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2015

LEARNING TO USE THE POWER OF TECHNOLOGY TO ENRICH KIDS' LIVES
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TECH FOR TOTS

The road ahead for **AUTONOMOUS VEHICLES**

A sober look at legalizing **MARIJUANA**

They set **POLITICS ASIDE** and joined the conversation

RAND Picks Five

AUDIO
INFOGRAPHIC
BLOG
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BOOK

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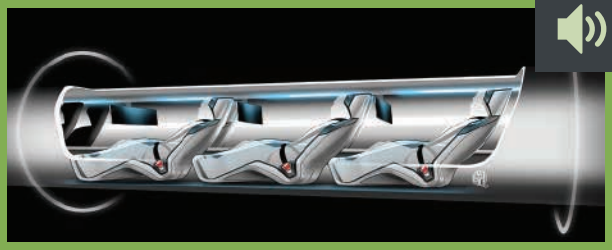

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1. A Conversation with Marco Villa, Adviser to the Hyperloop
So you can't listen to this podcast while traveling *through* the Hyperloop just yet, but listen to what experts have to say about its future.

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4. How to Better Support Military Caregivers
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5. How Effective Is Correctional Education?
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HYPERLOOP FROM TESLA MOTORS; GROCERY STORE: LYZA/FLICKR CREATIVE COMMONS; FABIUS MAXIMUS: ISTOCK; PRISONER FROM BLOSSOMSTAR AND MERIEL JANE WAISSMAN/ISTOCK

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6 **The Dream Drive** Autonomous vehicle technology may offer major societal benefits.

Advertisement from 1957 for "America's Independent Electric Light and Power Companies" (art by H. Miller). The accompanying text read: "ELECTRICITY MAY BE THE DRIVER. One day your car may speed along an electric super-highway, its speed and steering automatically controlled by electronic devices embedded in the road. Highways will be made safe—by electricity! No traffic jams…no collisions… no driver fatigue."

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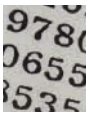

Cover photo by Lori Shepler

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Research Briefly

The prevalence of sexual assault and harassment in the military

An estimated 20,000 of the U.S. military's 1.3 million active-duty members experienced one or more sexual assaults in the past year, including assaults by other service members, civilians, spouses, or others, according to initial findings from an ongoing RAND study. This represents 4.9 percent of active-duty women and 1.0 percent of active-duty men. Among the study's other initial findings:

- 26 percent of active-duty women and 7 percent of active-duty men experienced sexual harassment or gender discrimination in the past year.
- Rates of unwanted sexual contact and sexual harassment for active-duty women have declined since 2012; rates for both men and women are lower than in 2006, but about the same as in 2010.

In response to criticisms of earlier DoD-run studies on the issue, RAND designed the 2014 survey form to include simpler, more specific questions and terminology to better measure the prevalence of specific crimes and violations. Approximately 170,000 service members, or 30 percent of the 560,000 invited, answered questions for the congressionally mandated study, one of the largest of its kind. Full results are expected in the spring of 2015.

MORE AT
www.rand.org/rmws

Will drones work in counterdrug operations?

Iraq, Afghanistan, and the U.S.-Mexico border share common ground: In the first two, the U.S. fought a war on terror, and in the third a war on drugs. The terrain in all three is so similar that the U.S. Department of Defense (DoD) has at times used the border region as a sort of testing ground for military technology.

Another commonality: DoD has developed advanced sensors for use in Iraq and Afghanistan that could be particularly helpful in counterdrug surveillance and monitoring along remote sections of the U.S. border. But is it legal for these sensors to be used domestically when they are operated by the military?

The short answer is yes, under certain conditions. In *Improving Interagency Information Sharing Using Technology Demonstrations,* RAND researchers concluded that DoD technology demonstrations along the U.S. border are legal as long as a valid request for support is made and no private information of U.S. citizens is collected.

It's a win on two fronts: Counterdrug operations gain a critical tool, and the military keeps a valuable testing ground.

MORE AT
www.rand.org/t/RR551

China poised to fail with commercial aviation push

China has invested billions of dollars in its domestic commercial aviation industry, which has yet to result in a commercially viable aircraft and is unlikely to do so for the foreseeable future, according to a study by RAND.

Efforts by the Commercial Aviation Corporation of China (COMAC)—the Chinese government's effort to compete with Boeing and Airbus—to construct new commercial aircraft have been hindered by problems in systems integration. An earlier regional aircraft has yet to obtain Chinese air certification. By the time the new jetliner is ready for production, COMAC will face stiff competition from new Boeing and Airbus models and pricing competition from used ones, the study finds.

The researchers suggest that China instead focus on general aviation, where it is more likely to succeed building smaller aircraft for private or charter use.

"The Chinese government sees designing and manufacturing passenger jets as an important indicator of the nation's advanced technological capabilities," said Keith Crane, director of the RAND Environment, Energy, and Economic Development Program and coauthor of the report. "What they have found is that the commercial aviation sector is a highly competitive market and that large passenger aircraft are difficult to build to international standards."

Still, should China succeed in penetrating the commercial aviation market, the study recommends several trade policies for the United States and European Union aimed at fostering a more transparent, more market-driven aviation industry in China.

MORE AT
www.rand.org/t/RR245

Your television may be watching you

Digital danger lurks in your living room. It's hiding in your smart TV and your set-top box, your DVD player and video game console, your Internet radio, and your iPad.

Just like a PC, these Internet-connected devices have the potential to expose you and yours to threats like the theft of personal data, identity fraud, even the monitoring of your movements and conversations through a device's microphone and camera.

At the moment, the risks are marginal, RAND researchers say. The devices are diverse and use a wide range of technologies, making it difficult for cybercriminals to create malware that works across the universe of machines. But the risks are rising as gadgets' guts grow more standardized, devices integrate with other platforms and architecture, and consumers bring more of them home.

Consumers can be their own worst enemy. People fail to read long user agreements and privacy policies that detail how their data can be used, and they balk at installing security patches. But device makers are also at fault. They make software updates too complex for most consumers (if updates are possible at all), and while companies manage to create engaging websites, they somehow forget to apply those attention-grabbing techniques to the text-heavy terms of service.

The good news is these are largely not new threats, just old threats in new devices. So these potential problems can likely be addressed by adapting existing solutions: user awareness campaigns, consumer-friendly terms of service and product information, built-in antivirus protection, industry-provided patches, encrypted routers, and firewalls and other proven approaches to network security.

MORE AT
www.rand.org/t/RR604

MILITARY PARADE: TECH SGT MICHAEL D EVANS; BORDER MARKER: JOSH DENMARK/FLICKR CREATIVE COMMONS; AIRPLANE: MARTIN HARTLAND/FLICKR CREATIVE COMMONS; RUG: ONLY1GRACE/ISTOCK; PERSON: S-CPHOTO/ISTOCK ; EYE: BRANISLAVI/ISTOCK

There are good hackers and malicious hackers. I consider myself a good hacker.

Lillian Ablon, shown here with her DEF CON black badge award, conducts technical and policy analysis research at RAND on topics spanning cybersecurity, computer network operations, emerging technologies, competitive intelligence and the human element in intelligence gathering, and digital exhaust.

The Good Hacker

Q You're a mathematician with expertise in cyber topics. What keeps you up at night?

A Many things: especially corporate and nation-state espionage, and the lack of focus on secure coding and user account security. I think about privacy concerns: not only having the right to be forgotten, but also the ability to be forgotten. There's the Internet of Things, which opens doors to personal networks. And the great weakness: the human element.

Q What's the one thing that would put a dent in cybercrime?

A Reducing confidence within black markets. Everyone is confident that the products work, that people are who they say they are, and that there's little risk of getting caught. To disrupt, maybe combine coordinated takedowns with blasting a ton of bad data, bad products, and false users into these markets to start to diminish confidence.

Q You were the first female winner of DEF CON 21. What does it mean to be DEF CON's "Deadliest Social Engineer"?

A DEF CON is one of the largest and longest-running hacker conventions in the world. It features technical talks and contests, one of which is on social engineering. The challenge was to get 45 specific pieces of information about a Fortune Top 10 company. I dug for open source information online, and then conducted a live social engineering phone attack on employees with the audience watching. I gained key insights into the company and could have successfully installed malware on its computers. The prizes included a lockpick set (adding to the one I already have), all kinds of gadgets, and—best of all—a coveted "black badge." I scored 200 points more than my closest competitor, and I was the first woman to win.

Q Which leads to your science, tech, engineering, and math (STEM) work with young women and girls.

A It's one of my passions. I loved math as a kid—I was 5 or 6 when I decided my favorite number was 959—and still love it. My husband and I throw an annual Pi Day party! So I want to do all I can to encourage more women to get excited and stay excited about numbers, math, and technology. It was such an honor to speak at inspiring conferences like CyberGirlz and Expanding Your Horizons. I'm mentoring a few of the young women I met, and it's incredibly satisfying. One reason few females are involved is lack of confidence, so I like to talk about "power posing"—Harvard's Amy Cuddy gave a well-known TED talk on this, but others also research the topic. Posing like Wonder Woman for just two minutes can reduce the stress hormone cortisol, increase your testosterone, and basically trick you into feeling powerful. Before I give any speech, you'd better believe I power pose!

Q Is "hacker" a dirty word?

A No! "Hacker" is an inspirational word. A hacker thinks outside the box, challenges the status quo, tries to improve things by figuring out how they work—often by breaking a thing or two. There are good hackers and malicious hackers. I consider myself a good hacker.

Q Your first career was working with code breaking, network exploitation, and vulnerability analysis. Was that as riveting as it sounds?

A (Long pause) It was absolutely awesome. Let's leave it at that. ◪

Ablon's most recent publication, *Markets for Cybercrime Tools and Stolen Data: Hackers' Bazaar,* is available for free download at www.rand.org/t/RR610

The Value of a Life

A Conversation with Kenneth Feinberg

Kenneth Feinberg has overseen compensation programs related to the terrorist attacks of 9/11; BP's Deepwater Horizon oil spill; mass shootings at Virginia Tech, Sandy Hook, and Aurora; the Boston Marathon bombing; and others. In November 2014, he spoke at RAND with Rob Cox of Reuters Breakingviews about the practical and philosophical issues that arise when attempting to calculate the monetary value of lives and injuries.

Sitting privately one on one with victims and their families—it is chilling, the stories are incredible, and you never get over it.

Hear the full conversation at www.rand.org/b141120feinberg

On the difficulty of adjudicating the monetary value of human life

In this country, money is the vehicle for compensating innocent victims. Maybe that's not the best way, but that's always been the way. And it really doesn't matter whether it's a pain-and-suffering formula, or a formula generated by a limited amount of money to all the victims. It doesn't really matter. You're still going to get people who will say, "Keep the money! Bring my son back." "Keep the money! Give me my leg back." So the formulas don't do very much to stifle emotion, anger, frustration. Is it fair? Don't even mention that word. This is not about fairness or justice. It's about mercy.

On fund administration

Get the money out as fast as you can. Avoid complex formulas. Don't place restrictions on funds. One couple lost a son and told me they were going to take the money—around $220,000—and to honor their son, they were going to take the whole family to Disney World. [Someone said] "I don't know if we can allow that," and I said, "Allow that? Don't you dare place restrictions on what grieving people want to do with that money! That's not your role!"

Nothing helps more than the public and the claimant seeing that there's millions or billions of dollars flowing, frankly, in record time. All the words in the world don't solve the problem if you can't get money quickly out the door.

The other thing is, any claimant who wants to come and see me, I'll see them. And that is by far the toughest part of what I do. Sitting privately one on one with victims and their families—it is chilling, the stories are incredible, and you never get over it. People come to validate the memory of a lost loved one. My office after 9/11 was filled with memorabilia: videos, audio, ribbons, diplomas, medals, certificates of good conduct, green cards. People want to take the opportunity to explain what the loss means to them.

On American generosity

Never underestimate the charitable impulse of the American people. It is astounding to me how, after the Boston Marathon, Mayor Menino in two months helped promote a fund that raised privately $61 million. I've never seen anything like it.

On public service

How do I do it? It's not rocket science. There are many people in this room who could do exactly what I do. I'm asked as a citizen by President Obama (BP), by President Bush (9/11), by Mayor Menino (Boston Marathon), by Governor Hickenlooper (Aurora mass shooting) … you're asked to do it. It's very bipartisan. It's not red-blue, liberal-conservative, Democrat-Republican. I was raised in the early 1960s in Massachusetts, where a fair-haired son of Massachusetts was in the White House and kept explaining how every individual in this country can make a difference, public service is a noble undertaking, *government* is not a bad word—and that tends to remain with me to this day. And if a president calls up, what are you gonna say? You're busy?

On survivors

Every time you do one of these programs, you've just got to be a good listener. Because there's very little you can say that will ameliorate the anger and the hurt. You've got to meet with people. I find that if you're willing to put a human face on the program and meet one on one, it's very painful, but it really helps people get through it.

A FOCUS ON THE RESEARCH OF
James M. Anderson, Nidhi Kalra, Karlyn D. Stanley,
Paul Sorensen, Constantine Samaras, and Oluwatobi Oluwatola

The Dream Drive

RAND researchers see challenges on the road ahead—as well as societal benefits of autonomous vehicle technology.

You're sweating, exhausted, and stuck on a sultry afternoon in a major jam on the notorious 405 Freeway in Los Angeles, or you're clutching the steering wheel as your teeth chatter during a morning Chicago snowstorm on a congested Dan Ryan Expressway. You may be swearing about the crawl caused by drizzle on Washington's Beltway or by a fender-bender on New York's FDR Drive.

Suddenly, an impatient driver from an adjacent lane swerves into yours. Or the motorist ahead of you jams on his brakes. Or both.

"The social benefits of autonomous vehicles will outweigh the likely disadvantages."

JAMES ANDERSON, SENIOR BEHAVIORAL SCIENTIST

Recognize this teeth-gnashing, crash-and-bang scenario?

It's sadly familiar across the United States, where drivers fume in stalled traffic, end up in tens of thousands of accidents, and lose to road congestion by some estimates billions of hours of productive time and billions of dollars for added fuel costs.

In the next decade or so, a smoother path may open. If automotive technology continues some of its recent well-documented advances, motorists across America, and, indeed, the planet, may embark soon on a new era of dream driving. Some say we're on the brink of a new day when cars drive themselves—and many other circumstances may change significantly, as a result.

"Our research finds that the social benefits of autonomous vehicles—including decreased crashes, increased mobility, and increases in fuel economy—will outweigh the likely disadvantages," says James Anderson, a senior behavioral scientist who led a recent RAND

POINTS TO CONSIDER WITH AUTONOMOUS VEHICLES

Keep on Going: Futurists envision autonomous vehicles picking up passengers, dropping them at destinations, and then getting dispatched to transport other riders all day long.

Safety and Economy: A decrease in the frequency of crashes could allow for lighter vehicles—over time increasing fuel economy and reducing emissions.

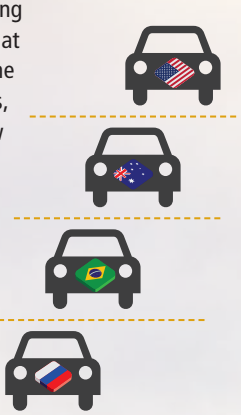
New Passengers: Advanced technologies may offer those who can't drive—such as the elderly, young, blind, or disabled—newfound mobility.

Sensors and Cameras: These systems help autonomous vehicles make sense of the surrounding world—the traffic, infrastructure, road regulation, and objects or obstacles ahead, behind, and around. But is that thing in the road a child or a flying newspaper? Are these computer-linked systems fully functioning and how might they be affected by weather, terrain, congestion, and other factors?

CLOUD PHOTO: DENIS/FOTOLIA; GOOGLE CAR BY SCOTT SCHRANTZ/FLICKR CREATIVE COMMONS; FLAG ICONS: BARNEYBOOGLES/FOTOLIA

Where will driving accelerate?

The world knows that Americans are car-crazy, but which other countries are likely to see growth in driving in the 21st century? Recent RAND research suggests that, after the U.S., Australia, Brazil, and Russia (in that order) will see increases in driving; this will be less so for Germany, China, India, and Japan. Per capita income is not decisive in determining if nations likely will see more driving. Researchers examined nine factors, including the prevalence of a car-friendly infrastructure in a given nation, the age of its population, and how many of its people need to travel to work. In Australia, a sprawling geography encourages auto use, while in Japan, an aging and densely concentrated population and excellent mass transit will discourage it. Though both economically burgeoning, India and China have giant populations; both will need to make ongoing and substantial investments in roads and other infrastructure to curb existing traffic congestion and to encourage more use of cars and mass transit. Brazil's growing working population and car industry both suggest driving will samba ahead, while an energy boom and infrastructure investments make it appear that more Russians will say 'Da!' to more driving. As has been shown by the Germans—legendary carmakers and high-speed drivers on their autobahns—public policies can influence whether driving increases. Since unification, Germany has discouraged driving with high costs for permits and parking.



Self-driving cars could present opportunities for those who don't drive, such as seniors, younger people, the disabled, and the vision impaired.

Four key policy considerations

California, Michigan, Florida, Washington, D.C., and Nevada lead the way in creating laws to regulate use of autonomous vehicle technology; the rest of the nation may soon follow. Will the U.S. have a regulatory patchwork and what key points should policymakers keep in mind about self-driving cars? Here's what RAND researchers recommend:

1 Policymakers should avoid passing premature regulations while this technology is still evolving

2 Distracted-driving laws will need to be updated to reflect advances in technology

3 Policymakers should clarify who owns data generated by this technology and how the data will be used, and address privacy concerns

4 Regulations and liability rules should be designed by comparing autonomous vehicles' performance with that of average human drivers; the technology's long-term benefits should be incorporated into determinations of liability

study that explores the communications and regulatory challenges and liability issues raised when vehicles navigate on their own or with minimal human intervention. "This is an area where things are zooming along faster than many experts expected and we need to think through now what it might mean to society."

Advances speed along

Google, as of March 2013, had logged more than 500,000 miles of autonomous driving on public roads without a crash, though, to be fair, it also had highly trained operators aboard, ready to take over in challenging situations. Mercedes-Benz, Tesla, GM, and Nissan—big names in the auto industry—are racing to lead the pack to get smart, self-driving vehicles on the road.

The technological and mechanical components for self-driving cars already have leaped into existing models, some of which already park themselves, stay in designated lanes, warn of obstacles or objects in the driver's blind spots, and even brake or improve stopping in certain emergencies.

If these kinds of features can be synched together and software and computing power can be stepped up to analyze and assess information provided by rapidly advancing, wirelessly communicating on-vehicle cameras and sensors, RAND researchers see an array of transportation benefits.

"People have proven to be generally poor at driving," says Anderson, and statistics support his harsh judgment. If cars can drive themselves well, experts envision huge safety improvements, in both auto fatalities (there were 32,000 of those in the U.S. in 2011) and accidents (in which some element of human error was to blame in roughly two-thirds of cases).

Autonomous vehicles also likely will reduce energy use and fuel emissions, both through more efficient operation and because, with fewer crashes, cars may be made lighter. Because self-driving cars won't get bored or distracted, and don't need to make ego-dives in and out of lanes at alternately fast and slow speeds, experts like Anderson estimate that existing roads could accommodate twice or three times the number of cars, all moving faster and more safely.

The report *Autonomous Vehicle Technology: A Guide for Policymakers* results from RAND's Investment in People and Ideas program. Support for this program is provided, in part, by the generosity of RAND's donors and by the fees earned on client-funded research.

MORE AT
www.rand.org/t/RR443-1

New benefits

Commuters, of course, could become more productive if they could take care of business—answering emails, making phone calls, reading and writing—while en route to their jobs in cars that handle all or most of the chore of driving, Anderson and his colleagues at RAND say. The productivity gain would be something to honk your horn about, considering that U.S. officials say 8.1 percent of Americans commute for an hour or longer.

As RAND researchers found, self-driving cars could open all kinds of new horizons for those who temporarily can't drive—when cars are in the shop or injuries get in the way—or for those who don't, including seniors, younger people, the disabled, and the vision impaired.

If cars can drive themselves, and if they could be linked into a transportation network, motorists might see even greater life changes: Cars might be programmed to pick them up and deliver them to work places, where there would be drastically reduced need, RAND researchers suggest, for what's now a big, land-grabbing use: parking. By one estimate, 31 percent of the space in central business districts in 41 U.S. cities is gobbled-up parking; self-driving cars could drop off passengers, and then head to more distant, satellite lots to recharge or refuel. Or they might be dispatched to provide rides for seniors and moms to shop during the day.

The path forward

For motorists who are ready to rip their hair out by the roots in frustration with driving as it exists today, however, RAND researchers urge not only patience but awareness that the road ahead for self-driving vehicles may have significant speed bumps.

The technology for self-driving vehicles isn't fully developed and ready for robust use—yet—and autonomous driving requires mastery of complexities, including varied weather, terrain, and road rules; whether an object in the road is a blowing brush or a child; if all onboard equipment, especially critical sensors and cameras, are operating fully and well; and how multiple self-driving vehicles might communicate and work together.

Cost, obviously, will be a driving issue. This could be challenging to resolve because many benefits of self-driving cars won't accrue to their purchasers and their positive societal effects may justify some form of government subsidy to encourage their spread and use.

"The future holds promise for autonomous vehicles," Anderson says, "but we'll have to see—and policymaking will play a crucial role in how we advance, or don't, in this area."

AX: KUNERTUS/THINKSTOCK; CAR: VLADRU/THINKSTOCK

Car hacking

Today's cars run millions of lines of software code to make driving safer and more comfortable: adaptive cruise control increases fuel efficiency, keyless entry offers convenience when carrying an armful of grocery bags, and electric power steering and brakes improve driver response. Modern cars also are equipped with integrated wireless communication and GPS navigation systems.

But these conveniences also can help hacking, as recent incidents show: In 2010, a 20-year-old disgruntled employee in Austin, Texas, tampered with data on a Web-based system used to remotely disable repossessed vehicles, leaving more than 100 drivers unable to start their cars or stop the horns from blaring. That same year, University of Washington researchers exposed flaws in onboard networks by embedding malicious code to disable a car's braking system. Last year, two DARPA-funded researchers connected a laptop to a Ford Escape, and then programmed the vehicle to override driver commands to divert it remotely to a vacant field. Those researchers showed on a Toyota Prius that they could remotely control its acceleration, steering, brakes, horn, and even its seat belts.

Rudimentary vehicle-security measures have not kept pace with sophisticated new computer systems. Onboard networks likely will grow more attractive to hackers—whether their aim is to steal a car, eavesdrop on a conversation, stalk a potential victim, or cause a devastating traffic accident. A review and upgrade of vehicle security standards are long overdue.

Politics Aside

The conversation has only begun.

In November 2014, RAND hosted its flagship Politics Aside event to convene thought leaders in a nonpartisan examination of pressing policy challenges. A collaboration with media partner Thomson Reuters, the gathering engaged policymakers, business leaders, researchers, entrepreneurs, and philanthropists in conversation on topics ranging from shifting Middle East alignments and international affairs to space and technology and innovations in health care. Visit www.rand.org/politicsaside to watch video highlights featuring our distinguished speakers.

CADY COLEMAN,
NASA ASTRONAUT

On her 159-day mission aboard the International Space Station

To live in a place where all the rules are different … when you change the environment, you change what people can do, and that's what exploration is all about. The science experiments and the engineering experiments that we do up there can't be done down here, and that's why we do it.

SUE SIEGEL,
GE VENTURES AND HEALTHYMAGINATION CEO

On innovations in health and technology

Brain health, because of this aging demographic, is in an emergency situation. As we start to bring new technologies into the marketplace, instead of thinking about pharmaceuticals, think about apps being prescribed by your physician. Just like we brush our teeth or work out, there's going to be this notion of working out your brain in these e-neuro applications.

ADMIRAL MICHAEL S. ROGERS,
NATIONAL SECURITY AGENCY DIRECTOR

On 21st-century threats

When we started off this whole idea of deterrence within the nuclear framework, we dealt with nation-states only—no individuals, no groups. Our nuclear capability resided solely at the time within the nation-state framework, and quite frankly, it was an incredibly small number of nation-states. Cyber is fundamentally different in that regard.

EVAN SPIEGEL,
SNAPCHAT COFOUNDER

On social media

It can be very challenging to turn attention into action. There's this myth that if you post something, people are listening. But they're not. While it seems like you're shouting into the world, people aren't listening and aren't necessarily taking action because there is such a high quantity of information being distributed.

JAMES DOBBINS,
RAND DISTINGUISHED CHAIR IN DIPLOMACY AND SECURITY

On ISIS

The Taliban never had any intention of striking the United States. But they were willing to host groups that did and facilitate their operations. And it's hard to believe that ISIS wouldn't do the same thing, whatever its own intentions are, if they were allowed to take and hold territory and set up a state.

JUDITH RODIN,
ROCKEFELLER FOUNDATION PRESIDENT

On resilient communities

Planning and readiness are critical, but they can't always keep bad things from happening. When bad things do happen, recovery must not be based on the "build it back" mentality that has guided the past. Rather, we need to ensure the recovery process unfolds in ways that better prepare us for the future.

A FOCUS ON THE RESEARCH OF
Lindsay Daugherty, Rafiq Dossani,
Erin-Elizabeth Johnson, and Cameron Wright

Tech for Tots

Was that iPad stocking-stuffer exactly the right holiday gift, **or was it too much too soon?**

Scarlett Langley was a toddler when she got an electronic tablet. The first-generation iPad, which she dubbed "Elmo Potty" because of an educational video loaded on it, was a gift from her grandfather, a law professor and pioneer in computer law.

"My dad lives nearby and he's always been deeply involved in my kids' lives," explained mom Cindal Langley, 28. "Scarlett, almost from the beginning, loved to climb in his lap, to grab his smartphone and to play with it. So he got her an iPad and we thought, 'Well, what's the harm? She'll get bored with it and will move on fast.'"

She didn't. Now almost 6 years old, Scarlett's experiences and those of youngsters like her exemplify issues that experts at the RAND Corporation are researching, with the support of the PNC Foundation, especially through

PHOTOS BY LORI SHEPLER

SCARLETT LANGLEY, ABOVE LEFT, AND HER BROTHER, MAX, DO NOT KNOW A WORLD WITHOUT TECHNOLOGY. THE KIDS ENJOY SOME SCREEN TIME WITH THEIR MOTHER, CINDAL, ABOVE.

THE EVIDENCE IS STILL LACKING FOR CHILDREN AGES 2 AND YOUNGER, BUT STUDIES INCREASINGLY SHOW THAT THERE CAN BE BENEFITS OF TECH USE FOR OLDER TODDLERS WHEN USED APPROPRIATELY.

Balancing screen time

The American Academy of Pediatrics has called for kids younger than 2 to be barred from screen time and for those older than 2 to be limited to two hours daily. Advocates say these curbs are important because studies offer some evidence that screen time affects youngsters' behavior, attention, focus, academic performance, weight, and social and language development.

But these physician- and government-approved guidelines were developed in 1999 and include TV viewing, as well as technology use. In *Moving Beyond Screen Time,* RAND researchers write, "Rapid evolutions in both technology and our understanding of its potential benefits and harms suggest that a new, more expansive definition of appropriate use … is necessary." After convening with educators, policymakers, researchers, teachers, and early education advocates, what's the revised RAND counsel?

Adults considering kids' tech use should ask these questions to see if screen time is purposefully integrated to support learning:

- Is it a tool to **thoughtfully improve** reading, mathematics, science, and motor skills?
- Is it **balanced** with other activities?
- Does it occur in solitary or **with others?**
- What are the **content and features** of media (software, apps, and videos) that kids take in on a device?
- Are these **developmentally appropriate,** free of violent or adult themes, engaging, interactive?
- Are youngsters sedentary or **mobile** when engaged?

MORE AT
www.rand.org/t/RR673z2

> "Why not let them learn the best ways to use this stuff?"
>
> —CINDAL LANGLEY

Grow Up Great, PNC's $350 million, multi-year initiative to help prepare children from birth to age five for success in school and life.

"Technology literacy plays an important role in a child's ability to succeed in school and later life," said Lindsay Daugherty, a policy researcher and lead author of a recent report on tech and kids. She and her RAND colleague, senior economist Rafiq Dossani, have noted that children ages 3–5, on a typical day, spend an average of four hours with technology and its use is increasing among children of all ages. In one of their series of new studies on the topic, they wrote, "We need to shift the conversation from 'Should young children use technology?' to 'How can we use technology with young children to maximize its benefits?'"

Technology's use, especially in education of the young, can provoke divisive reactions, the researchers said. Some studies and advocates say it can build reading, math, motor, socioeconomic, and cognitive skills; others see it doing the opposite, diminishing children's development of crucial social skills and interactions and discouraging them from creative thinking, play, and robust exercise.

RAND, with PNC, has reached out to parents, educators, researchers, policymakers, advocates, and others to launch a sustained, national conversation to address unresolved questions about technology and early childhood education and to provide evidence-based policy responses to ensure tech betters youngsters' lives and learning.

They convened a major forum in Pittsburgh, and presented a series of reports—fresh research and perspectives providing both a broad overview and closer scrutiny of key issues about tots and technology.

Tech's a regular topic at the Langley house, where mom Cindal contrasts her views with those of husband, Kevin. "With Scarlett and, now, her younger brother, Max, I'm looking at their tech use and asking, 'Why not let them learn the best ways to use this stuff?' while Kevin is asking, 'Why do they need to get it now while they're so little?' We make sure our kids are social and socialized. They're active and love to play outside. We're not just sticking our kids in front of a device and leaving them. We're looking at technology and realizing how important it's going to be to them—how big it is already—and we want to ensure they get a head start."

Langley described the time and care she devotes to her kids' tech lives. She carefully chooses media they consume. She tests the software and apps and screens videos they watch on devices. These all must be educational, engaging, interactive, and feature positive and interesting characters. "We want technology to enhance our kids' education and lives," she said. "It should offer a clear benefit."

In Oakland, agreeing with Langley, Davina Dickens reflected on the early tech experiences of her daughter, Sophia, 7, and son, Justin, 5. "Sophia probably started intensely using an iPad when she was 4, while Justin got into it probably at 3," Dickens recalled. "She started slowly, then as she got older, she figured out things that interested her online and with apps. But Justin, he started playing on an iPhone and then he was really into it."

JUSTICE STATUE: PHOTOVGEGESFOTOLIA; TABLET PHOTO: UMBERTOPANTALONE/ISTOCK; BOOK: ARSELA/ISTOCK

> "Why do they need to get it now while they're so little?"
>
> —KEVIN LANGLEY

Her son, she said, loves to play educational games on one of the two family iPads; her daughter likes crafts and seeks out videos online to learn how to make toy bracelets with rubber bands. "I monitor their use closely," Dickens said, noting that dad Tyrone helps her keep the youngsters tech use in balance with other activities.

"I feel like technology's a good thing/bad thing," Dickens added. "The kids seem to learn things faster than I do and they know tech things already that I don't. There are times I'd rather see them reading a book, and I try to buy apps more geared to education but letting them play games every now and then is not a problem."

Underscoring points made by RAND researchers—that busy parents need to stay engaged and informed about youngsters' early education and educators need to find ways to inform and involve families—Dickens and Langley both said they have been pleased with how their youngsters' preschools, kindergartens, and elementary schools teach kids about using technology. Dickens noted this learning can be hit or miss in her area.

"There are places nearby more prestigious and wealthy and some that are poorer," she said. "But we're lucky because our school and its community are active and the parents and families really want technology to be a good part of our youngsters' education and lives."

As for Scarlett and Max, on a recent gray afternoon, they both were busy at play on their tablets, giggling and bouncing between tech and old-fashioned play in their grandfather's living room. While Scarlett's glee with her iPad activities was evident, the most she would say is that she would be "very, very sad" if she couldn't use devices.

"Technology has been such an integral part of her life that it's beyond second nature. She doesn't know a world without it," observed her grandfather Michael Scott.

Its influence also has been clear: On a big trip to France, the family had to ask a local for directions. The adults were perplexed by his reply. But Scarlett, who had an early fascination with apps to learn French, piped up: "Mommy, he said to go right." And she was right.

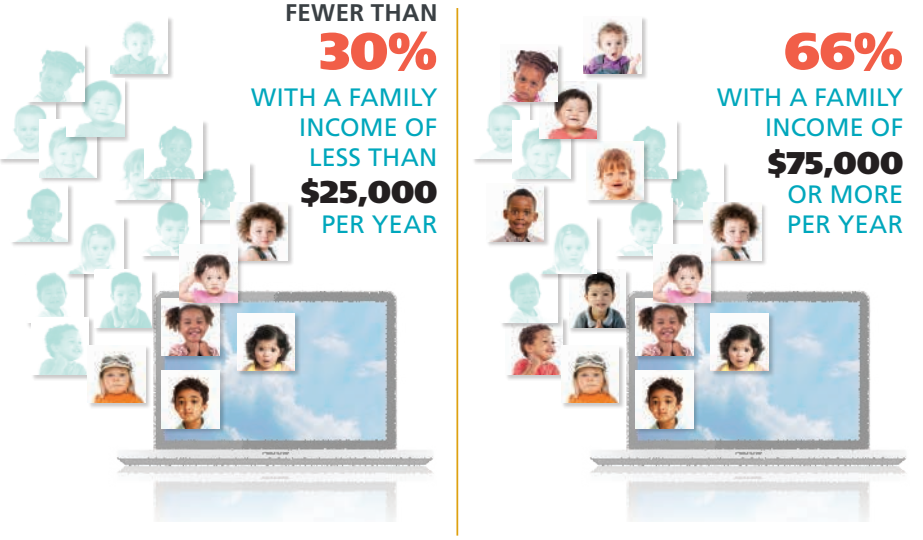
The digital divide

Walk down the aisle of any computer or toy store to check out kids' computing devices, software, applications, videos, and online services, and you'll get it: This stuff isn't cheap! It changes fast, it's complicated, and there's a dazzling—even daunting—array of product choices. Yet studies indicate that a digital divide—a gap between technology's haves and have-nots—manifests early on, in terms of not only access but also learning. For instance, kids in poorer areas are more likely to be taught to use computers for drill or practice, as opposed to their peers in wealthier spots, who tap technology in innovative ways and to support development of higher-order reasoning skills.

RAND experts have not only joined the chorus of concern about potential problems arising out of the digital divide; they have offered research-based ways to better frame policy discussions and proposals to address these pressing challenges. They urge policymakers and practitioners to define technology's appropriate use in early childhood education and, once this is clearer, to determine how best to support its effective use with devices, connectivity, software, and other components. Parents and families will need help so they play positive roles in seeing that technology improves their youngsters' learning and lives. Those who educate students aged 3 to 5 will need support and training, too.

Who gets a computer?

KIDS AGE 5 OR YOUNGER, WHO USED A COMPUTER, IN 2012



ISTOCK PHOTOS (UNLESS OTHERWISE), TOP TO BOTTOM, LEFT TO RIGHT: JANI BRYSON, SAMUEL BORGES, LEUNGCHOPAN, MARTIN CARLSSON, NELIK, HOGAN IMAGING/FOTOLIA, BOJAN KONTREC, NICOLESY; ANDRES RODRIGUEZ/FOTOLIA, JANI BRYSON, LANYCH, LEUNGCHOPAN, DOMREDRIVER, AEDKAFL, NICOLESY, AJAYKAMPANI, NELIK, HIGHTOWER, MITGIRL

BY
Beau Kilmer

A Sober Look at Legalizing Marijuana

Marijuana is in the news and you should get used to it. Retail marijuana stores opened last year in Colorado and Washington state, and voters in Alaska, Oregon, and Washington, D.C., passed initiatives to legalize recreational marijuana this past November. Throw in monthly revenue updates from Colorado as well as perpetual exposés about marijuana edibles and e-joints, and you are going to get your weekly pot fix whether you like it or not.

And this is only going to intensify over time.

AP PHOTO BY REBECCA BLACKWELL

Beau Kilmer is codirector of the RAND Drug Policy Research Center and coauthor of *Marijuana Legalization: What Everyone Needs to Know* (Oxford University Press, 2012).

An earlier version of this commentary appeared in the *San Francisco Chronicle* and on The RAND Blog on July 12, 2014.

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California and a handful of other states will probably vote on legal pot in 2016. Whether it passes will depend on several factors, including the quality of the proposal, how much money is involved in the campaigns, and how things play out in Colorado, Washington, and other places that have legalized production and sales. For states that will probably decide on marijuana policy, here are five suggestions to help policymakers who want to promote productive discussions:

1. Collect baseline information about the size of the marijuana market in your state. Credible projections about how legalization could influence use and tax revenues must be rooted in rigorous and transparent estimates of how much marijuana

is currently being consumed. Without these numbers, pot debates can get hijacked by wild overestimates. While it is hard to estimate the value of a black market, there is an emerging science about how to do this for marijuana.

2. Collaborate with health agencies to determine what share of drug survey respondents are honest about using marijuana. This is not only critical for sizing the current market; legalization will also be evaluated by whether self-reported marijuana use increases after the change. If legalization reduces the stigma of marijuana and leads people to be more honest, then this could complicate these studies. There is a precedent for validating self-report surveys with drug tests, but those analyses are outdated. They need to be updated and conducted at the subnational level, preferably by state.

3. Recognize that the Colorado and Washington approach of "regulating marijuana like alcohol" is only one alternative to marijuana prohibition. There is a lot of policy space between the extremes of prohibition and a commercialized industry. For example, states could start slowly and allow marijuana to be produced only by nonprofit organizations, or in co-ops, as is done in Spain and will soon happen in Uruguay. Creating a state monopoly for marijuana production and distribution is another option, but federal marijuana laws make this infeasible.

4. Make it clear that marijuana policy changes do not have to be permanent. Pioneering jurisdictions could include a sunset clause where, after a certain number of years, they decide whether to continue down that path or try something different. At a minimum, serious amounts of flexibility should be built into the policy so it is not hard to make midcourse corrections, especially with respect to setting taxes.

5. Remind your constituents and colleagues that reasonable people can disagree about marijuana policy. Individuals have different values about intoxication and personal liberties, and there

is uncertainty about how legalization will affect health. It not only depends on how legalization affects marijuana consumption patterns, but also on how it affects alcohol use. The science right now is unclear as to whether a change in marijuana policy will lead to more or less alcohol consumption. Acknowledging this before diving into legalization debates can help take the edge off this issue and hopefully promote useful discussions.

ILLUSTRATIONS BY MERIEL JANE WAISSMAN/ISTOCK

BOTTOM LINE

In states like California where legalization votes are likely, policymakers should be proactive about informing these debates.

These five tips are a place to start.

BUZZ FOR SALE

TOP LEFT: DANA CAIN, DIRECTOR OF THE DENVER COUNTY FAIR IN COLORADO, AT A PRINT SHOP WITH A POSTER ADVERTISING THE FAIR. THE COUNTY ADDED A CANNABIS-THEMED CONTEST TO ITS 2014 SUMMER FAIR.

ABOVE: IN THE GARDENING AISLE, CANNABIS SEEDS SHARE THE SHELF WITH DAHLIA BULBS.

BELOW: MARIJUANA EDIBLES AT GREEN ESSENTIALS, GLENWOOD SPRINGS, COLORADO.

COUNTY FAIR: AP PHOTO BY ED ANDRIESKI; SEED PACKETS: SUSANNE ALFREDSSON/SNAPWIRE; DISPLAY CASE: KENT KANOUSE/ FLICKR CREATIVE COMMONS

A $5 million gift from the late John M. Cazier will turbocharge research in environmental and energy sustainability at the Pardee RAND Graduate School.

This donation establishes the John and Carol Cazier Environmental and Energy Sustainability Initiative, which will help generate new concepts, tools, and methods to share findings, ideas, and insights clearly and broadly, so that they can improve public policy, foster better practices in the field, and be applied in the commercial sector to benefit people throughout the world.

"I want to ensure that the right bridges get built between the research powerhouses of RAND and Pardee RAND, the commercial world, and the best practitioners in the field."

JOHN CAZIER

"John Cazier was an inventor and innovator in automotive engineering," said Susan Marquis, dean at Pardee RAND. "We're grateful for John's generosity and his forward thinking on green practices and sustainability."

Developing, sharing, and applying new ways to tackle existing and emerging problems across a broad number of fields, including the environment, engineering, and sustainability, has long been a hallmark of RAND and is integral to the scholarly work at Pardee RAND, Marquis noted.

The philanthropist made his gift several months before he passed away in August 2014 after a brief illness.

"I'm truly impressed with the intellectual capacities of Pardee RAND and RAND," John Cazier said. "After having success in the engineering and automotive industry, I want to ensure that the right bridges get built between the research powerhouses of RAND and Pardee RAND, the commercial world, and the best practitioners in the field. People around the planet must deal with so many challenges, today and in the days ahead, that we need to share information, get smarter, and do so with all of us in our different spots pulling together."

Under the initiative—which also honors his late wife, Carol—the graduate school will bring important visiting fellows to campus and provide valuable research and dissemination tools to students and faculty members. The visiting fellows—some of the best minds and practitioners in their fields—will challenge, inspire, inform, and educate Ph.D. candidates, faculty, RAND researchers, and the RAND community—and it is hoped that being part of the RAND community will broaden the visitors' horizons, too.

Pardee RAND was founded in 1970 as one of eight graduate schools created to train future leaders in the public and private sectors in policy analysis.

For more about Pardee RAND, visit www.prgs.edu.

A Million Random Digits with 100,000 Normal Deviates

A Love Story

Though long retired, *A Million Random Digits* continues to receive reviews on Amazon.com—of the tongue-in-cheek variety.

"With so many terrific random digits, it's a shame they didn't sort them, to make it easier to find the one you're looking for."

"While the printed version is good, I would expect the publisher to have an audiobook version as well."

"This has got to be the most useless set of Sudoku puzzles ever."

The 600-page reference book *A Million Random Digits with 100,000 Normal Deviates* isn't exactly Shakespeare, but to J.C. Dixon, it still reads like a love sonnet.

As a student, the North Carolina man used RAND's classic volume to select phone numbers for a poll he was conducting as a statistics class project.

"One of those phone calls was answered by the woman who is now my wife. We've been happily married for ten years! Thank you, RAND," Dixon writes in a five-star book review on Amazon.com.

A Million Random Digits turns 60 this year. Published in 1955, the book contains 600 pages of five-digit numbers arranged in 10 columns across every page. Randomized numbers are useful to professionals like pollsters, statisticians, physicists, market analysts, lottery administrators, researchers, and cryptographers.

RAND used a kind of electronic roulette wheel to generate the numbers—a huge leap forward from the usual methods of casting dice, flipping through phone books, or drawing cards from a hat. Stored on 20,000 IBM punch cards, the numbers generated by the roulette wheel were scrambled twice more and printed using a Cardatype machine. RAND's titanic task took years to complete.

But the book's days were numbered. Enter the high-speed digital computer, and the book went out of print in 1989.

READ *A MILLION RANDOM DIGITS* AT WWW.RAND.ORG/T/MR1418

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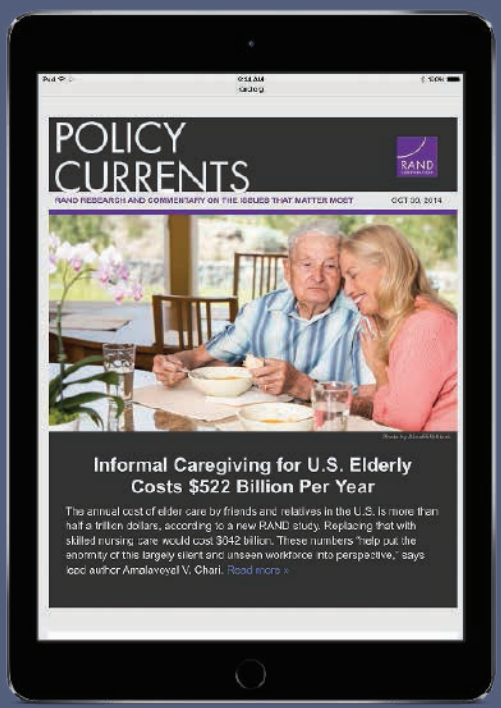

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