolitan areas, America's businesses, local governments, scientists, and everyday people are developing innovations that are making people's lives healthier, easier, more prosperous, or simply more interesting. Here is a sampling of the innovation hot spots in the United States.

Boise, Idaho: Job Innovation

Boise, the largest city in Idaho, is the commercial and financial center of the region in the United States known as the Northern Rockies.

One of the fastest-growing metropolitan areas in the United States, Boise led the nation in per capita job growth in 2006. Large employers such as Micron Technology, Hewlett-Packard, and startup companies continue to create jobs in the area.

In 2006, Boise was named one of the "Most Inventive Towns in America."

New York City: Digital Innovation

In recent years, the areas of New York City known as Silicon Alley — Upper Manhattan, Brooklyn, Queens, and Staten Island — have supported the growth of a $9.2 billion high-tech and new media (communicating with consumers primarily through the Internet) industry.

The program, Digital NYC, assists with the construction and remodeling of affordable office locations with ready access to the Internet. As a result, New York City offers businesses hundreds of thousands of kilometers of installed fiber optic cable, enabling swift communication with worldwide clients.

San Francisco, California: High-Tech Innovation

Silicon Valley, located in the southern part of the San Francisco Bay area, got its name from the large number of silicon computer chip manufacturers operating there.

The area, which became famous during the high-tech boom of the 1990s, remains the high-tech hub of the United States. Innovative companies such as Google, Apple, Yahoo, and eBay have taken root there, as have scores of small-tech and digital-media companies, as well as venture capitalists.

In 2006, California residents — private and corporate — received 15 percent of the all patents issued in the United States.

Austin, Texas: Workforce Innovation

Seventy-five percent of Austin's residents are under age 45, and nearly 50,000 students attend the University of Texas at Austin.

One Austin company, Applied Materials, is taking advantage of the young population and hiring only college graduates to make machines used in manufacturing semiconductors. By doing so, as manufacturing jobs become more complicated, Applied Materials — and Austin — will have a growing supply of workers with knowledge in the field.

Austin also has the most places per capita in the United States where the public can access the Internet for free.

Chicago, Illinois: Environmental Innovation

Chicago is well known as a U.S. leader in transportation, telecommunications, and finance. Over the last few years, Chicago also has become a leader in environmental innovations.

Chicago has 233,000 square meters of heat-reducing "green roofs" — layers of vegetative matter that grow directly on rooftops. This is more than all other U.S. cities combined. Millennium Park, a $475 million state-of-the-art example of modern urban green space, opened in 2004.

Raleigh-Durham, North Carolina: Research Innovation

From microbiologists to software designers, the Raleigh-Durham area is home to highly educated professionals and employees working for the numerous large companies — such as IBM — that have established their major research facilities there.

With one of the highest per capita concentrations of doctoral degree holders in the United States, Raleigh-Durham is close to three major universities: Duke University, the University of North Carolina, and North Carolina State University.

Webliography

Web resources for the people and ideas in this edition of *eJournal USA*.

Architecture

American Society of Landscape Architects
http://www.asla.org/

Sustainable Sites Network
A partnership to protect and enhance the ability of landscapes to provide services such as climate regulation, clean air and water, and improved quality of life.
http://www.sustainablesites.org/

Architecture for Humanity
A charitable organization that promotes architectural and design solutions to global, social, and humanitarian crises.
http://www.architectureforhumanity.org/

SmartWrap
A new building material that integrates the segregated functions of a conventional wall, such as shelter and insulation, and compresses them into one composite film that can be erected in a fraction of ordinary building time.
http://www.icaphila.org/exhibitions/past/smartwrap.php

Education

Angels' Landing
A playground designed by architects with Utah State University's Center for Persons With Disabilities to ensure accessibility by all people.
http://www.cpd.usu.edu/

Web Wise Kids
An organization that offers kids fun, challenging, and interactive Web simulations to promote Internet safety.
http://www.webwisekids.org/

The World Simulation
An experiment in learning — developed at Kansas State University — that harnesses the traditional concept of the world map to digital technology.
http://www.k-state.edu/

Health

Center for Aging Services Technology
An organization dedicated to the development, evaluation, and adoption of emerging technologies that can improve the aging experience.
http://www.agingtech.org/index.aspx

Home Guardian
A project of University of Virginia featuring a detector that uses floor sensors, rather than a device strapped to the body, to detect when someone falls.
http://www.virginia.edu

Music

Deep Listening Institute
An institute located in Kingston, New York, that is fostering a unique approach to music, literature, art, and meditation, and promoting innovation among artists and audiences in creating, performing, recording, and educating with a global perspective.
http://www.deeplistening.org/site/

Drake Music Project
A London-based project that provides opportunities for disabled musicians of all ages and abilities to explore, compose, and perform music.
http://www.drakemusicproject.org/makepage.asp?page=1

Hyperscore
A project at the Massachusetts Institute of Technology designed to introduce children to musical composition and creativity in an intuitive and dynamic way.
http://www.media.mit.edu/hyperins/ToySymphony/musictoysscore.html
http://www.hyperscore.com/

Institute for Music and Neurological Function
A New York organization that restores, maintains, and improves people's physical, emotional, and neurological functioning through the systematic use of music.
http://www.bethabe.org/Our_Mission212.html

Princeton Laptop Orchestra
An ensemble of computer-based musical meta-instruments (laptop, multi-channel hemispherical speaker, variety of control devices) at Princeton University in which the students who make up the ensemble act as performers, researchers, composers, and software developers.
http://plork.cs.princeton.edu/

Nanotechnology

Lawrence Livermore National Laboratory
A premier U.S. government research and development institution for science and technology as they apply to national security.
http://www.llnl.gov/

Social Networking

Babajob and Babalife
A social networking and job site in India that matches those in need of employment with available jobs.
http://www.babajob.com/

iCare
An organization that directs disaster relief assistance to those most in need without going through a middleman or other organization.
http://icare.ieor.berkeley.edu/

iReuse
A business that facilitates the re-use of unwanted products and materials of one organization by another organization that is seeking such products and materials.
http://www.ireuse.com/

Sports

Forest Steward Council
An organization responsible for developing standards to guide forest management toward sustainable outcomes, including, for example, ensuring that the rubber used in sports balls comes from responsibly managed forests.
http://www.fscus.org

Mojo Kickball
A team sport that is a form of kickball combined with tag and dodgeball.
http://www.mojokickball.com/

Wiffle Hurling
A derivation of the Irish game of hurling, but as a relatively safe contact sport that retains many of the qualities of the original game.
http://art.rutgers.edu/~russotti/wifflehurling.htm

Travel

Amizade
An organization that encourages intercultural exploration and understanding through community-driven volunteer programs and service-learning programs.
http://www.amizade.org

Global Exchange
A membership-based international human rights organization dedicated to promoting social, economic, and environmental justice around the world.
http://www.globalexchange.org

Global Volunteers
A worldwide network that provides "volunteer vacations" in which traveling individuals live and work with local people to meet identified needs.
http://www.globalvolunteers.org

Wilderness Volunteers
A nonprofit organization that organizes and promotes volunteer service to America's wild lands, national parks, and forests.
http://www.wildernessvolunteers.org

World-Wide Opportunities on Organic Farms
An international network that helps people share more sustainable ways of living, and, in return for volunteer help, offers food, accommodations, and opportunities to learn about organic lifestyles.
http://www.wwoof.org

The U.S. Department of State assumes no responsibility for the content and availability of the resources from other agencies and organizations. All Internet links were active as of January 2008.

Health
Nanotechnology
Social Networking
Sports
Architecture
Education
Music
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New in 2008

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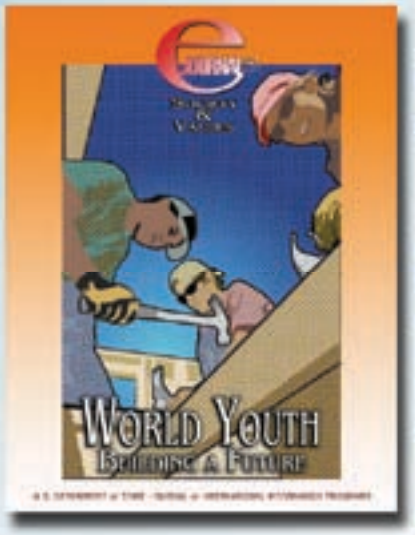
Telling America's Story

New home of eJournalUSA

http://www.america.gov

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