THE HOLLYWOOD ISSUE

L.A. MAYOR EDITORIAL: I ♡ ENGINEERS | MACGYVER CREATOR SPEAKS OUT

"AVATAR" TECHNOLOGY AND HOLOCAUST SURVIVORS | USC VITERBI + SILICON VALLEY + HOLLYWOOD

NEXT GREAT FILM / TV SHOW ABOUT ENGINEERS | MEASURING THE IMPACT OF MEDIA

HAO LI: 'TOP INNOVATOR' IN ANIMATION | FASTER VIDEO DOWNLOADS | TIMELINE: FROM Q TO IRON MAN

WHY NOT ENGINEERS AS CELEBRITIES ?

Assistant Professor Hao Li, whose work was instrumental in the visual effects of the upcoming *Star Wars: Episode VII*, was recently named one of the "the world's 35 top innovators under the age of 35" by *MIT Technology Review*.

The distinction puts USC Viterbi in a unique category: since 2009, according to the *Technology Review* web-site, seven of its faculty members have been selected as TR 35 young innovators — a unique distinction worldwide among full-time, junior faculty.

PHOTO BY NOE MONTES

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ERIC GARCETTI ON "THE FUTURE OF TECH IN LOS ANGELES"

DEAN'S LETTER

Imagination: The Driver and Speed Limit of Innovation

Among the 14 Grand Challenges for Engineering announced by the National Academy of Engineering is "Enhance virtual reality." It falls in the bucket of "enriching life" or "the joy of life." It is also at the core of the intersection between engineering and the arts, sometimes also narrowly (and erroneously) referred to as digital media.

The USC Viterbi School of Engineering has been in the avant-garde of this intersection for some time now, benefiting greatly from our collaboration with USC's six arts schools – among them the preeminent USC School of Cinematic Arts. Our School's marriage with the arts began in earnest with the award of the NSF Engineering Research Center in Integrated Media (Integrated Media Systems Center, or IMSC) in 1996, founded by current President C. L. Max Nikias; continuing with the Department of Defense-supported Institute for Creative Technologies (ICT), which emerged from the Information Sciences Institute (ISI) in 1999 as an independent research entity; and the creation of the vibrant USC Games program in 2006, in partnership with the School of Cinematic Arts. Today, the latter program continues to lead the nation.

Graphics, games and special effects all contribute to the enhancement of virtual reality for many purposes, from entertainment to education. It is another manifestation of the empowering nature of technology. Virtual reality is also the language of mathematical simulation—a language that has been used with prolific success over the centuries for modeling and understanding natural and biological phenomena and for building our world, one that never was.

I like to use the following definition of technology: exploiting (in the positive sense) phenomena for useful purposes. In the past, most phenomena of interest to technology were of physical or chemical origin. More recently, biological phenomena have become the foundation of great technological advances, ushering the convergence of engineering and medicine. But with the recent exponential advances in information technology, social phenomena are now becoming the surprise subject of technological applications. Think Facebook, Twitter, social media, digital media. It is this space where engineering and art (and the social sciences) are converging.

The rapidly emerging field of Big Data will be used to make sense of that phenomena, first through uncovering correlations and then by postulating new laws.

Technology is often used as a vehicle for translation, e.g., for that of artistic expression. As new technological feats are achieved, this translation becomes better, easier and more accessible, allowing infinitely many nuances. But it is not a one-way conduit, and it is not only limited to the arts. Technology has empowered the consumer of the artistic expression, the receiver of the message in communications or policy, to have his reaction sensed, carried back or spread, instantly, accurately, unequivocally. This feedback allows for better analytics for improving the message and the influence. Often, the consumer also becomes at the same time the creator, in a crowd-sourcing sense, even in a one-to-one interactive relationship, enabled by technology; hitherto only a matter of fantasy or science fiction, now amazingly possible.

I would argue, therefore, that the role of technology in this domain is no longer that of the plumbing of information. Rather it is enabling the discovery of new, unprecedented methods of creating and of communicating, where our own imagination becomes the driver, and the limit, of innovation. In this respect I often think that what microscopes, controllers, sensors and fabrication devices are for the natural sciences, digital media are for the social sciences and the arts. It is also where the NAE Grand Challenges could have been extended to include another bucket, in addition to sustainability, security, health and the joy of life: that of societal organization.

As technology inexorably advances, at least within the context of a continuing Moore's law, we'll confront some really important issues. As technology permeates more and more the human and societal interaction; as it empowers the sciences to ask fundamental questions about the human brain, and then about the "neuroscience" of human behavior and societal interaction; as such steps are becoming bigger and bolder, we will then come closer to the understanding of our own humanity, spirituality and creativity, and to celebrate and treasure them as never before.

[signature]

BY THE NUMBERS

This year's ranking of DEN@Viterbi (*US News & World Report*—Best Online Graduate Engineering Program) and USC Games (*The Princeton Review*—Top Graduate School for Video Game Design), a joint program between USC Viterbi and the USC School of Cinematic Arts.

The number of USC students, alumni and others who participated in the inaugural Viterbi Startup Garage, a 12-week tech accelerator held in Marina del Rey, Calif. Participants worked with consultants from USC Viterbi, Kleiner Perkins Caufield & Byers, and United Talent Agency to develop their product ideas. (see story, page 26)

The number of years since the school was named! On March 2, 2004, Andrew J. and Erna Viterbi gave $52 million to the school. Andrew Viterbi is the co-founder of Qualcomm and earned his doctorate in electrical engineering from USC in 1962.

#1
25
10
$500,000,000
$3,250,000
7 ft. 1 in.
3,000

The grant amount that the Bill & Melinda Gates Foundation and the John S. and James L. Knight Foundation awarded the Norman Lear Center to establish the Media Impact Project. With support from USC Viterbi researchers, the project will measure the social impact of media. (see story, page 22)

The amount that USC Viterbi's fundraising initiative aims to raise as part of the Campaign for the University of Southern California. To date, $146 million has been raised to help "create the world that never was."

viterbi.usc.edu/giving/

The height of Steel Cyclone, a battling robot built by USC Viterbi alumnus George Kirkman for competition in the SyFy network's Robot Combat League. (see story, page 40)

The approximate number of endangered languages in the world (of 7,000 total). David Chiang and his team are developing a computer linguistics program that provides a cheaper, faster way of preserving endangered languages and are currently documenting 15 languages in Papua New Guinea. (see story, page 10)

Jimmy Iovine and Dr. Dre Establish an Innovative Academy at USC

Cross-disciplinary curriculum will include engineering and foster ingenuity

By Megan Hazle

Last spring, USC President C. L. Max Nikias announced that music industry icons Jimmy Iovine and Andre Young, also known as Dr. Dre, have given $70 million to the university to establish a specialized undergraduate program. The USC Jimmy Iovine and Andre Young Academy for Arts, Technology and the Business of Innovation will span traditional disciplinary boundaries to encourage students to create new art forms, technologies and business models.

Faculty from USC Viterbi, the USC Marshall School of Business, the USC Roski School of Fine Arts and the USC Thornton School of Music are working together to shape programming and a four-year curriculum for the academy that will provide its students with in-depth learning opportunities in engineering, computer science, business, fine arts, visual design and leadership. USC Viterbi faculty, including Ashish Soni (founding director of the Viterbi Students Institute for Innovation and the Viterbi Startup Garage) and Michael Zyda (founding director of the USC GamePipe Laboratory), and faculty members in the Information Technology Program, are consulting on the curriculum development for the engineering-focused coursework.

The core of the curriculum will focus on four areas—arts and entrepreneurship; technology, design and marketability; concept and business platforms; and creating a prototype—and will include a capstone experience, called the Garage. In the Garage, fourth-year students will form project teams to develop a prototype over their final year. The program will also include internship opportunities and interaction with faculty and entertainment industry mentors who will also serve as guest speakers and lecturers. The first class of 25 students will begin their coursework next fall.

Both Iovine and Young have decades-long, accomplished careers in the music industry as well as a collaborative relationship that preceded their partnership on the new academy at USC. Now chairman of Universal Music Group's Interscope-Geffen-A&M Records, Iovine co-founded Interscope Records in 1990, a label that includes many successful artists including Lady Gaga and Dr. Dre. A co-founder of NWA, Young made his solo debut with the album *The Chronic* and launched the record company Aftermath Entertainment, which represents hip-hop artists including 50 Cent and Eminem. Together, Iovine and Young founded Beats Electronics in 2006, a high-performance headphone and sound company that has since successfully expanded into smartphones and car audio systems.

This gift is part of the Campaign for the University of Southern California, a multiyear effort to raise $6 billion in private philanthropy to advance the university's academic priorities and expand its impact.

Moving ISI to New Levels of Excellence

Former Raytheon executive Prem Natarajan takes the helm of ISI

By Marc Ballon

Prem Natarajan long held USC and its Information Sciences Institute (ISI) in the highest esteem, seeing them as engines of innovation that create jobs, fuel the economy and benefit the world.

That's why the former executive vice president at Raytheon BBN Technologies in Cambridge, Mass., is excited to have landed the top position at ISI, one of the nation's largest and most successful university-affiliated research institute.

"I am truly excited to be at ISI, which provides an outstanding platform for exerting an international impact in several key technology areas," said Natarajan, who holds a PhD in electrical engineering from Tufts University.

USC Viterbi Dean Yannis Yortsos said he expects Natarajan to contribute significantly to the Institute's longstanding excellence.

"In the person of Dr. Natarajan, we look for the continuation and growth of the Keith Uncapher and Herb Schorr legacies, and the development of a truly exciting new vision for the Institute," Yortsos said.

Natarajan succeeds USC Viterbi Executive Vice Dean John O'Brien, who served as interim executive director for 10 months.

O'Brien enjoyed his ISI tenure, he added. "I learned and appreciated much more deeply the breadth and depth of the work going on at the Institute."

Natarajan, who began his new job on July 1, envisions ISI building on its thought-leadership position in areas such as networking, natural language processing, advanced electronics and quantum computing. Natarajan also expects the Institute to demonstrate leadership and have a major impact in emerging areas such as social media technologies, multimedia information processing and cybersecurity, and in the role of technology in education.

Natarajan brings a potent mix of managerial experience and scholarship to ISI. During his 17 years at Raytheon, Natarajan made a name for himself both as a mentor and a researcher. He holds four patents.

Having grown up in India, Natarajan is conversant in four languages, which partly explains his interest in language processing technologies such as handwriting recognition, speech recognition and machine translation. He also showed an early interest in science, in fourth grade fashioning a flashlight out of a camphor tin box, a spring and a light bulb.

"That gave me a little more cachet with my friends," he said with a laugh.

HOW TO SAVE AN ENDANGERED LANGUAGE

In Five Easy Steps

Research Assistant Professor David Chiang works to preserve dying languages for their cultural and scientific value.

By Anna-Catherine Brigida

"A language will only stay alive if its community wants it to stay alive."
—D. Chiang

1

HOP ON A PLANE

to a country that's home to one of the world's roughly 3,000 endangered languages. Better yet, head to Papua New Guinea, the most linguistically diverse place on earth. That's what David Chiang, computer scientist with the USC Viterbi Information Sciences Institute, did in May 2012. There, he collected data on 15 endangered languages.

2

FIND HAPPY & EAGER RESIDENTS

willing to share their language with you. For example, the Gahuku clan of the Eastern Highlands of Papua New Guinea speaks Alekano. There are only 25,000 speakers.

3

RECORD 100 HOURS OF AUDIO

It's estimated that you'll need about a million spoken words to preserve an endangered language. Give the local residents voice recorders and ask them questions like, "How do you start a chainsaw? How do you make a muumuu?" Don't forget to have a translator listen to all 100 hours and record an English translation.

4

GET OUT YOUR COMPUTER

Now that you have all the data, you can use your extensive knowledge of computer programming to start analyzing the information. What words are used most frequently? Are certain words related to others? Once you have aligned the Alekano data with its English translation, you can build a machine translation system and see how well you can translate Alekano into English.

5

ARCHIVE & DISSEMINATE THE DATA

Identify linguists and anthropologists who care deeply about preserving endangered languages, cultures and histories. Share, as appropriate.

Chiang and his team gathered data on 15 endangered languages in Papua New Guinea.

Glossary

Financial Engineering
By Katie McKissick

Financial markets are complicated, interconnected and constantly fluctuating. Understanding them and making predictions have proven difficult in the past. It's time to bring in the engineers.

The new discipline of financial engineering uses the power of engineering tools to dissect, demystify and discern the many cause-and-effect relationships at work and how they affect everyone's bottom line.

Electrical Engineering Professor Petros Ioannou teaches financial engineering students to use computer models to analyze the complexities of the marketplace. Here's an overview of the industry terminology.

DUPONT ANALYSIS
A way to analyze return on equity by evaluating profitability, operating efficiency and financial leverage.

Dupont analysis: it's 423.7% better than a crystal ball.

MARTINGALES
A scenario where past events have no bearing on the future outcomes because it is purely random.

A schizophrenic nightingale would be a martingale.

STOCHASTIC PROCESS
A situation where the behavior of a system is random and needs to be analyzed based on probabilities.

Reginald's bizarre behavior at the garden party could only be explained with stochastic processes.

STOCK VALUATION
The method used to calculate the value of companies and their stocks .

Ted applied his stock valuation expertise to himself within the dating market. His value was lower than he'd projected.

BROWNIAN MOTION OR WIENER PROCESS
A mathematical model used to describe completely random movements.

Only Brownian motion could describe Gladys's black lab's search for the perfect spot to pee.

MARKOV CHAINS
A model of random events where the next state depends only on the previous state and not on the past ones.

Elsa tried to explain Markov Chains to her car insurance agent, but he seemed skeptical.
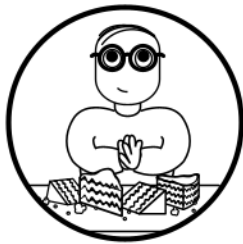
DYNAMIC PROGRAMMING
A method for solving complex problems by breaking them down into smaller issues.

Ted used a dynamic programming method to eat an entire cake by himself: He just cut it into very small pieces first.

TABU SEARCH
A search for a solution to a problem that keeps track of what has already been tried and seeks different solutions.

Toddlers often employ Tabu search methods when trying to convince their parents that they really need to have a cookie.

GENETIC ALGORITHMS
A problem-solving technique that uses methods inspired by biological evolution to be more efficient.

Hopefully genetic algorithms could come up with something better than evolution's naked mole rat.

RENEWAL THEORY
A part of probability theory that considers random events and the time each one takes to guess when a certain outcome might present itself.

Based on renewal theory, an orangutan randomly pounding a keyboard would need two years to write a Simpsons' episode.

FINANCIAL RATIO
A comparison of two values in an enterprise's financial statements used to compare strengths and weaknesses in a company.

Steve feared his ornate cubicle decorations might somehow affect the company's financial ratio.

DERIVATIVE
A security whose price is derived from one or more underlying assets.

After the zombie apocalypse, no one will be bartering with derivatives.
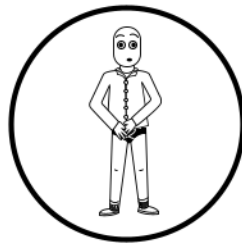
STOCHASTIC ANNEALING
A method for finding the best solution to a complex problem given a finite amount of time.

Bob had less than five seconds to figure out how to explain why he wasn't wearing pants. Time for some stochastic annealing!
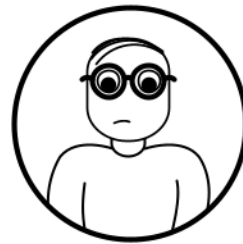
SECURITY
Any kind of tradable asset.

No, Frank, your "shining personality" is not a security.

"ENGINEERING: THE MOTION PICTURE"

NINE IDEAS FOR THE NEXT TV SHOW OR FILM ABOUT ENGINEERS

In his most recent *Forbes* editorial, Andrew Viterbi lamented the appetite of young people for careers in the STEM fields (science, technology, engineering and math). He wrote: "We have to do everything we can to overcome the negative perception of engineers and make the profession more attractive to prospective students.... Is it ridiculous to think we can elevate the top minds within the scientific community to true celebrity status? I don't think it is so far-fetched. As the estimable Norman Augustine once stated, if there can be a popular TV show called 'L.A. Law,' why not an equally engaging prime-time drama called 'L.A. Engineering?'"

In that spirit, *USC Viterbi* magazine seized the gauntlet, brainstorming ideas for the next great film or TV show to feature engineers and scientists. Our target audience: middle school and high school students.

The Tower
Genre: Mystery/drama

In the middle of the desert, Alistair McKeon, a mysterious engineer/billionaire, builds the first 100-kilometer tower, reaching all the way into space. A dazzling vertical city becomes the Earth's most ambitious engineering and social experiment.

Entangled
Genre: Romantic Comedy

When Chaz, a cocky young particle physicist on track to win the Nobel Prize, accidentally opens up a rift in spacetime—he becomes stuck in time—doomed to repeat the same day and the same failed experiment forever—unless he can make amends and win the respect of his colleague and adversary, Lydia, the only one with the knowledge to fix his mistake.

Dakar
Genre: Adventure

A young mechanical engineer convinces his father, an aging auto mechanic, to help him home-build a rally truck to enter the Paris-Dakar rally. They get in, but find themselves in over their heads and at each other's throats on the remote and dangerous race route.

Office Bionic
Genre: Mockumentary

Tracking the minutia of the lab space a la "The Office," juxtaposing everyday work drudgery (stale coffee and never being able to find the stapler) alongside ground-breaking work in biomedical engineering.

Two and a Half Limbs
Genre: Action / Adventure / Buddy Story

After a tragic shrimping accident that literally cost him an arm and a leg, a dispirited Harris Swagner was resigned to live out his life confined to a chair—until a chance encounter with an eccentric roboticist (or is he a mad scientist?!) and a brush with the law changed everything.

Trapeze, Moon, Inferno
Genre: Sci-fi action/adventure

"Fear drove humans into space, curiosity kept them there, and money made them kill for it." The first space war erupts after an incredible find on the moons of Jupiter. Former astronauts and engineers are pressed into service as the first starfighter pilots in history.

The Bee Keeper
Genre: Thriller

A retired engineer who gave up the field years ago for a simpler life raising bees learns the big agricultural companies are plotting to decimate bee populations to force farmers to buy their seeds. He and a team of high school delinquents forced to do community service on his farm must uncover the data proving the conspiracy before bee populations disappear forever.
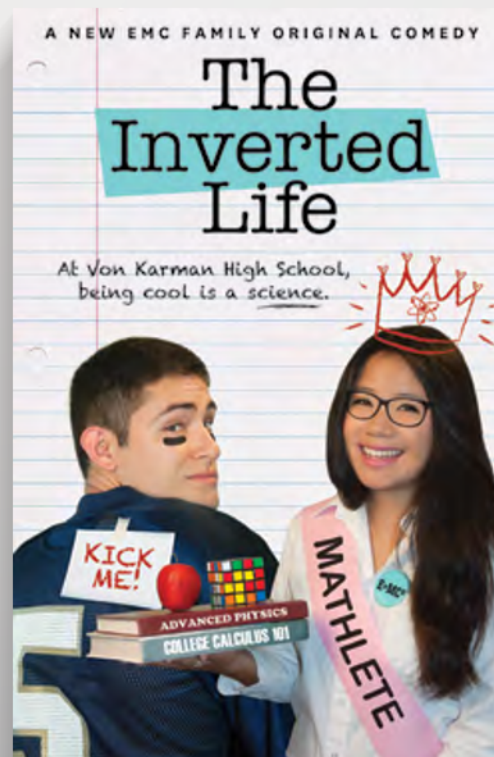
The Inverted Life
Genre: Comedy

At Von Karman High School, the social order is reversed. Mathletes and Science Olympiad stars run the school, ostracizing jocks and cheerleaders alike. Quinn Shepherd, the lowly high school quarterback, will stop at nothing to win the Science and Inventors Showcase, thereby earning his spot among the cool kids.

Rapper's Delight
Genre: Coming of Age Comedy

A nerdy electrical engineer with a secret love of hip-hop designs a vocal processing machine that transforms her reedy, nasally voice into the most funky of instruments. Her creation turns this sheltered, shy, suburban girl into an unlikely rap star who parties with Jay-Z and Beyoncé and tops the iTunes charts.

Faculty Accolades

01 **Alan Willner**
2014 IEEE Eric E. Sumner Award

02 **Andrea Armani**
Popular Science's "Brilliant 10" Grainger Foundation Frontiers of Engineering Grant

03 **Barry Boehm**
AIAA Aerospace Software Engineering Award

04 **Burcin Becerik-Gerber**
Selected to participate in the National Academy of Engineering's (NAE) 2013 U.S. Frontiers of Engineering Symposium

05 **Craig Knoblock**
Best Paper Award, Extended Semantic Web Conference

06 **Eric Shen**
Outstanding Educator Award, Western District of the Institute of Transportation Engineers

07 **Gerard Medioni**
2013 USC Mellon Mentoring Award, Faculty Mentoring Graduate Students Category

08 **Giuseppe Caire**
Alexander von Humboldt Professorship, International Award for Research in Germany

09 **Henry Koffman**
2013 USC Mellon Mentoring Award, Faculty Mentoring Undergraduate Students Category

10 **Jonathan Gratch**
Best Paper Award, IEEE International Conference on Automatic Face and Gesture Recognition

11 **Louis-Philippe Morency**
Best Paper Award, IEEE International Conference on Automatic Face and Gesture Recognition

12 **Lucio Soibelman**
American Society of Civil Engineers (ASCE) Fellow

13 **Milind Tambe**
Meritorious team commendation for service, The Commandant of the U.S. Coast Guard

14 **Patrick Lynett**
2013 Walter L. Huber Civil Engineering Research Prize

15 **Pedro Szekely**
Best Paper Award, Extended Semantic Web Conference

16 **Theodore Berger**
MIT Technology Review's 10 Breakthrough Technologies List IEEE Engineering, Medicine and Biology Society's Academic Career Achievement Award

17 **Yannis C. Yortsos**
Associate member of the Academy of Athens

18 **Hao Li**
MIT Technology Review's "35 Top Innovators Under 35"

18 **Francisco Valero-Cuevas**
HENAAC Award in Technical Achievement

Timeline: Engineers In Hollywood

In film and television, engineers have been portrayed as everything from madmen to superheroes. Along the way, they've invented Aston Martins with ejector seats, DeLorean time machines and Kevlar-reinforced Batsuits. Ranked on a scale of 1 to 10 of engineering genius and "cool factor," here are Hollywood's best engineers.

COOL

10
09
08
07
06
05
04
03
02
01

NOT COOL

1985 — **Angus MacGyver** *MacGyver*
2008 — **Tony Stark** *Iron Man*
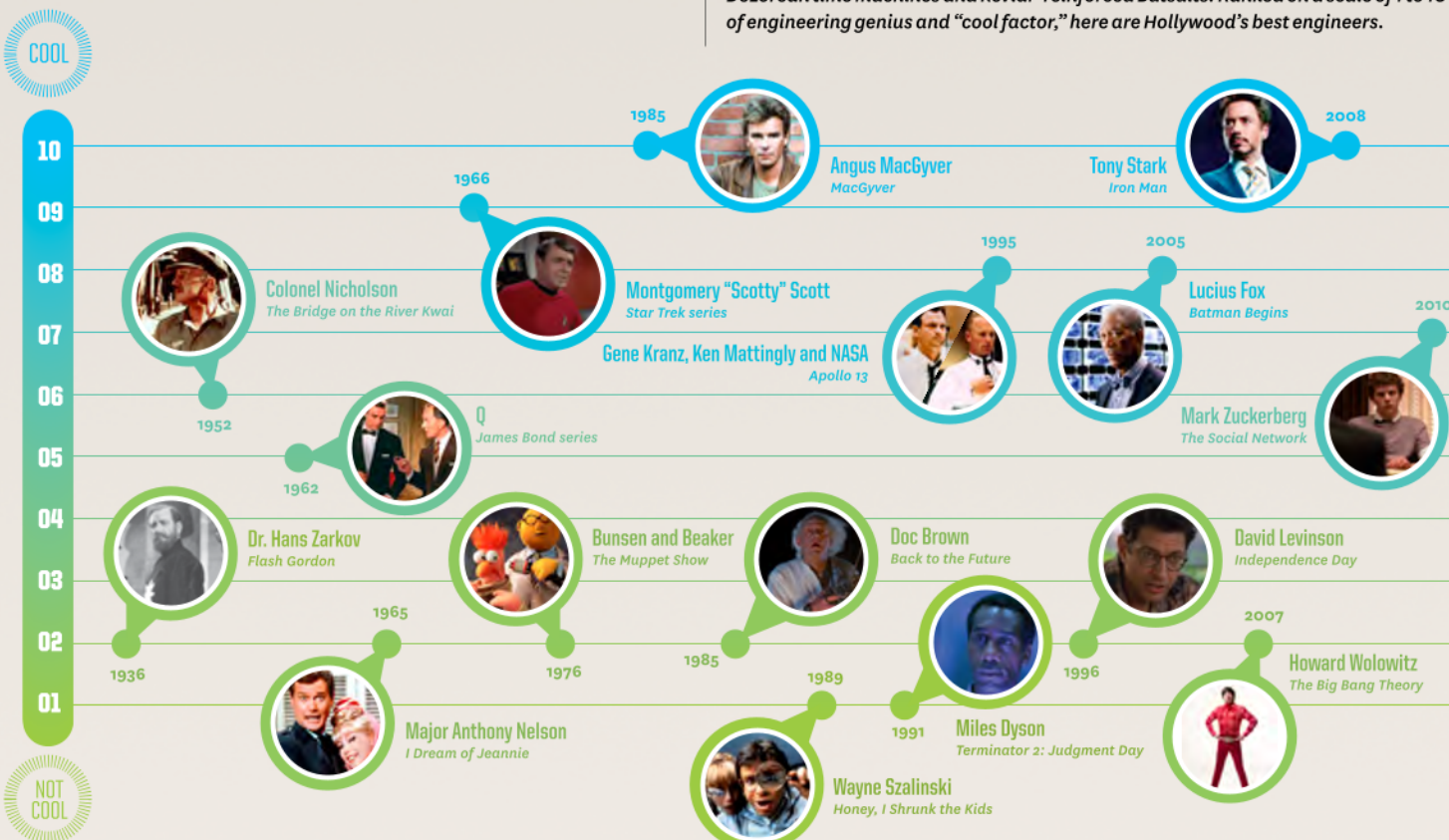1966 — **Montgomery "Scotty" Scott** *Star Trek series*
1995 — **Gene Kranz, Ken Mattingly and NASA** *Apollo 13*
2005 — **Lucius Fox** *Batman Begins*
2010 — **Mark Zuckerberg** *The Social Network*
Colonel Nicholson *The Bridge on the River Kwai*
1952 — **Q** *James Bond series*
1962
Dr. Hans Zarkov *Flash Gordon*
Bunsen and Beaker *The Muppet Show*
Doc Brown *Back to the Future*
David Levinson *Independence Day*
1965 — 2007
1936 — **Howard Wolowitz** *The Big Bang Theory*
1976 — 1985 — 1989
Major Anthony Nelson *I Dream of Jeannie*
1991 — **Miles Dyson** *Terminator 2: Judgment Day* — 1996
Wayne Szalinski *Honey, I Shrunk the Kids*

The Spiky-Haired Computer Scientist Revolutionizing Animation

Why Hao Li left a major Hollywood effects studio to join the USC Viterbi Department of Computer Science

By Rosalie Murphy

At only 32, Hao Li's teams have already built the technology that drives the Microsoft Kinect and developed the animation system that will make Star Wars characters snarl and squint in more detail than ever in J.J. Abrams' forthcoming film. He's helped cancer researchers track tumors in real time and animal biologists trace patterns in elephant skin. His next venture brings him to Los Angeles, where he'll join USC Viterbi as a tenure-track assistant professor this fall.

Li is hardly a stereotypical computer science professor, though—he's the life of the party. Fluent in English, French, German and Mandarin, Li sports a Mohawk with blonde tips. His YouTube channel is a potpourri of research demos backed by rock songs, serious technical conference presentations and playfully self-deprecating portraits.

At USC Viterbi, Li will launch the Geometric Capture Lab, a team within the USC Computer Graphics research group dedicated to advancing 3-D acquisition and animation technologies.

"Hao's work is extremely creative," Computer Science Department Chair Gaurav Sukhatme said. "A lot of people in the computer science graphics community took notice at an early age. He has a very dynamic mix of deep technical skills and art."

Born in Germany to Taiwanese parents, Li grew up drawing avidly and dreaming of a career as a Disney artist. But then he started programming on a computer his father brought home from his lab, and computer-generated graphics in movies like *Terminator 2* captivated the aspiring animator.

"I thought, That's much cooler than if I were to just become an artist. I could use technology to improve art," Li said.

Now, his research focuses on capturing body and facial movements in three dimensions and in real time. In Hollywood, his algorithms capture human performances and model them for animated characters. In medicine, they support radiation therapy systems and track heartbeats.

He comes to USC from George Lucas' visual effects company, Industrial Light & Magic. Li had developed an algorithm for non-rigid registration, allowing filmmakers to capture facial motion using geometry, without placing a single tracking dot on an actor's skin, just a year after *The Curious Case of Benjamin Button* (2008) made vivid, mutable faces so desirable. He spent the summer of 2009 sharing the state-of-the-art project with ILM while writing his dissertation at ETH Zurich.

Li returned to Switzerland to finish his degree, spent a year as a postdoctoral fellow at Columbia and Princeton, then rejoined ILM to advance real-time performance capture technology for *Star Wars: Episode VII*.

After a full year with the company, "I definitely wanted to go back to academia," Li said. "In a big corporation, you're not that free to do whatever you want. If you have the strong desire to pursue long-term visions that are riskier than the immediate interests of a company, then academia is the right place to do it."

Li joins USC's Jernej Barbic of Computer Science and Paul Debevec of the USC Institute for Creative Technologies (ICT) in the Computer Graphics group. Debevec's work on 2009's *Avatar* won a Scientific and Engineering Academy Award, and Li hopes that together they can re-create faces more accurately than ever.

"I was looking for a place where people are sort of young and where they have the potential to become big. It's like a startup," Li said. "I think in a few years we can build something huge."

Li will probably teach a new undergraduate graphics class in spring 2014.

"We want faculty to collaborate with people outside computer science—in games, film, medicine," Sukhatme said. "We want people who will set the trends."
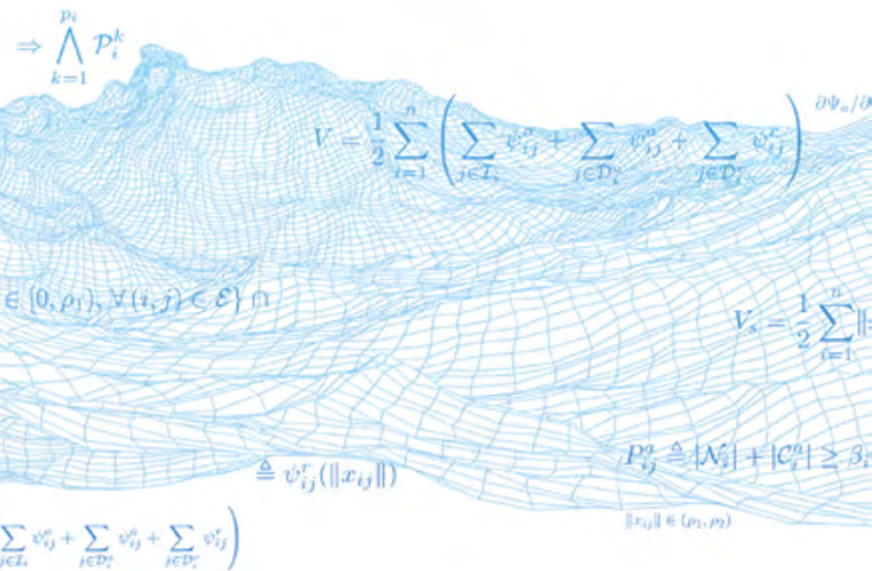
And from Mohawks to movie sets to cancer treatment, it's tough to call Li anything but a trendsetter.

PHOTOGRAPH BY NOE MONTES

A Beautiful Mind

By Marc Ballon

A surfing accident left Viterbi School PhD student Ryan Williams a quadriplegic, but his drive and USC's distance-learning program have allowed him to pursue his academic dreams

Ryan Williams led a charmed, sun-splashed existence.

The USC Viterbi School of Engineering PhD student found his classes stimulating, professors engaging and research on autonomous underwater robots fascinating. And then there was his California Dreamin' lifestyle.

Williams, a Roanoke, Va., native, luxuriated in the Southern California sunshine, golfing, swimming and skiing. He even took up surfing, which exhilarated and energized him.

And then everything changed.

On Jan. 27, 2008, Williams went to Santa Monica with friends to catch some waves. As he paddled toward the breakers, he dove under an oncoming swell. In a freak accident, he landed headfirst in a hidden sandbar and snapped his neck. At just 26, the former high school pitcher and star basketball player had become a quadriplegic, with no use of his legs and limited use of his hands.

Many people in a similar position would have understandably retreated into self-pity and bitterness.

Not Williams.

"I don't feel downtrodden at all," he said. "I try to say, 'This is life. This is the way it is. Let's try to do something with it.'"

And so he has.

After his accident, Williams returned to his family's Virginia home nearly 2,500 miles away. But DEN@Viterbi, USC Viterbi's award-winning Distance Education Network, made it possible for him to pursue his academic dreams. Through the program, Williams took three online graduate engineering classes to complete his doctoral program's required coursework, including his favorite one on probabilistic graphical models.

U.S. News & World Report recently named DEN@Viterbi the nation's No. 1 online graduate engineering program and USC Viterbi No. 1 in online computer science.

Still, Williams' transition from on-campus to distance-learning student has required some adjustments.

Prior to his accident, he had planned to study underwater robots. However, he changed his focus because of his inability to conduct on-site research and distance from the USC robotics lab.

Today, Williams' basic research investigates the development of algorithms for multi-agent systems to interact intelligently and autonomously. His work, he said, might one day help satellites, robots or military drones function more efficiently.

Williams' typical workday begins at 9 a.m. and runs late into the evening. Sitting in front of his computer, he corresponds with colleagues via Skype, runs simulations and takes "sanity breaks" to ruminate.

To type, Williams puts his hands into a brace with a pencil attached at the end. He uses his right hand to hunt and peck about 25 to 30 words per minute. His left hand operates the mouse and shift key. This makeshift method causes Williams intense arm and neck discomfort.

He tries to carry on much as he did before.

Last fall, Williams flew to Southern California for his oral PhD qualifying exam, which he passed. To make the trip, his father drove them in a van for four hours to a hotel near Dulles International Airport in Greater Washington, D.C., where they spent the night. The next day, his father and an airline employee lifted Williams out of his wheelchair and placed him in a smaller one that could easily go up and down the plane's aisles.

At USC, Williams said he greatly appreciates the support he has received from several Viterbi School professors, especially his PhD advisor, Gaurav

"I don't feel downtrodden at all. I try to say, 'This is life. This is the way it is. Let's try to do something with it.'"

Sukhatme, chairman of the Department of Computer Science. Sukhatme has advised him on everything from how to submit and publish academic papers to what to focus on in his dissertation.

"Ryan is intellectually a very gifted person who is very much in charge of his life," Sukhatme said. "I see great things ahead for him."

At an early age, Williams displayed the creativity and attention to detail he would later exhibit as an engineering student, spending hours alone with Legos and Lincoln Logs building castles, spaceships and other complex structures. He went on to graduate summa cum laude from Virginia Tech with a Bachelor of Science in computer engineering.

In 2006, Williams came to USC, thriving on the "freedom USC afforded me to be creative."

That USC connection has never wavered. When his professors learned of Williams' surfing accident, they immediately came to the hospital to support him. Their message was the same: They would help however they could to ensure his continued academic success.

Williams plans to graduate next year from USC Viterbi and "not a second later," he said.

"Within the next decade, I expect to have an academic research lab at a top university and serve as an adviser to a committed group of graduate students," he said. "I don't know that any of this would have been possible without USC."

Creating the Key

By Rosalie Murphy

A historian found a century-old precinct map in an archival basement. Now, the Information Sciences Institutes has engineered it to help tell an American story

It's Election Day, 1920. American women cast national ballots for the first time. The results are broadcast on the radio. And 75 percent of California voters approve the Alien Land Law, which prevented Japanese immigrants from owning land.

Studying the law for a forthcoming book, USC History Associate Professor Lon Kurashige found Los Angeles's 1920 election returns and a precinct map in city archives. That's all USC Viterbi researchers needed to give Kurashige access to more information than he imagined.

"I asked, 'Hey, here's a map I found. How can I make it useable?'… And he just did his magic," Kurashige said.

What Kurashige calls "magic" was another day's work for Yao-Yi Chiang, a lecturer at the USC Spatial Sciences Institute and a postdoctoral researcher who joined the USC Information Sciences Institute (ISI) in 2007 and received his PhD in Computer Science in 2010.

"He got this map with a bunch of red lines, 724 of them, and he made it operable for me," Kurashige said. "I didn't have to do anything but upload my data."

Chiang and ISI's director of Information Integration, Craig Knoblock, started with topographic maps kept by the U.S. Geological Survey since 1884. More than 200,000 of these maps detail altitude, railroads, forests and creeks, and cover every inch of the contiguous United States. In a future project, Chiang hopes to compare old maps to new ones to reveal growing urban centers, eroding rivers and changing transportation corridors, for example.

Like Kurashige's precinct map, those maps were originally stored in raster format—that is, as simple scanned images. But Chiang's computer program, Strabo, converts map images into vector data, which stores boundaries and map features as complete lines, not collections of pixels.

This way, a geographic information system (GIS)—a computer program designed to analyze historical data, common in history and geography studies—can recognize a polygon as a certain voting precinct and link it to that precinct's demographic and voting record data, or recognize a road and link it to any information the user provides.

In Kurashige's case, creating a modern electoral map confirmed his theory: White, working-class neighborhoods on the South Side supported the Alien Land Law, but African-American and wealthy neighborhoods opposed it. He could have manually matched data to precincts on a paper map, but visualizing votes on this ballot issue and precincts' racial and economic makeup at the same time would be nearly impossible.

"I don't think I would have done it if I had to do it by hand. Now, with the click of a button, I can see all those percentages. The way you can manipulate the data is essential," Kurashige said. "I wouldn't be able to make any of these claims without that image."

Strabo is about 80 percent accurate on its first read; users correct mistakes. In 2009 and 2010, Department of Defense employees operating the program took 70 percent less time than a human-only team to process sample maps.

"We still require the user to do the work, but our job is to train the computer to do the heavy lifting," Chiang said.

The potential to create global, data-linked records from existing maps with such little manual effort has drawn the Air Force Office of Scientific Research

Right now, Yao-Yi Chiang and Craig Knoblock's software reads multicolored and grayscale maps and English words. They hope to expand its extraction techniques so it can work on duotone maps and eventually recognize Chinese characters.

and the National Geospatial Intelligence Agency to Chiang and Knoblock's work.

"In some places, the most current [map] data is from World War II," Knoblock said. Satellites cannot peer through trees, around corners or down sharp cliffs. But geospatial data integration—combining data from multiple map sources using a GIS—could allow agencies to share data about flood plains, freeways and fault lines seamlessly.

Most maritime maps exist only in raster format too. To extract data from existing nautical charts, "someone sits there and clicks on the locations and enters the values for all the soundings on a chart. It's very slow," Knoblock said. But transforming maps of buoy markers, depth changes and chemical readings into vector layers makes it possible to use them in electronic navigation systems. "In maps, we have so much knowledge," Chiang said.

ILLUSTRATION: GREER FRESHWATER BURTON

Playlist: Music to Engineer To
SC RACING

By Kathleen Concialdi

SC Racing is a student-run group that uses their engineering skills to design and race a new Formula-style race car every year. On any given night team members can be found in a makeshift car shop in campus Parking Structure A, designing and producing the next great race car to compete at the annual Formula SAE in Lincoln, Neb. Below is the playlist that provides the soundtrack to the building and racing process.

(Compiled by SC Racing President Luke Heisinger and the SC Racing Team)

▶ **"Controversy"** by Milkman: *"Nearly all of us take the EE 423 Loudspeaker design class, and the race team members build their speaker boxes in the race shop and become very picky about the tonality and the engineering behind how the music sounds."*

▶ **"Phantom Pt. II"** by Justice: *"All the techno-style songs are from a playlist called Good Welding Music."*

▶ **"Headlock (feat. Johanna Phraze)"** by Bad Boy Bill: *"The members care less about what is played as long as it is upbeat. It's a comedic situation, but we love it."*

▶ **"Hanger 18, Rust in Peace"** by Megadeath: *"Our shop where we build our cars is in PSA—we have a raw concrete floor and ceiling, and chain-link fence, with tarps for walls. The music is always very loud and upbeat. It seems like it's usually something with a lot of rock guitar, or an upbeat techno song."*

▶ **"Life in the Fast lane"** by The Eagles: *This song is "mildly about cars, and we like to talk about going fast in our car."*

Mashups:
Take any two songs, blend them together using common beats or harmonies to create a new, unique song, and you have a mashup. (Take OutKast's "Hey Ya," mix it with Queen's "We Will Rock You," and you've got "Hey We Will Rock You Ya.") Mashups are great ways to get anyone fired up and excited. Says Heisinger, "To build a car like we do, it takes a lot of physical hard work, so I think we like music that gets us pumped up." Below is a list of SC Racing's favorite mashups.

"Beat It Barbara" by 3LAU
"Do What U Like (feat. Alyssa Palmer)" by Bad Boy Bill
"G6 Kids" by Lobsterdust
"Call Me Greyhound (Kap Slap Bootleg)" by Swedish House Mafia feat. Carly Rae Jepsen

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Programming Rosie

Teaching robots to navigate cluttered spaces

By Katie McKissick

1950s home appliance advertisements promised the luxurious lifestyle only a combination freezer refrigerator could allow and the banishment of "wash day blues" by means of an automatic laundry machine. It seemed that toasters, stand mixers and electric ranges were the key to a happy life. Indeed, the advent of the home appliance did change our lives for the better, freeing up countless hours to spend in more fulfilling pursuits, but little has changed since those magazine advertisements boasted the merits of giving a Hoover vacuum as a birthday present.

What will be the next breakthrough in housework delegation?

Robots.

Today the household robot market is limited to Roomba vacuum cleaners and variations that mop floors, clean pools and wash windows. But in the near future we will bring home assistive robots with appendages and movable digits that can do more than clean surfaces: they will fold laundry, find lost shoes and put away groceries… and so much more!

But the Spartan futuristic household that employed Rosie in *The Jetsons* has not come to pass. How will robots function in a cluttered and disorganized average human home?

Graduate student Megha Gupta answers questions like these in the Robotics Embedded Systems Laboratory in the group of Gaurav Sukhatme, USC Viterbi School of Engineering Computer Science professor and chairman. She works with a PR2 robot that uses an Xbox 360 Kinect to perceive the world around it. She writes algorithms to prepare robots for different challenges when it comes to sorting and searching for items in disorganized spaces.

To sort items in a messy pile, the robot has a physical constraint: its ability to grasp with its two digits. In a pile of blocks, for example, the PR2 has difficulty picking up just one block from the stack. "If objects are all cluttered together, we tend to spread them out," Gupta explained, so she programmed the robot to do the same. It scatters the objects until its target is not touching anything else. Only then will it attempt to pick it up.

To search for an item in a crowded cupboard, Gupta established three types of spaces on a shelf: occupied, free and hidden. Gupta's algorithms instruct the robot to search the hidden spaces by moving other objects out of the way. To search for an object, the robot looks in the largest hidden space first, by moving a cereal box perhaps. If the object is not found, it looks behind the next biggest object until the target is located.

Gupta now wants to move in the direction of robotic learning. She will write algorithms that allow the robot to adapt to different situations. "The human should have to show the robot a couple of times what we would do in a situation, and the robot should learn," she said.

University Space Race

The USC Rocket Lab aims to become the first university to get to space

By Stephanie Shimada

Established in 2005, the USC Rocket Propulsion Laboratory (USC Rocket Lab) is a wholly student-run research organization dedicated to a single mission: build a custom-designed rocket and send it to space. The group has made significant advances in rocket technology and has designed and flown an eight-mission set to date.

Since the Rocket Lab's inception, a university space race has been stirring across the country. Now, only two groups remain standing: USC and a Dutch group. Both teams claim to have the capability to get to space this year. Which team will prevail? Keep your eyes on the horizon this fall as USC attempts to take its trusty rocket Traveler where no student-designed rocket has gone before—past the 100-kilometer-high Kármán Line and into space.

DC-1 DEL CARBON
1st Flight: May 2006
Altitude: 7,000 ft.
Max Speed: Unknown

DC-2 DEL CARBON
2nd Flight: October 2006
Altitude: 21,500 ft.
Max Speed: Mach 1.4

DC-3 DEL CARBON
3rd Flight: April 2007
Altitude: 18,461 ft.
Max Speed: Mach 1

DD-1 DOUBLE DOUBLE
Flight: April 2008
Altitude: 45,000 ft.
Max Speed: Mach 2.5
The two-stage rocket is now in "temporary storage" in the Mojave Desert (read: completely, totally lost)

DG-1 DEL GRANDE
1st Flight: October 2009
Altitude: 22,900 ft.
Max Speed: Mach 1.2

DG-2 DEL GRANDE
2nd Flight: April 2011
Altitude: 20,000 ft.
Max Speed: Mach 1.1

SS-3 SILVER SPUR 3
Flight: October 2011
Altitude: 59,000 ft.
Max Speed: Mach 4.2

SB-1 SIXYBACK
Flight: December 2012
Altitude: 63,000 ft.
Max Speed: Mach 4

TTS-1 TEXAS TWO STEP
Flight: April 2013
Actual Altitude: 12,000 ft.
Expected Altitude: 70,000 ft.
Max Speed: Mach 1.2

GR-1 GRAVELER
Test Date: May 2013
Ground Test of Traveler motor
Produced 4,000 lbs. of thrust
Shares its name with a bipedal Pokemon

TR-1 TRAVELER
Proj. Flight: September 2013
Expected Altitude: 360,000 ft.
Expected Speed: Mach 6.5

Mesosphere
Stratosphere
Troposphere

Meteors
Noctilucent Clouds
75 Km.
Sounding Rockets
Nacreous Clouds
50 Km.
Felix Baumgartner Space Dive
Ozone Layer
25 Km.
Cirrus Clouds
Cumulonimbus Clouds
Commercial Flight
Cumulus Clouds
Mt. Everest
Empire State Bldg.

DC-1 DC-2 DC-3 DD-1 DG-1 DG-2 SS-3 SB-1 TTS-1 GR-1 TR-1
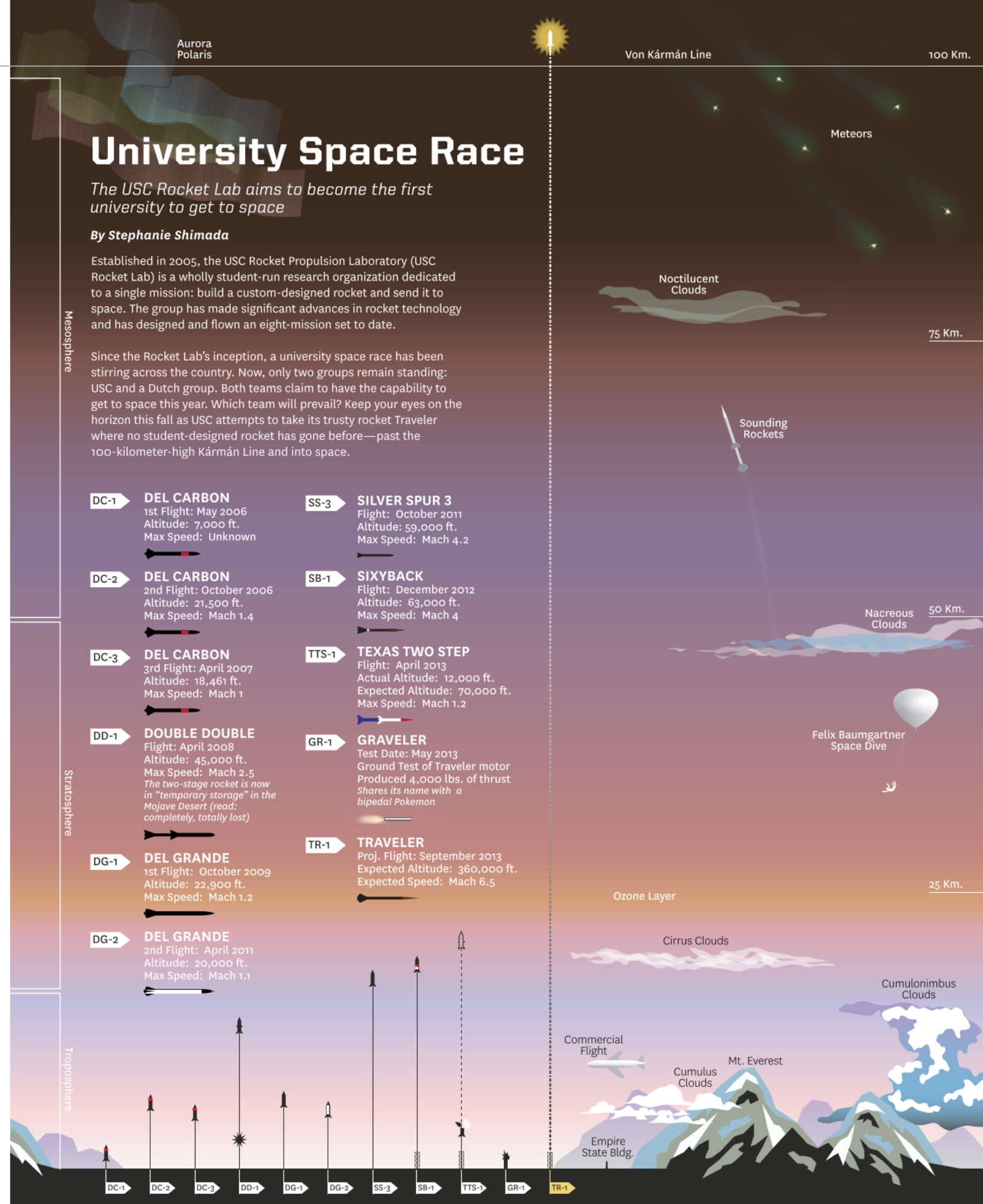
iWatch Can Help Fight Terror

USC Viterbi Professor Cyrus Shahabi is developing an intelligent surveillance system that can help law enforcement detect and eradicate threats of mass destruction

By Conrad Wilton
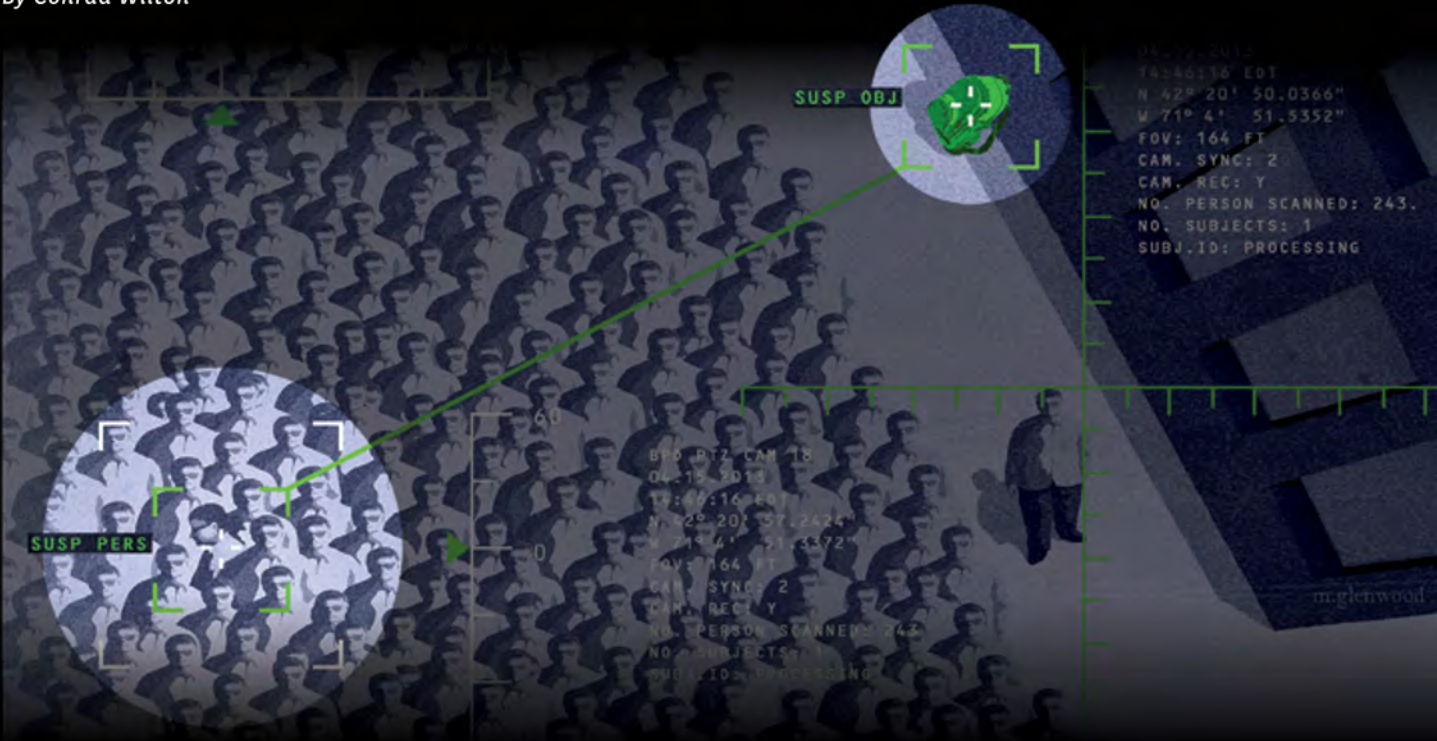
On April 15, two terrorists planted bombs packed with shrapnel, ball bearings and nails at the Boston Marathon, killing three people and injuring hundreds more.

Surveillance cameras captured the Tsarnaev brothers dropping backpacks two and a half minutes before the bombs inside exploded. Thankfully, the images captured by those cameras later allowed police to stop the pair. But the damage was done.

According to the Heritage Foundation, "of the 50 publicly known terrorist plots against the U.S. foiled since 9/11, 42 could be considered homegrown terrorism." Although authorities have thwarted most attacks, the tragedy of the Boston bombing serves as a harrowing reminder that there is little room for error.

Cyrus Shahabi, USC Viterbi professor of computer science and electrical engineering, is creating a powerful technology that could help police prevent such attacks and quickly track terrorists before they strike again.

Shahabi, along with dozens of PhD candidates, postdoctoral students and faculty, has developed iWatch, or "Intelligent Watch," which extracts video from a city's surveillance cameras and stores it in a massive database for computer processing. iWatch analyzes the data to detect suspicious behavior, such as someone abandoning a backpack. The system then immediately flags questionable or suspicious footage for law enforcement officers to review.

"iWatch reveals the where, when, what and who of

certain data," said Shahabi, whose favorite television show is *Person of Interest*, a CBS drama featuring a computer program that analyzes information collected from public surveillance cameras and other sources to identify suspects and threats before a crime occurs.

iWatch uses USC-designed Pan Tilt Zoom (PTZ) surveillance cameras to automatically detect and track every person's face that appears in a single frame of video. iWatch can then zoom in, producing high-resolution images of faces. The PTZ system, which USC Viterbi Professor of Computer Science and Electrical Engineering Gerard Medioni developed, can help identify suspects to pursue as events unfold.

Since some of Boston's surveillance cameras are PTZ, "police could have used our iWatch software to easily locate, access and disseminate high-resolution images of suspects in a matter of seconds," said Medioni, an expert in imaging technology including surveillance and automated face recognition.

In the event terrorists elude detection and successfully launch an attack, iWatch can help police identify and apprehend suspects after the crime has been committed.

"After the bombings in Boston, the FBI asked everyone at the marathon to upload all of their videos and pictures," Shahabi said. "That's terabytes of data. How do you process all of it?"

In Boston, FBI agents sorted through this massive amount of data. Although they identified the suspects relatively quickly, iWatch could likely have

hastened the process by extracting the GPS data from all the cameras and phones used to send videos of the event. From there, iWatch can tag each video with a specific time frame and field of view.

"Let's say you're interested in a certain area between 2:45 p.m. and 2:50 p.m.," Shahabi explained. "iWatch can immediately show you only the videos that overlap into this area within this time frame. So suddenly, instead of terabytes of data, you only need to deal with megabytes, and it is much easier to manage as a result."

This technology might have helped FBI agents identify the bombing suspects sooner, perhaps leading to an earlier arrest. Considering that Dzhokhar Tsarnaev allegedly admitted that he and his brother, Tamerlan, planned another attack in the near future, police did not have much time to catch the pair before they struck again.

iWatch is a $1 million, two-year effort funded by the National Institute of Justice. Although it is still a prototype and has not been applied to the real world, USC's Department of Public Safety has said it might start using iWatch to improve crime prevention and more strategically deploy resources as soon as next year.

"iWatch is a powerful tool because once everything is tagged in time and space, then suddenly everything becomes linked," Shahabi said. "Once you connect the dots, you can quickly track criminals and protect innocent people."

Watch Movies on Your Phone... Faster

How USC Viterbi engineers are streamlining wireless video streaming

by Katie McKissick
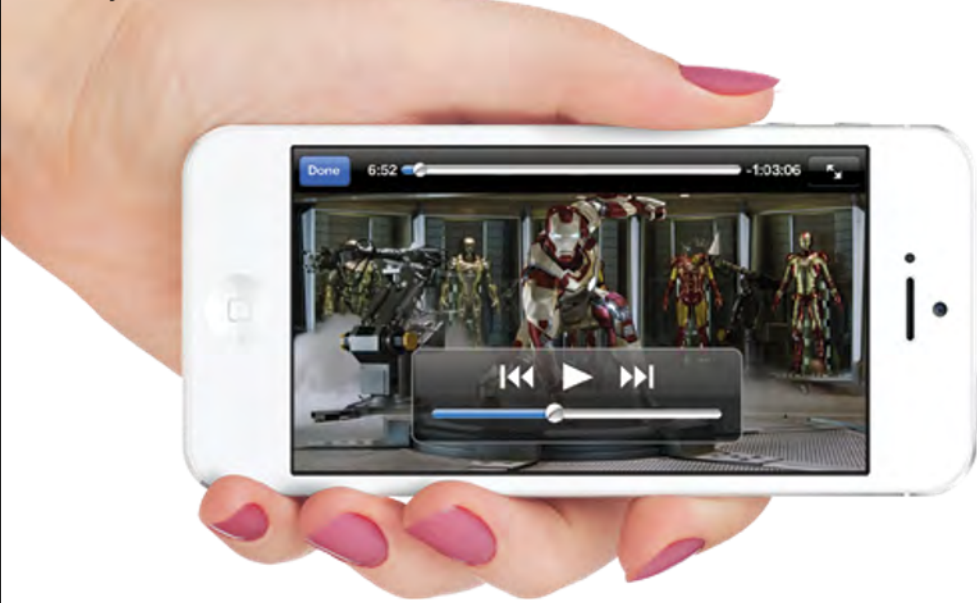
You're on the hot, crowded metro getting to work. To distract yourself, you decide to watch *Iron Man 3* on your mobile tablet. Your signal is weak, and you don't want to spend half your commute watching the video sputter and buffer. But someone a few rows back has the movie cached on her cellphone, available to be streamed by users nearby. Your phones establish a connection, and before you can say "avoiding data overage charges," you're watching Robert Downey Jr. don his cardinal exoskeleton.

This is precisely how Andreas Molisch, USC Viterbi professor of electrical engineering, envisions people watching videos in the future on their mobile devices. He and a team of engineers are researching ways to more efficiently transmit video across cellular networks. This work is a joint effort with Giuseppe Caire and Michael Neely from electrical engineering systems and Antonio Ortega from signal and image processing. Intel and Cisco have already provided $300,000 in funding toward this goal.

Video traffic is by far the fastest growing type of wireless data traffic, and it's anticipated to increase by a factor of 70 over the next five years. Today, watching a movie on a smartphone or tablet involves a lengthy download process that can use as much as half of the monthly data allotment from a cellular provider.

How can we become better at transferring video data to mobile users?

"Something unique to video content is that a relatively small number of files account for a large part of the overall traffic," says Molisch. A new release of the latest blockbuster movie, for instance, might account for a majority of the video downloads on a given day.

Right now, advances in hard drive storage space are growing faster than anything else in telecommunications, so Molisch's team will use this to their advantage. "We can use local caching of popular files to get a better network."

Rather than rebuild existing infrastructure, which would be expensive and time-consuming, Molisch's team is working on a concept that would instead employ networks of "helper stations," mobile-accessed hard drives that store the most in-demand video files. These helper stations might be installed on existing infrastructure such as telephone poles, or cellular providers could give customers discounts on their bills for storing one at home. People's devices themselves could even serve as helper stations, reserving a portion of the memory to be dedicated to caching videos that other users nearby could wirelessly access.

"From Intel's perspective, this is creating new product opportunities to build platforms in the network and at the edge of the network which integrate greater intelligence (i.e., CPU processing), storage, and communications together, and will also create new opportunities for smarter devices," says Jeff Foerster, Principal Engineer at Intel.

But once the helper stations are in place, how are they updated with new video files, and who decides which files to store?

Molisch has a plan for that.

"You can download it slowly at an off-peak hour using wireless 3G functionality from a base station when no one else needs that bandwidth," Molisch says. Since this upkeep will only happen about every week, it doesn't need to be as fast.

The video content available for easy downloading could be determined by projected popularity, date of release or industry competition. Distributors could vie for coveted disc space on one of the many deployed helper stations. In this way, they can shorten the bridge between content creators and the consumers of their media. Everybody wins, and you can easily watch *Iron Man 3* on the metro ride to work.

Happy Together

By Marc Ballon

The emerging field of behavioral signal processing might hold the key to better couples' counseling

A young married couple attends a counseling session together, sharing their feelings, frustrations and needs.

"You work too much. You're never home," the wife says. "I mean, isn't there life outside of work? I can't be by myself all the time."

Her husband leans back, sighs and briefly stares at the ceiling.

The woman calls her spouse a workaholic and complains that they are drifting apart. "I feel like I'm living with a roommate," she says. "You're a stranger to me now. I wasn't expecting this when we got married."

Again, he pauses, leans back, sighs and briefly stares at the ceiling. "Are you done dumping on me?" he says.

"I'm not dumping on you," she says, her voice rising. "I'm calling it as it is."

Clearly, this is a relationship in need of repair.

However, the pair's willingness to speak hard truths and confront problems head-on would seem to give rise to some optimism.

Not necessarily. Beneath the surface, several largely hidden interactions are taking place that cast their union in a much darker light. Thanks to the pioneering work of a team of USC engineers, marriage and family researchers and counselors might one day have access to a treasure trove of additional information that could both deepen their understanding of couple dynamics and increase their effectiveness. In the process, therapists just might save more troubled relationships.

Shrikanth Narayanan, the Andrew J. Viterbi Professor of Engineering, and USC Engineering Research Assistant Professor Panayiotis Georgiou are at the vanguard of a new field called behavioral signal processing (BSP) and informatics. BSP aims to capture, quantify and interpret human behavior, both overt and covert, through the use of engineering, computing and algorithms.

By sifting through massive amounts of data captured by videotape, audio recordings and physiological sensors, behavioral signal processing can consistently and objectively evaluate vocal synchronization, word choice, gestures and minute physiological changes—information that can provide clues about a relationship's health that even the most attentive therapists might otherwise miss or just be unable to process.

Along the way, USC scientists have refined their technology and algorithms to better detect and analyze both verbal and non-verbal behavior. This valuable information, when combined with a therapist's professional observations, provides a richer and more nuanced picture of a couple's relationship, and perhaps their future prospects.

"We want to support, not supplant, human expertise," said Narayanan, whose ongoing BSP research includes autism diagnosis, learning quality and measuring the effectiveness of addiction therapeutic practices.

How does this all work in practice? Let's revisit our married couple. In the above example, the husband and wife never shouted, swore or glared at one another. They also appeared to honestly communicate their emotions, no matter how painful.

So far, so good.

However, an audiovisual analysis of the session uncovered deeper fissures.

Turns out the couple used the word "you" repeatedly during their session. In counseling arguments, a preponderance of "you" is an indicator of blaming behavior. A computer evaluating their movements and gestures found that the couple continuously moved ever so slightly away from each another, and that the husband often averted his wife's gaze by looking at the ceiling. Not good.

Additionally, algorithms mapped a worrisome lack of vocal synchronization. When the wife spoke loudly, her husband spoke softly. When he spoke slowly, she often spoke quickly. They interrupted each other.

Taken together, behavior informatics revealed the magnitude of the couple's problems. Their marriage and family counselor—now armed with objective data about the couple's lack of vocal entrainment, their frequent use of the blaming word "you," and their avoidance behavior in moving away from one another—could use those new insights to modify the therapy for the betterment of all.

USC's distressed couples' research, though not yet in the translational phase, holds considerable promise. Georgiou seeks additional funding for a study that would allow therapists to monitor interactions throughout the week instead of only during sessions.

For instance, couples in therapy might set aside time at home to talk about a particularly nettlesome issue and record their conversation on a mobile phone. The device could then remotely transmit the conversation securely to a computer for processing and analysis, giving therapists valuable information prior to the next counseling session.

And it's not just couples that stand to benefit from Narayanan, Georgiou and their team's behavioral signal processing studies.

"Computational tools can model not only couples who are interacting but also the psychologist who is judging," Narayanan said. "Hopefully, we can offer insights about what works and what seems to work less well."

Using massive amounts of data captured by video, audio recordings and physiological sensors, behavioral signal processing (BSP) can provide clues about a relationship's health that even the most attentive therapists might otherwise miss or just be unable to process.

Can Media Create the Ideal Citizen?

USC Viterbi and Annenberg schools measure media impact

By Jennifer Delson
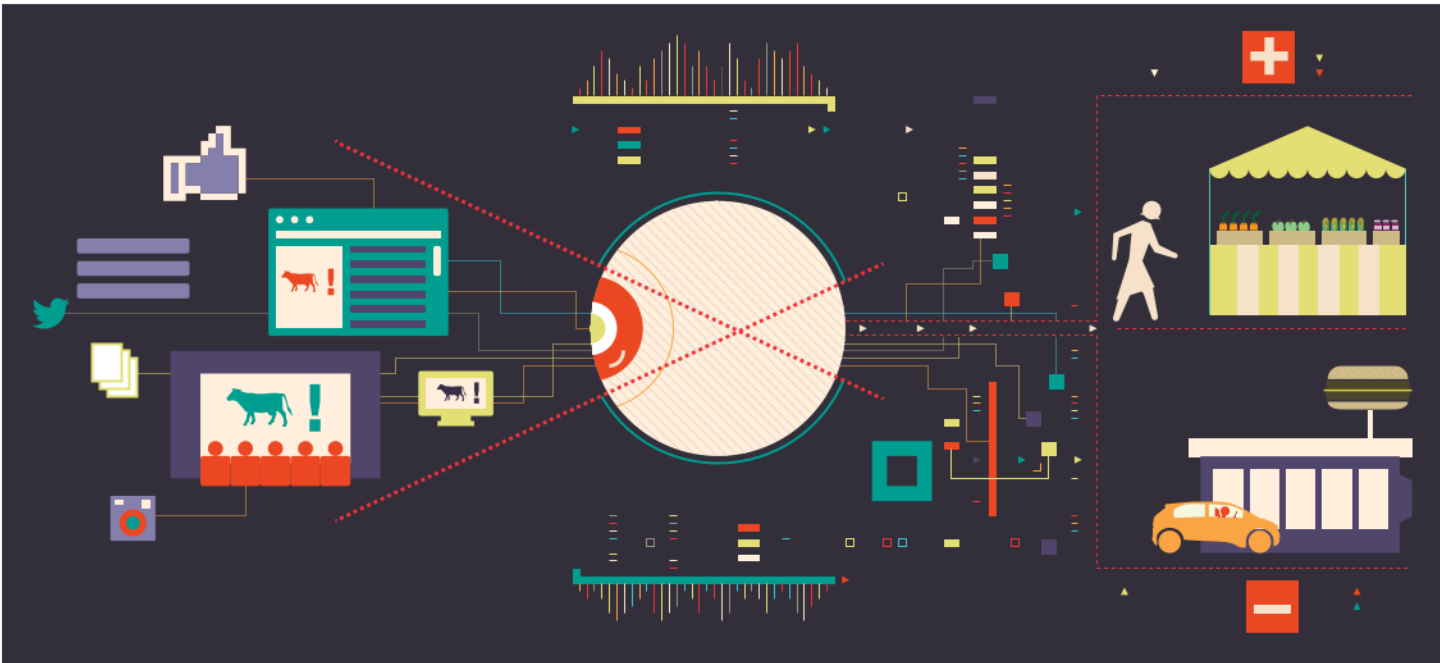
The icons representing Facebook, Twitter and LinkedIn have become symbols as common as the red, yellow and green circles in traffic lights. But what impacts do these social media outlets, and all media outlets, really have on our behavior?

Astonishingly, there are very few tools available to measure the impact of media. Sophisticated analytic methods have never been used before to measure how a newspaper opinion piece, a documentary film or a television show could influence societal behaviors.

Ironically, archaic metrics are commonly used to gauge audience engagement with content and its effects on individual perceptions and behaviors. Page views, TV ratings, "likes" and retweets just don't pack enough punch to reveal how media influences people's awareness or actions.

The USC Viterbi School of Engineering hopes to change that by teaming up with the USC Annenberg School for Communication and Journalism for the Media Impact Project. The effort has received $3.25 million in initial funding from the Bill & Melinda Gates Foundation and the John S. and James L. Knight Foundation. The foundations conducted three summits in 2011 and 2012 to discuss the challenges in media analytics and then conducted interviews around the globe before choosing to invest in USC.

"We are especially interested in the bigger picture—how, in this day and age, does media make us better citizens, and whether the words on the page had an impact, positive or negative," said Carl Kesselman, director of the Center for Health Informatics, USC Information Sciences Institute. "Our goal is broader than commerce."

The effort will measure changes in attitudes, knowledge and behavior to determine whether media has the impact desired by its creators. For instance, after watching a documentary about food safety, is the viewer more likely than a similar non-viewer to eat more healthfully or to have more conversations with friends and family about food safety?

These are the types of questions Johanna Blakely, managing director and director of research at the Norman Lear Center, asked in a USC study of the documentary *Food, Inc.*, which concluded that the movie did indeed lead viewers to eat more healthy food and shop at farmers' markets.

Similarly, more than a decade ago, the Lear Center employed a matrix to determine that an episode of the daytime drama *The Bold and the Beautiful* about an HIV-positive character changed attitudes about the disease. When viewers were provided a hotline number, they called it, the study showed, indicating that audiences can be motivated by a dramatic health-related television story to seek health information.

The center will use similar methods to evaluate the impact of TV shows, fiction films, radio programming and news websites. Instead of looking at the number of clicks, tweets or likes, the Center will look at their impact.

The results, he said, will manifest how engineering

Carl Kesselman of the Center for Health Informatics—who has crunched such complex data sets as all the prescriptions issued in a health community—will develop the analytical machine for the center.

can be applied to socially relevant problems and bolster the idea that engineering can be multidisciplinary. The metrics that will be developed will be available to community organizations and others.

"For years, [Annenberg] Dean [Ernest James] Wilson and Dean Yortsos have been speaking about the ways our two schools complement each other," said Martin Kaplan, Norman Lear Professor of Entertainment, Media and Society at USC Annenberg, and director of the Lear Center. "Now we have a project with the potential to demonstrate that. As it turns out, the Lear Center has also been studying the process of collaboration at USC."

Blakely, who has spent years studying media's impact, is thrilled to get the support of the engineering school. Kesselman and his team will be able to crunch vast sets of data to provide tools that are currently the secret weapons of marketers, she said.

"What we see is that private companies try to process data but generally do not reveal their processes," Blakely said, adding that this project will allow everyone to have a uniform way to measure the impact. "For the first time, everyone will be able to benefit from an open and transparent way to see the effect of media."

Communicating Beneath the Waves

An overview of USC Viterbi wireless underwater networks

By Katie McKissick

Designing and deploying an underwater sensor network requires a highly interdisciplinary set of skills from communications, control, robotics and sensing.

Depending on the application, engineers and computer scientists as well as marine biologists, environmentalists, military experts and public policy makers will come together to coordinate research and development. Applications of these networks are wide and far-reaching, including environmental monitoring, tsunami detection, oil and gas recovery, aquaculture, military surveillance, and climate sensing and control.

Given these possibilities, there is strong interest in furthering the technology that will enable such systems. Professor Urbashi Mitra from the Ming Hsieh Department of Electrical Engineering designs underwater wireless networks that allow underwater robots to communicate with each other and relay information to humans.

TRANSMITTED DATA

DISTORTED SIGNALS

RECEIVED SIGNAL

2 Buoys receive acoustic signals and send an above-ground radio signal to a satellite, which in turn relays the information to a science station, enabling prompt tsunami warnings.

3 Stations based on the coast send radio communication to ships that are in contact with mobile underwater robots.

5 Underwater robots send collected data to nearby robots, unmanned vehicles, buoys or ships.

4 Underwater semi-autonomous robots make control and communication decisions while balancing energy efficiency, the ability to communicate and mission objectives, such as collecting environmental data, sealing underwater pipe leaks or tending aquaculture.

These wireless networks transmit signals that have much in common with the communication signals for underwater mammals such as dolphins and whales.

A major challenge for underwater acoustic communications is retrieving the original data signal from the highly distorted and noisy received signal.

Sending and receiving acoustic signals, especially from moving objects, requires novel communications and signal processing methods to counteract distortion from currents, echoes and spatial variations in water properties.

1 Stationary sensors monitor seafloor conditions for earthquakes, always ready to relay critical time-sensitive information to nearby buoys via acoustic signals.
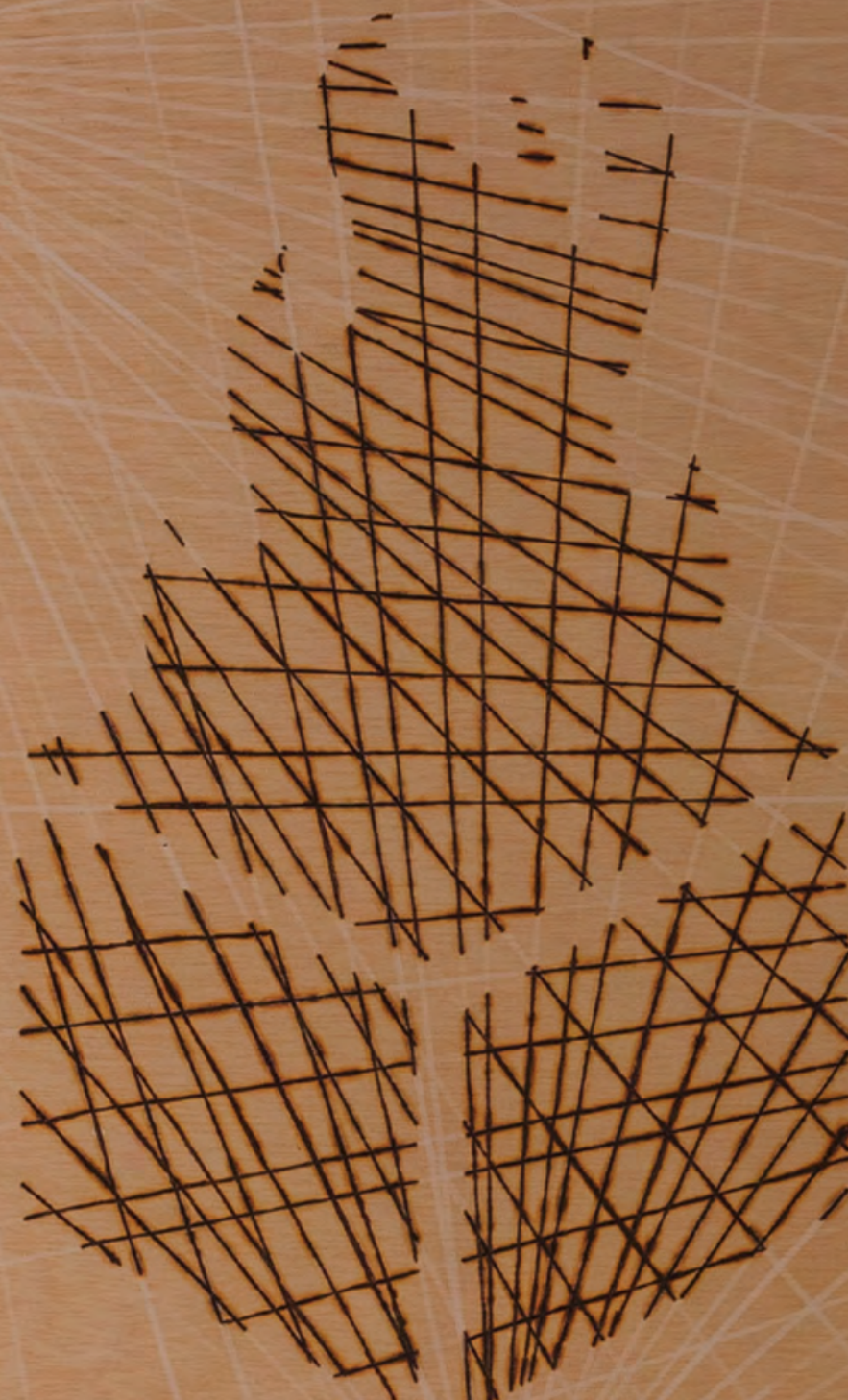
Fanning The Flame

ARMED WITH CURIOSITY AND FLEXIBILITY, VISHAL SANKHLA SEEKS STARTUP STARDOM

By Rosalie Murphy

Vishal Sankhla started Viralheat as a weekend hobby. But in the eight years since Sankhla and co-founder Raj Kadam met, the company has grown into a venture capital-funded social media management platform with all the trimmings. Clients can monitor Twitter hashtags and Google keywords, measure positive and negative sentiment in posts, and communicate with users on an unlimited number of accounts. Now Viralheat is starting to go viral itself.

Viralheat has 25,000 subscribers, including Amazon.com, Men's Wearhouse and Six Flags, and nearly 200 more join every day. *Forbes* lauded Viralheat's May update as "the best new app for social media on the go," and the company plans to close a second round of funding by this time next year.

USC Viterbi alumnus Sankhla didn't arrive at the engineering school thinking of Silicon Valley. But when he earned his master's degree in electrical engineering in 2004, he knew he could succeed there.

"USC really helped me explore and find out what I liked," Sankhla said. He took computer science courses and wrote a master's thesis advised by USC Research Associate Professor Clifford Neuman—something only about two percent of MS students do, Neuman estimates.

"It has to have some implication beyond educating yourself," Neuman said. "Very few people choose to do that."

That research led Sankhla to a career in computer programming. Without it, "I wouldn't have joined that startup, and I wouldn't have met my co-founder," he said.

The startup was Network Chemistry, where he developed Wi-Fi security systems, the subject of his thesis. He and Kadam worked closely with one another as engineers, but popped into sales and marketing discussions as data analysts. Sankhla had attended USC Marshall presentations on entrepreneurship and marketing during his time on campus, and now he supplemented those discussions with practical knowledge.

"I had that startup exposure very early on," Sankhla said. "Meeting MBA grads, going to presentations at USC, really helped plant that seed."

That seed sprouted, cultivated by Kadam's and Sankhla's shared fascination with YouTube.

"We were really trying to understand what makes a video viral," Sankhla said. "We started looking at views, comments, people favoriting it … and we started putting out these little charts every week. That's actually how we got our first customer"—Coca-Cola, which asked the duo to measure the success of its commercials online.

Network Chemistry's owners sold the company in 2007; Kadam joined the new team and Sankhla took a job at Cisco. Throughout 2008, they met on weekends to tinker with algorithms. They consulted for political firms managing Barack Obama's and Hillary Clinton's presidential primary campaigns. Then, in December 2009, they received their first $75,000 in seed capital. Suddenly, Viralheat was real.

Fortunately for Sankhla—who grew up in India and studied at USC Viterbi on a student visa—Kadam was a U.S. citizen. Sankhla's H-1B visa did not permit him to start his own company.

"The whole issue around being an immigrant and being a startup founder is a big one," Sankhla said. "There are a lot of smart people out there, from USC and other colleges, who don't even try starting a company."

But Sankhla couldn't leave the project now. He applied for a long-term visa while Kadam became CEO. In early 2011, Viralheat closed its first round of funding with $4.25 million, led by venture firm Mayfield Fund.

Today, many of its 25,000 users pay for their subscriptions, and some request the highest-tier, customized "enterprise" suite, which costs about $2,500. The vast majority of Viralheat's revenue comes from subscriptions, but clients can also pay for "Developer" status, which gives them access to Viralheat's APIs.

And despite his duty as co-founder to address business concerns, Sankhla remains the company's chief technology officer.

"Try to imagine 500 million tweets sent out today, millions of communications happening on Facebook, large amounts of video uploaded on YouTube. Taking data from all these and analyzing them quickly is a very, very interesting technical problem," he said. "Having the technical background and skills I developed at USC has really helped."

Already with 13 employees, Viralheat plans to double its staff in the next year. And as he did at USC, Sankhla is eager to keep exploring until he finds a perfect fit.

"We are in this for the long run, absolutely," Sankhla said.

Viralheat began as a platform for YouTube analysis. Now, it provides a nearly complete social media toolkit to marketing teams. The company hopes eventually to provide insights to its clients about how they can better use the platform to engage with audiences.

ENTERPRISING ENGINEERS

The Viterbi Startup Garage, a venture accelerator for engineering-led new student businesses, aims to create the next Facebook in Los Angeles

By Marc Ballon

USC Viterbi School of Engineering alumnus Jeff Khoshgozaran had an exciting idea for a startup.

Why not create a location-specific app that provides information in real-time about interesting goings-on in a given neighborhood? Through the app, people could learn about local concerts and festivals, traffic jams, news, unfolding emergencies, flash sales at nearby hotels, restaurants and retailers, and much more.

In early 2013, Khoshgozaran and two other engineers co-founded Tilofy (combining "time" and "location") to bring their concept to market. Khoshgozaran, with a USC Viterbi PhD and a pedigree that includes stints at Yahoo, Microsoft and Samsung Electronics, quickly positioned the new business for success. Within a few weeks, he secured more than $200,000 in seed funding and an offer from a Silicon Valley incubator to move Tilofy up north, which Khoshgozaran said would "expose us to a strong network of Bay Area investors."

As has happened all too often, it appeared the Southland would lose yet another promising engineering-led venture to the land of Apple, Google and Facebook.

Los Angeles has much going for it—a vibrant culture, great weather, Hollywood diversity, and world-class universities such as USC, UCLA and Caltech. But the City of Angels lags when it comes to nurturing high-tech startups.

Whereas Silicon Valley has nearly 160 venture capital firms, with $5 billion to $10 billion in available capital, Los Angeles has fewer than 20 venture funds, with only $500 million to $1 billion, according to PricewaterhouseCoopers. Silicon Valley also dwarfs Los Angeles when it comes to the number of high-tech incubators, business development consultants, angel investors, tech firms, entrepreneurs and engineering talent, the ingredients that make for a flourishing startup ecosystem.

Despite Silicon Valley's allure, Khoshgozaran

and his Tilofy co-founders decided to remain in LA. Why? The Viterbi Startup Garage, a new USC-created accelerator created specifically to keep companies like Tilofy in Southern California by providing them the support and resources they need to succeed.

The Startup Garage is a unique collaboration among USC, venture capital giant Kleiner Perkins Caufield & Byers, and United Talent Agency (UTA), a Hollywood talent firm that for several years has advised entrepreneurs on strategy, key partnerships, business development and other growth-oriented strategies.

"The Startup Garage allowed the Tilofy team to stay in 'Silicon Beach,'" Khoshgozaran said. "We believe USC's partnership with Kleiner Perkins and UTA has fundamentally differentiated it from other startup accelerators."

The brainchild of Ashish Soni, executive director of Digital Innovation in Engineering and founding

STARTUP COMPANIES

MEDIAHOUND
A social discovery platform for premium entertainment, MediaHound helps users discover, consume and share movies, TV shows, music, books and games.

RACEVINE
A website that aggregates and reviews thousands of endurance races around the country. In the future, this comprehensive race index will add more social components as well as an event management platform, including race registration features.

GYMFLOW
The GymFlow mobile platform leverages historical data and gym card swipes to predict current and future fitness center traffic to help people who work out avoid crowds and long waits. Future GymFlow applications might include restaurants, clubs, bars and shopping malls.

EVERLAB
Everlab makes the Koala mobile app that allows people to give their photos a voice. After a user captures a photo, he or she can record an audio annotation to tell the photo's story, and then send it off to any of their contacts.

LOOKALLURE
The LookAllure app helps consumers find specific fashion items they want at nearby stores or online. Shoppers take a picture of the desired shoes, bags, clothes or accessories, and the LookAllure app searches for them or something similar.

MOVING ANALYTICS
A phone-based app that measures daily movements, including walking and sitting, and makes smart recommendations to increase healthy physical activities.

AIO ROBOTICS
AIO Robotics is designing and building an all-in-one 3-D copy machine that combines 3-D scanning and 3-D printing technology. Consumers can make a 3-D copy of an object with the push of a button.

TILOFY
Tilofy (short for "Time" and "Location") is a location-specific app that provides information in real-time about interesting goings-on in a given neighborhood. Through the app, people could learn about what's happening at local concerts and festivals, traffic jams, news, unfolding emergencies, flash sales at nearby hotels, restaurants, retailers and much more.

TAGGLE
An online reverse auction platform, Taggle seamlessly brings together buyers who want customized T-shirts with local screen printers, who place quotes to do the work. At www.letstaggle.com, customers get competitive prices and manufacturers have the opportunity to win jobs.

SCHOLASPHERE
Scholasphere allows college students to apply for many scholarship opportunities using one application.

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director of the USC Viterbi Student Innovation Institute (VSI2), the Startup Garage offers financial support, mentoring and other strategic resources to a select group of USC student and alumni entrepreneurs over a 12-week period. More than 90 teams competed for 10 spots in the accelerator, which launched May 28. Each team, co-founded or led by a current USC Viterbi student or alumnus, received $20,000 in exchange for 4 percent equity.

"The ultimate vision is to help create the biggest technology company in LA, which will create a ripple effect and build a thriving ecosystem of new investors, professional services and entrepreneurs," Soni said. "We want to keep engineers and other talent that drive the economy here in Los Angeles."

New firms create about 3 million jobs per year, according to the Ewing Marion Kauffman Foundation, an entrepreneurial advocacy group.

Given engineers' integral role in today's high-tech economy, it makes sense for USC Viterbi to nurture its students' talents for the benefit of Southern California and beyond, USC Viterbi Dean Yannis Yortsos said.

"The world is being re-created and reimagined like never before, with an astonishing speed, at an exponential pace and in front of our very eyes, thanks to engineering and technology," Yortsos said.

The 10 Startup Garage teams reached several milestones during their time in the accelerator. At one month, they proved demand for their concept with market research data. At two months, teams completed early iterations. After three months, the budding entrepreneurs had finished software or hardware products that they could shop to prospective investors, including UTA and Kleiner Perkins.

> "You've got to try your own thing at some point. You have the rest of your life to work at some big company."
> – Greg Lou, CEO of Racevine, USC Viterbi alumnus

"We are very keen on finding engineers that are working on grand challenges or solving difficult problems that look like they can be transformed into companies," noted Kleiner Perkins General Partner Mike Abbott.

Teams came into the accelerator at different stages of development. Some already had paying customers and investors, while others had little more than a good idea. What they all shared was a passion to create something innovative and an overall appreciation for the Startup Garage's dark and Spartan space on the fifth floor of the Information Sciences Institute (ISI) building in Marina del Rey.

Inside the facility, team members sat together in an open, communal space, with dim lighting and a billion-dollar VSI2. The business builders typed away frantically on laptops, retired for impromptu meetings in adjacent meeting rooms, and shared ideas and strategies with one another. They sat on no-frills red-and-yellow USC-themed furniture. Over the three months, many spent the night at the Startup Garage, catching late-night shut-eye in sleeping bags donated by VSI2 board members Jeff Stibel and Peter Delgrosso.

"For me it's perfect," said Jonathan Sutherland, 23, co-founder of Everlab, the maker of the Koala mobile app that allows users to record and share an audio annotation to tell a photo's story. "All I need is a large table and room to think."

The Startup Garage's teams came to the accelerator with a cornucopia of interesting ideas.

Gregory Lou, 31, a USC Viterbi master's alumnus and an Ironman triathlete, hopes to turn his passion into profits. He spent the summer working on Racevine, a website that aggregates and reviews endurance races around the country.

"I want to create the go-to source for racing as much for myself as for anybody," Lou said with a laugh.

Christian Vanderwall and Awadi Rathugamage, both USC Viterbi students, created Scholasphere, a common application for academic scholarships. The AIO Robotics team worked on designing a 3-D copy machine. Moving Analytics made a phone-based app that measures daily movements and encourages healthy physical activities. MediaHound overhauled its film and TV aggregating website to include other premium entertainment and better social discovery. Jiangyang Zhang, a 26-year-old USC Viterbi PhD, and his partner, Jimmy Liu, a USC Marshall alumnus, built out GymFlow, a mobile platform that leverages historical data and gym card swipes to predict current and future gym traffic.

That collection of talent made it easy for UTA to decide to participate, said Brent Weinstein, the talent agency's head of digital media and himself a USC alumnus. (see page 29)

"When we considered doing a program like this, it was very appealing to work with a school that has such a strong pedigree and that puts out so many talented engineering graduates every year," he said. "And the mission of building something to support those engineers and further grow the technology and startup scene is something we're very excited about."
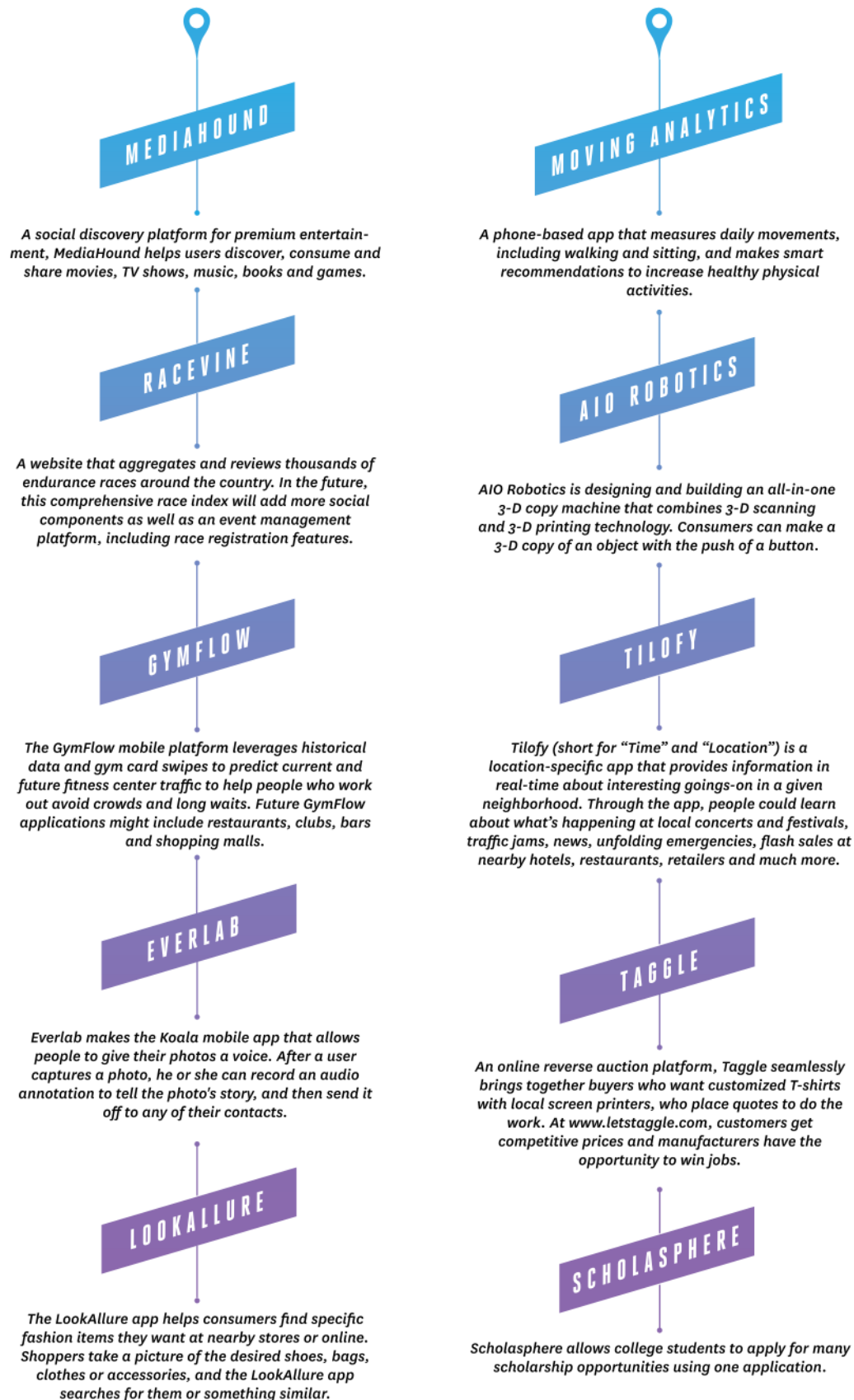
Q&A WITH BRENT WEINSTEIN, HEAD OF DIGITAL MEDIA AT UNITED TALENT AGENCY

Talking UTA in the USC Viterbi Startup Garage, engineering stars and Silicon Beach

USC: How did United Talent Agency get involved in the Viterbi Startup Garage?

BRENT: Ashish [Soni] and I were quoted in the same *USA Today* article, and he reached out to me. Over lunch, we both revealed our interest in putting together an early-stage technology accelerator. It was very appealing to work with USC Viterbi, which has such a strong pedigree and puts out so many talented engineers every year.

USC: Is engineering a new area for UTA?

BRENT: We're not in the engineering business per se, but we pride ourselves in representing thought leaders and unique voices and innovators in media. Whether that's the Coen brothers, Wes Anderson or Lena Dunham, we always want to represent people who are on the cutting edge of storytelling and entertainment, and engineering talent has become critical to the industry.

USC: What, specifically, is UTA's role in the Viterbi Startup Garage?

BRENT: We help companies think about how to get to market, form the right business and marketing partnerships, and think about ways to engage consumers.

USC: Is the concept of "Silicon Beach" a hard sell?

BRENT: No. USC Viterbi being a prime example, there's amazing engineering talent in LA. It's a wonderful place to live and the media industry is here. By building programs like this, we'll hopefully create a domino effect where local companies grow and provide more opportunities for engineers, so that when those engineers start their own companies, they do it here in LA.

USC: LA is home to many Hollywood stars. On a scale of 1-to-Gwyneth Paltrow, how glamorous is engineering?

BRENT: Geek is chic, right? I don't think anyone thinks that [Instagram co-founder] Kevin Systrom is a nerd. A lot of people would love to have his life. It doesn't matter your age, your race or your origins—if you create a product that millions of people love, you're a rock star!

USC: With rock stars like Kevin Systrom and Mark Zuckerberg, will more young people be inspired to become engineers?

BRENT: Absolutely. The world has changed. I've always laughed when my parents couldn't manipulate a video game controller or navigate the Web, whereas it's second nature to me. Now more than ever, some basic engineering is a common skillset, and today you can launch a company off almost nothing with the platforms available. That's empowering.

USC: How would you rate your own engineering skills?

BRENT: I don't have any!

USC: So, if you were in an Apollo 13-like situation—where Houston was like, "Mayday! You need to fix the space shuttle and you can only use what's in this box!"—would you be able to save the day?

BRENT: I think I would be really good at managing a team of people who would get me out of the situation. I'd be the guy who dumps the box on the table and says, "We've got to make this square filter fit into this round hole!" And then I'd let the people who are a lot smarter than me figure out how to make it happen.

Brent Weinstein is head of digital media at United Talent Agency in Beverly Hills, Calif. He graduated from the USC Marshall School of Business in 1997.
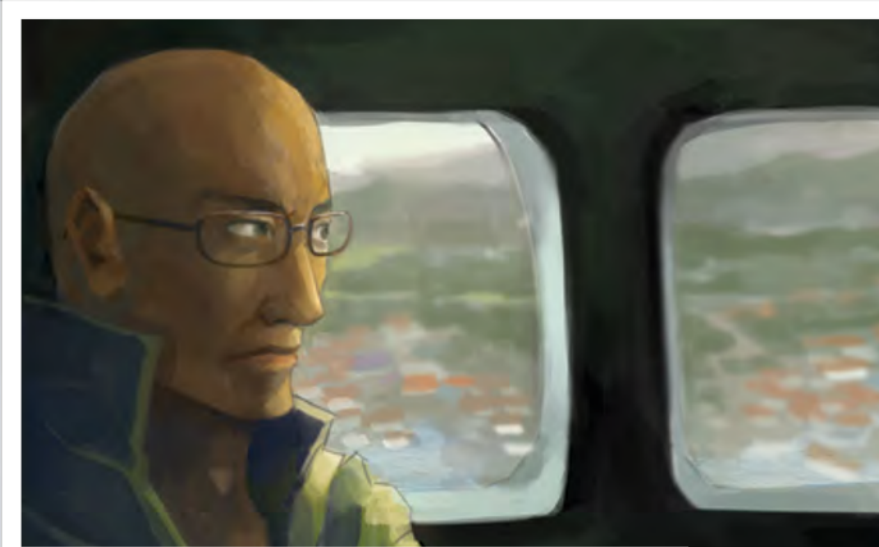
PATRICK LYNETT

CSI OF THE OCEANS

PATRICK LYNETT: JOHN AND DOROTHY SHEA EARLY CAREER CHAIR IN THE SONNY ASTANI DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

STORY BY: ADAM SMITH | ART BY: TENG CHENG

WHEN I WAS A KID, EVERY SUMMER WE'D DRIVE DOWN TO THE JERSEY SHORE. USED TO RIDE THE STAR JET AT THE SEASIDE BOARDWALK.

WENT BACK LAST SPRING.

GIRL NAMED SANDY BEAT ME TO IT.

I'M LIKE THE CSI OF EXTREME EVENTS. IF THERE'S A HURRICANE OR A TSUNAMI, I'M THERE.

I HOP ON AN AIRPLANE WITH A TEAM OF RESEARCHERS. GRAB MY FIELD CLOTHES, MY SURVEY RODS AND A SIDE OF BEEF JERKY.

EVERY DISASTER SITE TELLS A STORY—IF YOU ONLY KNOW WHERE TO LOOK.

SRI LANKA, 2004. I'D NEVER SEEN DEVASTATION LIKE THIS. NOT EVEN IN PICTURES.

ENTIRE VILLAGES WIPED OUT. 250,000 PEOPLE DEAD.

THE REAL TRAGEDY: SO MUCH OF IT WAS PREVENTABLE.

IT WAS THE FIRST BIG TSUNAMI IN 30 YEARS. THE TIDE RECEDES AFTER THAT FIRST WAVE, REVEALING ACRES OF BEAUTIFUL CORAL REEF.

THE PEOPLE CAME DOWN TO THE BEACH, MESMERIZED, WATCHING, COLLECTING SEASHELLS.

NO ONE TOLD THEM. THAT WAS JUST THE PROLOGUE.

THERE'S A CLUSTER OF EXTREME EVENTS HAPPENING RIGHT NOW. SOME THINGS WE WON'T SEE AGAIN FOR GENERATIONS.

WE HAVE A WINDOW OF 10 YEARS. TO LEARN. TO PLAN. TO REMEMBER.

AFTER THAT, WE FORGET.

ABOUT THE INDIAN OCEAN TSUNAMI (2004).

ABOUT KATRINA (2005).

ABOUT CHILE (2010).

ABOUT SANDY (2012).

ABOUT JAPAN (2011).

MY FAVORITE CHARACTER IN THE LORD OF THE RINGS IS ARAGORN. THE RANGER.

HE'S THE ANONYMOUS GUY WHO KEEPS THE SHIRE SAFE. THE SHIELD IN THE DARKNESS.

MY WEAPONS ARE COMPUTER CODE. COUL Wave. WITH IT, I CAN DESCRIBE THINGS NO HUMAN CAN IMAGINE.

I TAKE THIS CODE AND I RUN IT ON THE USC SUPERCOMPUTER—FIFTH FASTEST IN THE WORLD.

I CAN SIMULATE DOWN TO A MATTER OF FEET HOW A TSUNAMI OFF ALASKA MOVES ACROSS THE ENTIRE PACIFIC OCEAN. WHAT HAPPENS WHEN A 30-FOOT TSUNAMI WITH A FORCE OF A 300 MPH TORNADO COMES SCREAMING INTO THE PORT OF LOS ANGELES.

I WAS IN NEW ORLEANS AFTER KATRINA. PART OF THE FORENSICS TEAM—I HAD TO RE-CREATE THE EFFECTS OF A MONSTER STORM, FIND OUT WHY THE LEVIES FAILED.

THEY GAVE ME A MEDAL AND BUILT A WALL.

TODAY, THE LAKE BORGNE SURGE BARRIER IS THE GREAT WALL OF DEFENSE FOR THE CRESCENT CITY.

I CAN TELL ARCHITECTS AND CITY PLANNERS HOW TO SAVE LIVES.

WHY THIS ROW OF BUILDINGS STILL STANDS. AND WHY FOUR ROWS BACK, THESE ARE UTTERLY DESTROYED.

1700 AD. THE INDIANS TOLD STORIES ABOUT THE OCEAN RISING LIKE A MONSTER AND DEVOURING THE LAND.

WE'VE FOUND EVIDENCE TODAY OF AN EARTHQUAKE AND GIANT WAVES THAT SEEMED INCONCEIVABLE. UNTIL JAPAN, THAT IS. UNTIL FUKUSHIMA.

UNLIKE ARAGORN, MY OPPONENT IS NOT EVIL. IT'S HARD TO FIGHT SOMETHING THAT COVERS 3/4 OF YOUR PLANET.

BUT OUR WINDOW IS CLOSING. AND I'VE GOT WORK TO DO.

Never Again

A joint project by the USC Institute for Creative Technologies and the USC Shoah Foundation leverages advanced technology to continue the conversation about the Holocaust

By Marc Ballon

With the magic of the spherical Light Stage — used by such films as Avatar and The Avengers — Holocaust survivor Pinchas Gutter is captured as a 3-D, interactive hologram for future generations.

Holocaust survivor Pinchas Gutter wants to make sure the world never forgets, that his and others' testimony will help prevent future crimes against humanity by making the world aware of evil and the need to combat it.

That's why he readily makes himself available for questions, always ready to testify. People ask: Do you believe in God? How did you survive? Did you ever want revenge?

Like so many who lived through the Holocaust, Gutter's story is equal parts tragedy and triumph, of the strength and endurance of the human spirit in the face of unspeakable cruelty.

Gutter, now 81, remembers the horrors of the Warsaw Ghetto and the day the Nazis tore him away from his 10-year-old twin sister and parents upon their arrival at the Majdanek concentration camp in Poland. He never saw them again. He remembers exhausting Nazi death marches and his glorious liberation in 1945.

Looking resplendent in a white dress shirt, brown vest and slacks, Gutter speaks calmly but with authority in heavily accented English. Seated, he waits for a query.

David Traum, who leads the Natural Language Dialogue group at the USC Institute for Creative Technologies (ICT), asks him how he survived.

"It wasn't just one thing. It was help from people. It was luck. It was chance. It was faith. It was a combination of one thousand things," Gutter says.

"Do you believe in God?" asks Traum, who also serves as a research assistant professor of computer science at the USC Viterbi School of Engineering.

Gutter pauses. He taps his feet.

"I believe in God, yes. I believe there is a power higher than human beings, and I'm not quite sure what it is," Gutter said. "And of course, in the Jewish religion, in our theology, we are allowed to question….. You're allowed to actually stand up and question: Why, what and when?'

Why does Gutter tell his story?

"I tell my story for the purpose of improving humanity, if that's possible," he says.

Perhaps the most surprising aspect of this conversation is that Gutter wasn't actually there. Instead, his hologram-like image was projected onto a screen. The virtual Gutter, a technological marvel of imagination and engineering, can make eye contact and respond to questions with thoughtful answers, giving him an almost human presence.

That's the whole point.

The Institute for Creative Technologies, Conscience Display and the USC Shoah Foundation are collaborating on a initiative called New Dimensions in Testimony. The ambitious project's goal: to transform Holocaust survivors like Gutter into 3-D holograms that can engage in dialogue with future generations long after those survivors pass on.

Already, the team has produced the first of what they hope will be several 3-D holograms of Holocaust survivors. Together, they hope to raise $6 million to $10 million from private donors and foundations so that this important project can reach fruition.

At a time when worldwide anti-Semitism is on the rise, the New Dimensions project is of considerable value, according to Rabbi Marvin Hier, director of the Simon Wiesenthal Center in Los Angeles.

"The majority of people want to hear a story from somebody who moves, somebody who has emotions," Hier said. "Since we don't know the secret of life and death, there will be no survivors left on this planet in 10, 15 or 20 years. This makes the Holocaust real."

Creating an interactive, digitized Holocaust survivor requires time, precision and teamwork.

As a first step, researchers ask Holocaust survivors at least 400 questions over the course of several days and record their answers. In beta testing, audience members' most commonly asked queries included questions about survivors' early lives, life during the Nazi period, religion, resistance and life after the war.

Thanks to natural-language technologies, the hologram-like figures possess speech recognition capabilities similar to Apple's Siri. When somebody asks a question, a computer turns sound waves into text. Algorithms created by USC Viterbi Research Assistant Professor Anton Leuski, a member of Traum's ICT team, automatically identify keywords and phrases and match them with appropriate answers in the database. The process, Traum explained, leverages the same techniques as cross-language information retrieval.

And what happens if somebody asks a question that cannot be answered, such as who will win the 2015 NBA championship or become the next president of the United States?

Gutter's hologram responds: "I'm afraid I cannot answer that question."

To create a realistic image, Gutter gave his interview in ICT's Light Stage. Seven high-speed, high-definition cameras in the 26-foot spherical stage with more than 6,000 LED lights recorded his interview in 3-D with unprecedented detail. The next phase of the recording process will feature up to 50 cameras and be even better at recording the survivor testimony, said Paul Debevec, the associate director of graphics at ICT, a USC Viterbi School research professor of computer science, and the chief developer of the Light Stage technology.

So good are Debevec's Light Stage technologies that they have been used to create digital faces and bodies in several Hollywood blockbusters, including *The Curious Case of Benjamin Button, Avatar* and *The Avengers*. In 2010, the Academy of Motion Picture Arts and Sciences awarded Debevec and three colleagues a Scientific and Engineering Academy Award.

Debevec explained that the USC team's 3-D hologram differs considerably from the better-known imagery of Tupac Shakur that made an acclaimed appearance at 2012's Coachella Valley Music and Arts Festival. Virtual Tupac was two-dimensional video reflected by a thin plastic screen toward the distant audience, offering only a flat, frontal view. By contrast, Debevec said, the holograms under development will appear in 3-D from every angle, creating a believable experience in even the most intimate of settings, like a classroom or small auditorium.

"We want the virtual survivor to have depth, to have presence, to seem like they are sitting in the same room as the audience," he said.

To reach the widest possible audience, the United States Holocaust Memorial Museum and the Illinois Holocaust Museum & Education Center, among others, will likely feature interactive exhibitions of holographic Holocaust survivors, said Stephen Smith, the USC Shoah Foundation's executive director.

Such groundbreaking technology is an especially effective communication tool with today's tech-savvy youth, a most important audience, he added.

"There's an expectation for a greater depth of intimacy and a more immersive experience," he said. "We're living with a generation now whose expectation of high-speed delivery, virtual reality and intimate engagement with digital culture is only going to go up."

City of Dreams

USC Viterbi alumnus Dr. Sultan Ahmed Al Jaber is helping to build one of the world's most sustainable cities in a Middle Eastern desert

By Marc Ballon

In a hot, arid patch of desert in the United Arab Emirates, the future unfolds.

Masdar City, a low-carbon, low-waste, urban development powered entirely by renewable energy, has begun taking shape, fueled by green dreams of clean-energy technology and sustainable development.

Overseen by Dr. Sultan Ahmed Al Jaber (BS CHPE '97), CEO of Masdar — Abu Dhabi's renewable energy company — the burgeoning city currently has 15 buildings, with several more under construction, designed to reduce energy demand by 56 percent and potable water demand by 54 percent against global sustainability standards. When completed in 2025, the $18 billion project will house 40,000 people in about two square miles.

Everything about Masdar City, from its widespread use of renewable energy sources, to recycled building materials, to grey water for irrigation, has been done with an eye toward sustainability, energy efficiency and carbon-footprint minimization. Taking advantage of the intense year-round sunlight, photovoltaic panels generate electricity, while solar power also provides energy for cooling.

But Masdar City is more than just an environmental oasis in an oil-rich land. Much more. Al Jaber envisions the city of tomorrow becoming a money-making incubator for green technology innovation and collaboration. The development's success, he says, will hasten the country's economic diversification and transformation into a knowledge-based society.

"The objective behind Masdar City is to create a global clean-technology cluster, a kind of Silicon Valley environment where tech developers, academics, entrepreneurs and companies come together for the development of renewable energy and green technology," Al Jaber said.

Toward that end, the Masdar Institute of Science and Technology (MI), the Middle East's first graduate research institute dedicated to renewable energy and sustainability technologies, opened its doors in 2010. MI, which will produce many of the city's future entrepreneurs, researchers and thought leaders, was established in partnership with the Massachusetts Institute of Technology.

"It was at USC Viterbi that I learned how through innovation universities can lead the way in incubating tomorrow's leaders," Al Jaber said. "It is a pursuit that I have continued to build on at Masdar as well."

As a reflection of Masdar's attractiveness to outsiders, Siemens AG is building its new Middle East headquarters in the city, as is the International Renewable Energy Agency, or IRENA, an intergovernmental agency with more than 150 member states. Mitsubishi plans to have a presence in Masdar.

Masdar City, though only in the early stages of construction, has already made a name for itself as an environmental leader. A 10MW solar photovoltaic (PV) plant, the largest such plant in the Middle East, powers the Masdar Institute and other buildings. A huge, hollow tower in the center of town acts as a cooling wind catcher that noticeably reduces temperatures in the city. Treated wastewater is 100 percent recycled for use in landscaping.

Not everything has gone according to script. A water desalinization plant had to be scrapped because of the projected energy needed to clean the exceptionally salty local water.

"We're learning while doing," Al Jaber said. "Look, nobody's done this before, but we want to do it right."

MASDAR CITY (LEFT, ARTIST'S RENDERING) - When completed in 2025, Masdar City will be one of the world's most sustainable and energy efficient municipalities. The $18 billion project will eventually house 40,000 people in about two square miles.

Building a Global, Solutions-Focused IEEE

As IEEE president, USC alumnus José Roberto Boisson de Marca aims to advance technology and solve global problems

By Stephanie Shimada

When USC alumnus José Roberto Boisson de Marca stepped into USC Viterbi Professor Robert Scholtz's office for the first time in the early 1970s, he never imagined the professional connections and lifelong friendship that would follow.

Scholtz was one of the so-called "Magnificent Seven," the faculty group that founded the USC Communications Sciences Institute (CSI) in 1982. Together, Scholtz, Solomon Golomb, Charles Weber, Lloyd Welch and others served as the perfect mentors for the young de Marca, who always knew he wanted to work in communications technology.

The Magnificent Seven taught de Marca both sides of their profession: teaching and research. They showed him how to collaborate and work well in a team.

"They were good teachers, good researchers and good human beings," de Marca said. "They were all friends and helped each other to do well. This was a very good example for me."

Now de Marca is taking this knowledge to his position as president-elect of the Institute of Electrical and Electronic Engineers (IEEE), the world's largest technical professional society. He is the group's first non-North American president, bringing more than 30 years of IEEE experience to the role, including past leadership positions on four boards.

IEEE, which was formed in 1884, brings together the global community of electrical engineers to collaborate on world-changing technologies that can help benefit humanity. De Marca passionately believes that knowledge sharing among the field's top professionals can lead to solutions for life sciences, urban challenges, engineering and the Internet.

"Technology will play a major role in solving the problems of the world and protecting the lives of people in the future," said de Marca, who has also served as a professor at the Catholic University, Rio de Janeiro, and scientific director of the Brazilian National Research Council.

De Marca enters IEEE at a time when technology is moving faster than ever and the engineering field has become more multidisciplinary. He wants to ensure that IEEE stays at the forefront of international leadership and innovation.

"I will continue to motivate and create opportunities for the top people in the world in technology to choose IEEE to publish their research and attend conferences," de Marca said.

Over the years, de Marca has shown a knack for bringing diverse people together. His former PhD classmate, Walter Braun, remembers him as an open, lively and interesting person, engaging everyone in the room at Scholtz's pool parties and constantly networking at school functions.

"He was interested in the context outside of just studies," said Braun, who is now a consultant at Braun Communications Consulting GmbH. "He wanted to talk to people."

Playing with Robots

USC Viterbi alumnus George Kirkman makes robotics accessible to a wide audience

By Katie McKissick
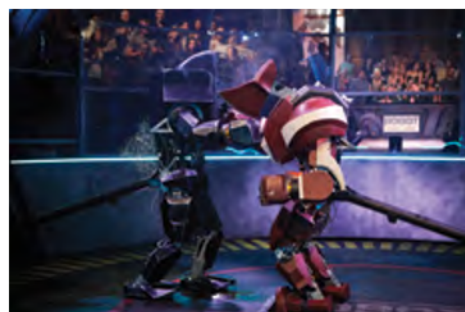
Steel Cyclone is not your average robot. He's an impressive 7 feet tall, weighs 768 pounds and has torpedo-shaped fists, which he uses in close-quarters combat with other humanoid robots as TV cameras capture every robotic punch.

Created by USC School of Cinematic Arts alumnus Jeremy Whitham, *Robot Combat League* on the Syfy channel is a tournament in which 12 teams of human-controlled robots fight in hand-to-hand combat.

As the robots battle it out, sparks fly, hydraulic fluid leaks and robots are cut in half. But for many of the contestants, the spectacle is just a starting point.

Each team consists of a robotics expert serving as the "robo-tech" and a professional fighter serving as the "robo-jockey." The robo-jockeys are outfitted with sensor-laden exo-suits that translate their arm movements to the robot. The robo-tech controls the rest of the robot using throttles and joysticks, and is responsible for between-fight repairs and maintenance.

USC Viterbi alumnus George Kirkman had the rare opportunity to participate in this show as the robo-tech on Team Steel Cyclone, joined by robo-jockey and Olympic hurdler Bayano Kamani.

For fellow robo-tech Ross Mead, a USC Viterbi computer science graduate student, being on *Robot Combat League* was an opportunity to popularize robotics to a wide audience.

"We all do outreach work, so we all talked about robotics and kids, and getting more people interested in science, technology, engineering and math," he said.

And for Kirkman, getting people interested in robotics is his full-time job. He's the co-founder and co-owner, along with his wife, Bing Jiang, of Rolling Robots, a destination for children to learn about science and technology in the most engaging of contexts. In summer camps, after-school classes and birthday parties, kids build robots, learn about computer programming, and even design and print custom parts with a 3-D printer.

"I started Rolling Robots to create a fun place to attract kids to technology," said Kirkman. "One of the things we really try to instill in them at an early age is, 'You can do this stuff!'"

Find out more about Rolling Robots at rollingrobots.com.

Obituaries

MERWYN CARLYLE (M.C.) GILL, 102, passed away on May 30. Gill is renowned as a pioneer and entrepreneur in the field of plastics manufacturing. He was the founder and chairman emeritus of M.C. Gill Corp., one of the world's leading manufacturers of reinforced plastics.

Gill was the first of his family to attend college. He began his education at a regional junior college, transferred to the University of Minnesota, and completed his education at the University of Southern California. He earned his bachelor's degree in chemistry in 1936, and received a second bachelor's degree in chemical engineering the following year.

After graduation, Gill began his professional career at U.S. Royal Tire Co. as a quality engineer. When World War II broke out, Gill went to work at Swedlow, where he furthered his knowledge and interest in plastics.

Following the war, Gill pursued his lifelong dream of starting his own business, founding M.C. Gill Corp. in September 1945. His venture began in a rented garage in Montebello, Calif., where he began crafting consumer items out of plastic. The company was initially slow to gain momentum, and Gill went to work for Aerojet Co. at night while simultaneously pursuing his own business during the day. Gill received his big breakthrough five years after launching his business when he received an opportunity to make cargo compartment wall liners for the DC-6 aircraft. Today, M.C. Gill Corp. remains the leading manufacturer of aircraft cargo liners, provides products to airlines around the globe and employs more than 750 people worldwide.

With a vision of making USC a leader in composites education and research, Gill endowed the M.C. Gill Chair in Composite Materials at USC Viterbi in 1986, and the Merwyn C. Gill Foundation Composites Center in 2001. In addition to his contribution to composites, he served as a member of the USC Viterbi Board of Councilors and as an honorary USC trustee. He also had season tickets for USC football and basketball games, which he frequently attended.

Beyond USC, Gill was a dedicated father and gracious benefactor to numerous community organizations. He served as a Cub Scout scoutmaster for the Boy Scouts of America and coached youth athletics. He also extended his support to Think Tank Thuto, a Los Angeles-based nonprofit organization, and established a scholarship program at the University of Arizona's College of Engineering.

Gill is survived by his wife, Hester; his three children, Stephen, Phillip and Debaney; his three stepchildren, Dirk, Annelize and Carine; nine grandchildren and eight great-grandchildren.

KENNETH NEIL EDWARDS, retired CEO of Dunn-Edwards Paint Corp., passed away at his home in Glendale, Calif., on Feb. 20. He was 80.

A renowned polymer chemist, Edwards taught as a senior lecturer in the Department of Chemical Engineering at the University of Southern California from 1976 to 1980. He also served the coatings and plastics technology industry as an independent contractor and researcher, and published a wide variety of important industry books and papers. From 1971 to 2000, he received numerous technology and process patents, as well as a plethora of awards, including the ACS Industrial Innovation Award.

During his early career, Edwards worked as a principal chemist for Battelle Memorial Institute. In 1958, Edwards joined the family-owned Dunn-Edwards Paint Corp., serving as director of new products R&D, corporate secretary, board member, and finally as CEO from 2001 to 2011.

Edwards received his bachelor's in chemistry from Occidental College, and his master of science in chemical and metallurgical engineering from the University of Michigan. He also attended UCLA's Graduate School of Business. Edwards was highly involved in the American Chemical Society (ACS) and the professional chemical fraternity Alpha Chi Sigma, holding numerous leadership positions in both organizations.

JOHN C. HARDY SR., 77, died on March 14 after a short battle with brain cancer. Hardy earned his bachelor of science in mechanical engineering from the University of Southern California in 1960, and a master's degree at Rensselaer Polytechnic University. During his career, he worked for McDonnell Douglas, DuPont, Hamilton Standard, Rockwood, Maremont Corp. and Electrodyne. During his tenure at Hamilton Standard, he was instrumental in the development of the Apollo spacesuit. In 1983, Hardy, along with his wife, opened La-Z Boy Showcase Shoppes, South Portland. Hardy is survived by his wife of 56 years, Lois Elizabeth Geary Hardy. He is also survived by his two sons, John and Timothy; a daughter, Elizabeth; two sisters, Dorothy and Ruth; a son-in-law, Robert; and nine grandchildren.

ROBERT H. LUBETKIN, 87, died on June 1 at Scottish Rite Park in Des Moines, Iowa. Lubetkin volunteered to serve in the U.S. Army in World War II after high school, where he was injured at the Battle of the Bulge. After serving in the Army, Lubetkin completed his bachelor's in industrial and systems engineering at the University of Southern California in 1949. He moved to Des Moines after graduation, where he spent a long career in management at the Younkers Department Store. He also enjoyed teaching at the Des Moines Area Community College, as an adjunct at Drake University, and as a docent at the Des Moines Art Center. Lubetkin served as a leader in numerous community organizations, including president and trustee of the Des Moines Art Center, president of Temple B'nai Jeshurun, and president of Des Moines Planned Parenthood, and was a devoted member of the Century Club. He was an active participant and leader in boards and organizations that supported Iowa Public Television, the Development Commission for the Eastside of Downtown Des Moines, and beautification of the Iowa State Fairgrounds. Lubetkin is survived by his wife, Harriette; his two sons, Paul and Andrew; his sister, Jean; and three grandchildren.

MATSON CLEMENTS, passed away in Venice, Fla., on June 21. Clements was a Southern California native who attended the University of Southern California as a ROTC scholarship recipient. He received his bachelor of science in civil engineering in 1956. After graduation, Clements served as a United States Naval officer before starting his career as a civil engineer in the petroleum industry. Clements was regarded as an oil refinery expert, and is known for building and consulting on refineries all across the globe. In addition to being a world traveler, Clements was an avid golfer, competitive bridge player and ballroom dancer. He is survived by his brother, Dan; his three children, Scott, Karen and Kristan; and seven grandchildren.

ROBERT FOGWELL, 91, died in his home in Scottsdale, Ariz., on Feb. 13 after a short battle with cancer. Fogwell received his bachelor's in mechanical engineering from the University of Southern California in 1943, and earned a second bachelor's in electrical engineering in 1947. He went on to attend the Naval Training School at Cornell University prior to entering World War II in December 1943. Fogwell served aboard the USS Appalachian through three major assaults in the South Pacific before he was honorably discharged as Lieutenant (Junior Grade), USNR. After serving in the military, Fogwell worked in the aerospace contracting business for many years. He retired from Page-Fogwell Corp. in 1986. Outside of his career, Fogwell was an avid member of Kiwanis, the Kappa Alpha fraternity at USC, and the KA Investment Club. Fogwell is survived by his wife of 67 years, Helen; three daughters, Kathy, Laura and Margaret; six grandchildren; and a great-granddaughter.

ROBERT MICHAEL NORMAN, 61, passed away in his home in Williamsburg, Va. on August 7. After graduation from high school in 1969, Norman was appointed to the United States Naval Academy in Annapolis, Md., where he received his degree in aerospace engineering in 1973. Norman was commissioned in the U.S. Navy as a fighter pilot, then as wing commander of the 84th Fighter Squadron. In 1979, Norman graduated from the U.S. Naval Test Pilot School in Patuxent River, Md., and in 1980, was selected as a NASA Group 9 astronaut candidate. He went on to receive his Ph.D. in aerospace engineering from USC Viterbi in 1995. After graduation, he began working as a research scientist with Boeing, where he would work for the rest of his lifetime. Norman was passionate about music and spent his free time singing and songwriting. He frequently performed at local establishments in the Williamsburg area. He is survived by his wife, Carolyn Elizabeth Whitehurst-Norman; daughter, Alicia Cristin; son, Eric Michael; and two step grandchildren, Logan and Calysta Lawhorn.

Geek Chic | *L.A.'s new mayor: the future of tech in the City of Angels*

Los Angeles is the creative capital of the U.S. In 1969, Los Angeles became home to the first Internet node. In 2012, SpaceX launched the first commercial spacecraft here. In between, we changed the face of social media with MySpace, built aerospace technology that became the envy of the world, and redefined the video game industry. L.A. is the go-to place for innovation. And the future economic growth of Los Angeles goes hand-in-hand with the growth of our startup industries.

Los Angeles is already a powerhouse in developing future technology leaders. The schools in our area – USC, Caltech and

"(USC Viterbi Start-Up Garage) forges the way for other schools and business partners to join in and serve as economic engines and job creators for our city."

UCLA – graduate more engineers annually than UC Berkeley and Stanford. With our colleges and universities creating a stellar talent pool, my job as mayor is to help keep that talent here in L.A.

That's why I'm talking about "Geek Chic" – my push to make tech even bigger in L.A.

First, we should ensure we have the kind of education and business partnerships with our colleges and universities that have been so successful in Silicon Valley. The USC Viterbi Startup Garage is a great

example of this kind of partnership, which brings together the Viterbi minds and the know-how of two premier firms to keep our best and brightest here in L.A. This partnership forges the way for other schools and business partners to join in and serve as economic engines and job creators for our city.

City Hall needs to make L.A. more business-and investor-friendly, and grow our already robust venture capital culture to rival Silicon Valley's. As mayor, I'm committed to cutting the red tape that prevents organic business growth, including easier permitting processes and getting rid of the gross sales receipt business tax. We'll also listen to tech industry and university leaders to make our city as competitive as possible with other tech centers. For example, I helped lead the fight to keep LegalZoomin L.A., and will continue that business-friendly tradition as mayor.

The most fundamental element of keeping talent in L.A. and attracting new business is in improving the basic quality of life in Los Angeles. Better city services, more parks and fixed-up streets bring investment, bring businesses and bring more op-

portunities for graduates. That's why I will hire L.A.'s first chief technology officer to harness the power of technology to make our city better, faster and more efficient in delivering the basics –simple things like online portals to give residents a "one-stop shop" to get all the permits they need to start a business.

While we work to prevent brain drain from L.A., we also need make sure the next generation is ready to compete in our global economy. That's why I'm supporting increased STEM education in our middle and high schools, and teaching our students programming and foreign languages. I'm working with LAUSD, nonprofit and private-sector partners to grow "Silicon South" – developing the Crenshaw light rail line as a new tech corridor and improving technological education to the students of South L.A.

Our college and university students know L.A. is the ideal place to learn, live and play. Now I'm working to make sure these talented tech graduates can stay here and realize their professional dreams in our amazing city.

— Eric Garcetti is the 42nd mayor of the City of Los Angeles. He assumed office July 1, 2013.

The Movie Theatre of the Future (In Your Living Room)

Going to movies is one of my favorite pastimes. I still remember when I was attending USC, I used to drive up to the Beverly Center with my buddy and watch those off-the-wall artsy films, most of them foreign. I don't quite remember the name of the cinema, but that was when small theaters first became popular.

With the popularity of cable TV, HBO, VCRs and later DVDs, those small theaters started to disappear. Also, TV viewing is no longer just for the live broadcast shows or short episodes of soap operas. Demand for better picture quality and bigger screens in your living room became more popular. Remember those big and bulky rear projection Mitsubishi televisions?

I don't know whether HBO helped the popularity of those big screens or the other way around, but the perception of a quality living room experience definitely became different. If everyone had money, their family room would have had a 50-inch rear projection TV. I built my first house 15 years ago and the living room was designed for viewing of my Mitsubishi!

I jumped into the TV market 11 years ago with the belief that the emerging semiconductor process of making flat-screen TVs would improve the quality

of entertainment at home. Sure enough, first with plasma and now LCD and LED, VIZIO helped drive the popularity of bigger screens, higher resolution, better color, lower power and great value.

Back then, after college, it took me 15 years of hard work to afford a 50-inch Mitsubishi at around $4,000. Who would believe that today we are selling an 80-inch 1080 resolution LED TV with half of the power consumption at a lower price tag? Yesterday's 50-inch is today's 80-inch. Flat screens are lightweight and thin, and hanging them on the wall is not a problem. We're now working on sizes beyond 110-inch.

Our aggressive approach to reducing power consumption has resulted in a reduction from the 120W power requirement of the 32-inch television of a few years ago to the 24W of VIZIO's 32-inch television today, and our 80-inch only consumes around 90W. Watching TV now uses less energy than the lighting in the living room.

As for the future, don't be surprised if someday your windows or paintings will be overtaken by one of our giant TVs. Who wouldn't want to have a Picasso hanging on their wall during a date night or a video of snowfall during Christmas? Or you can look at Hawaii waves pounding on the lava rocks

rather than your neighbor's boring chimney. Just like how the invention of canvas and oils changed the way artists paint, digital pixels will allow new age artists to express their feelings on a more dynamic and vivid display. Perhaps in the not so distant future, technologists will overcome the barrier and perfect the technology of 3-D holograms so that VIZIO can bring James Bond to your couch—that is entertainment!

Thanks to the Internet, better streaming compression and bigger bandwidth are coming to your home, and watching TV will not be the same. An Internet-enabled TV can send as well as receive information, and this provides video/audio streaming, on-demand viewing, time shifting and user profiling, all of which was not possible 10 years ago. Ease of access to more and better-quality content from Hollywood will make consumers demand even bigger, better, higher resolution and killer audio TV sets. We love this, and VIZIO will keep on pushing the limits for that, of course at an affordable price, as we always do!

— William Wang (BSEE '86) is a member of the USC Viterbi School Board of Councilors and CEO of Vizio, the bestselling HDTV company in the United States

Wanted: Engineers on the Silver Screen | *On Movies, science and engineering*

From the scientists and engineers in *From Earth to the Moon*, to Christopher Lloyd in *Back to the Future* and beyond, movies are full of madmen and nerd scientists. Unfortunately, one of the messages of these films is that science is not for regular folks. And it's nerdy too!

What is missing in most portrayals is the deeper appeal of science and engineering. These are people who are rolling back a curtain, engaged in probing nature's deepest secrets. It's hard to imagine a more interesting, challenging or useful career choice—or a more fascinating way to spend time.

The few exceptions to stereotypical portrayals nevertheless can stand out—in the mind of a child. In my own childhood, I was influenced by 1950s classics *Destination Moon*, with its efforts to introduce verisimilitude (such as no sound in space – something a friend and I argued about) and *The Day the Earth Stood Still*, with an intelligent alien who unbelievably wasn't interested in eating humans.

Today, enrollment in graduate education in science and engineering is a serious concern. Aeronautical engineers, electrical engineers and others will suffer shortages that are important to national interests. The policies of our government must reflect the value of engineering in the future. In the U.S., university efforts to recruit science majors are surely not helped by movies that suggest an alienation of science from the world at large.

I conduct research in pulsed power. So, when in *Ocean's 11*, George Clooney and his buddies drive up to a research lab and tosses a "Z-pinch" into a van,

a person who works in pulsed power research can't help feel disconcerted. The Z-pinch itself is about the size of a person's wrist. However, the pulsed power that drives the Z-pinch is large, specialized and about the size of an Olympic swimming pool.

It turns out that it's not that hard to fix things like that in a movie. Easy, for a picture on this scale, with very minor revisions—two or three lines, typically. As an example, I was hired on *Real Genius* as a laser expert, and was fortunate to have a strongly supportive director, Martha Coolidge, as well as a bright and cooperative actor, Val Kilmer, to work with. Martha supported verisimilitude, had a great attitude toward the students being portrayed. Val learned lines describing his breakthrough laser letter perfect, and 25 years on the movie still gets good marks for its portrayals of the students and science.

However, there is a more important problem than simply verisimilitude. There is a disconnect between science and society, and that it is not a good thing. And this more serious problem affects the nation's future.

With a little movie experience, one way we thought of for addressing this was—along with colleagues Joe Petricca of the American Film Institute (AFI), veteran directors Alex Singer and Martha Coolidge and Robert J. Barker of the Air Force Office of Scientific Research—to foster participation by engineers and scientists in the making of movies. These people are bright and creative, write, and it is reasonable to think that some of them have good script ideas. Thus, a potential creative source for

movies, but a source that appreciates the science!

So we put together workshops at the AFI from 2004-2006. We selected 12-15 participants from diverse areas of science and engineering through a screening process. The quality of applicants was enhanced by a press release through the National Academies, and a note in the journal "Science." Participants in the first workshop included an aerospace engineer, molecular geneticist, molecular biophysicist, neuroscientist, chemical engineer, nano-scale physicist (who later wrote the well-received book *The Physics of NASCAR*), an electrical engineer and others. Teachers included experts such as Syd Field, agents and representatives of other aspects of the business. Recently, Valerie Weiss, an MIT-educated biophysicist, produced a feature-length film, *Losing Control*.

I believe this is an important and useful approach to improving story lines and going beyond sequels and explosions, largely because of the quality of the contributors—as individuals. They have remarkable abilities, talent, and enthusiasm. I believe that their judgment, brains and scripts will contribute to communicating science – and even to the quality of entertainment.

— Martin A. Gundersen is a professor in the Ming Hsieh Department of Electrical Engineering. He was a technical advisor on the films Real Genius, The Lost World, Congo *and several television productions.*

THE MANY LIVES OF ENGINEERS

"For both engineering and music, you need to have certain technical knowledge and abilities, but once you have that down, you can be creative, improvise, and make something truly amazing."

— SHIRIN NIKAEIN, *alumnus, BS EE '08*
systems engineer, Beats by Dre

PHOTOGRAPHY BY NOE MONTES

"Playing lacrosse requires great discipline and strategy, both to play and fit into a difficult engineering schedule. Being a member of such a large and competitive team helps me to hone my communication skill which I can translate over to group project settings within engineering."

— NATALIE ALVAREZ, *senior, civil engineering*

"Brewing has a lot in common with working in the lab... It isn't like cooking, where you can taste the food as you're making it and make adjustments. It's a weeks-long process, and you can't be sure of what you have until it's done. The difference between brewing and lab work is that in brewing your success isn't judged by absolute quantitative standards; instead, it's a matter of taste."

— NOAH MALMSTADT, *Assistant Professor*
Mork Family Dept. of Chemical Eng. & Materials Science

"I love to explore: I can dissect a piece of music, like I can dissect an engineering problem. For me now, it's a form of relaxation. I'm always thinking, but when I am playing in the orchestra, I am so focused on what we are doing that my brain gets some rest from anything else that may be on my mind."

— STEPHANIE KEMNA, *PhD candidate, computer science*
[classical trio includes CS PhD students JENS WINDAU AND ZHIYUN LU]

"The world needs a hero like MacGyver now."

A conversation with MacGyver creator Lee David Zlotoff

Q: Take us back—*MacGyver* debuted in 1985. What's the television landscape like at this time?

A: This was when *The Cosby Show* was on, *Murder She Wrote, Who's the Boss, The A-Team.* But there's been this almost complete inversion between TV and film. It used to be that films were about weighty, controversial and intense subjects and that TV was really more escapist mind candy. Now, it's the other way around.

Q: So MacGyver is a secret agent who is best known for his engineering prowess. What was the evolution of his character?

A: The first key decision about the character was to send him into a dangerous situation with *no weapons and basically nothing* and make him sort things out from there. That meant his only real tool was his mind. *He knew everything.* He knew physics, he knew chemistry, electronics, and so on; he could look at any given situation, and, using whatever was available, produce something that would get him out of the situation or overcome the bad guy. Because, although this was originally done for purely dramatic purposes, if you don't give him a gun, he's gotta find a different way to defeat the bad guys, which really became the hook for the show.

Q: As the creator of *MacGyver*, what sort of responses and fan mail would you get from kids, parents or viewers about inspiring an interest in science or creating new things?

A: I cannot tell you how many times people have come up to me and said, "I became an engineer, or I went into the sciences because of MacGyver." Just this past week, I gave a talk at the Jet Propulsion Laboratory where I heard this from a number of people. But one young man in particular came up after the talk and said, "I have to tell you flat out the only reason I went to college was because I wanted to do what MacGyver did. I realized the only way I could do that was by going to college, and if I hadn't gone to college, I wouldn't be working here at JPL. And I owe it all to MacGyver. Thank you."

Clearly, MacGyver inspired people to look at the world differently, and to look at science not as this dry, dead thing, but as the ability to perhaps redefine the narrative of whatever challenges they were facing. That fact alone has literally changed countless lives just based on the anecdotal evidence I've seen.
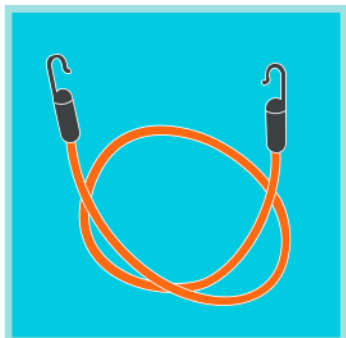
The other thing, curiously enough, I hear repeatedly was that *MacGyver* proved to be a show the whole family could watch together. Dad liked it because of the engineering stuff. Mom liked it because he wasn't always shooting a gun. The kids said, "Wow, here's a show that Mom and Dad like, and I can watch it at the same time; and we're all interested." It became a remarkable family event.

Q: Exciting kids to the STEM fields (science, technology, engineering and mathematics) has been declared a national priority by the president and American industry. What are your thoughts on the power of TV and film to excite kids to these things or specific professions?

A: Well, there's no question that if you see something on TV or film that excites or inspires you, you are more likely to go out and try to imitate it. Let's face it. They put on the Olympics, and kids want to be gymnasts, ice skaters and high jumpers.

If TV or film exposes you to something, that's how you become aware of it, and if you are aware of it, then you can potentially see yourself doing it.

So do I think entertainment could play a key role in this? Absolutely. Certainly it's one of the reasons that I'm now trying to bring *MacGyver* back on a slew of platforms as well as in directed, project-based educational curriculum.

Q: So if someone came up to you today and said we really want to launch the next great TV show about engineers or scientists, what would be your ideas or advice to them?

A: I would say it isn't important to *call* him an engineer or a scientist. Just call him something else and have him or her use the capabilities and skill sets of an engineer and scientist and let the backstory explain how they're able to do all this. But if you start out saying we want to do a story about an engineer, it's like saying we want to do a show about an accountant. Really?

The key is to have the character *do* what you want them to do, but don't worry about what you call him. MacGyver clearly had all these skill sets, but he was portrayed as a secret agent of sorts, not an engineer.

Q: I read somewhere that you actually do carry around a Swiss Army knife or duct tape. IS that true?

A: The only time I don't have a Swiss Army knife with me is when I travel by plane because they won't let me keep it with me, which becomes a problem unless I'm checking luggage.

Q: What's the most fascinating single thing you ever learned about science or technology?

A: To me, the most astonishing thing about science is the fact that it is evolving, that it is dynamic and that it is fundamentally creative, even though it may not appear so.

Everyone thought that Newton's physics was the living end until Einstein came along and said, in effect, "I think I can turn this whole thing upside down because I don't think that's how reality works."
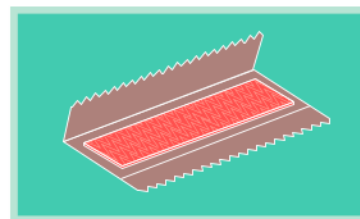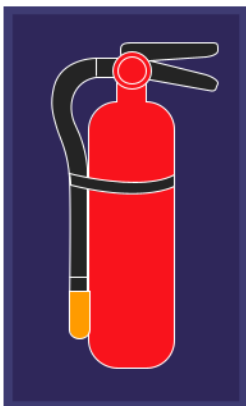
Science is fluid. Science is not fixed and immutable, and when you realize that science is a moving truth, an evolving truth, a developing truth, it's a lot more exciting than if you think it's just that stuff that some expert knows and you can do some things with it, but it's a fixed dead thing. The truth is it's the exact opposite. Science is changing all the time, and we are always discovering that what we thought to be the case was not actually or entirely the case.

Q: You have this quote here: "I am convinced that given the current pressures on national and global resources such as food, water and energy, etc, certainly this country, if not the world needs a hero like MacGyver now." What makes this kind of hero so timely in 2013? Why now?

A: In addition to not simply resorting to violence, MacGyver represented the idea of "how do I take what I have and turn it into what I need?" As a global civilization, we can no longer sit around and say we all want everything. Because we all can't have everything. Even the essentials are getting harder and harder to come by. So, as an effective approach, it might be better to ask, "What do I have and how can I find a way to turn what I have into what I need?" Which, like it or not, is something we are all going to need to do going forward.

Anyone who pays attention knows the resource issues are becoming more critical by the day. Food resources, water resources, energy resources, waste management — whether its CO_2 or other forms of pollution, these are problems that affect all of us… And it's not governments that are going to resolve these issues. Governments are just reflections of people. If and when the people are ready to resolve it, then governments will really act decisively. But before that, the governments will, I'm afraid, just talk and not do anything substantial.

To hear the entire conversation with Lee David Zlotoff (including the back story on how MacGyver was made) visit: www.viterbi.usc.edu/magazine