MIT Technology Review

VOL. 116 NO. 5 | SEPTEMBER/OCTOBER 2013 | $5.99 US

A Printer for Bionic Body Parts
Demo p104

Designing reener ildings
ws p94

The Next Silicon Valley
Business Report p84

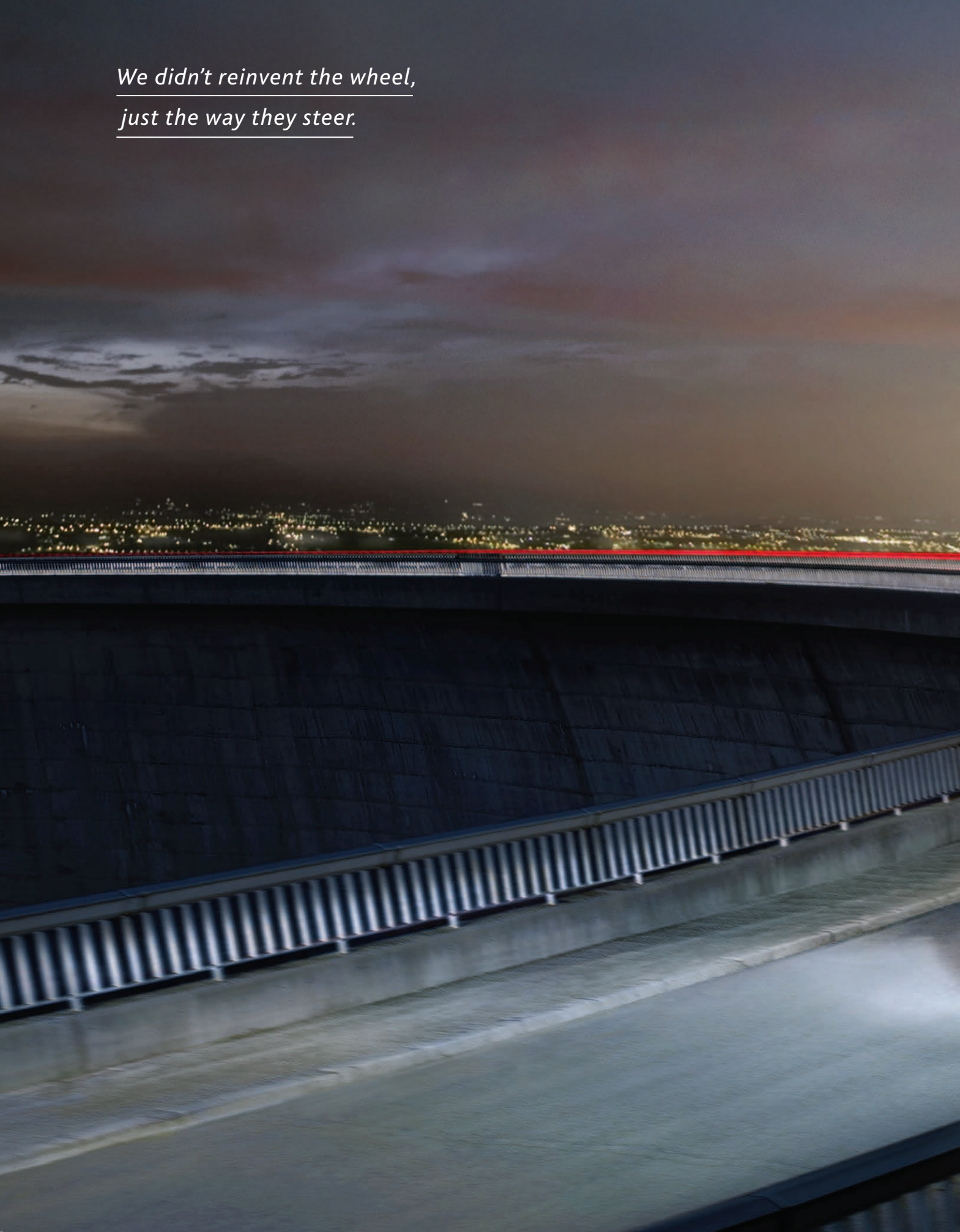
(REALLY) CREATIVE DESTRUCTION

Ben Milne wants to demolish the credit card industry and transform how we'll pay for everything.

Meet him and 34 other world-changing innovators under the age of 35.

10

0 71658 01308 7

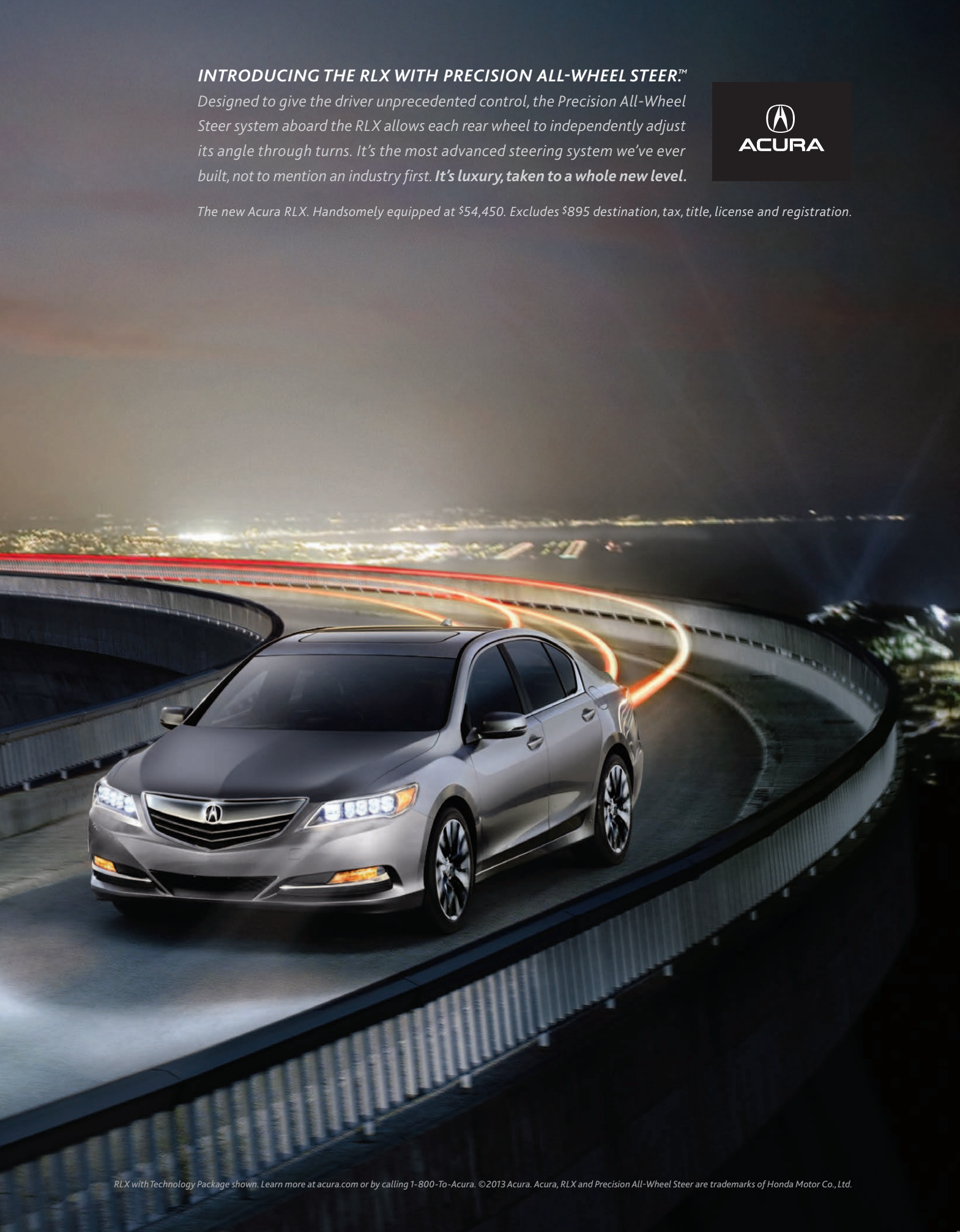

We didn't reinvent the wheel,
just the way they steer.

INTRODUCING THE RLX WITH PRECISION ALL-WHEEL STEER.™

Designed to give the driver unprecedented control, the Precision All-Wheel Steer system aboard the RLX allows each rear wheel to independently adjust its angle through turns. It's the most advanced steering system we've ever built, not to mention an industry first. ***It's luxury, taken to a whole new level.***

ACURA

The new Acura RLX. Handsomely equipped at $54,450. Excludes $895 destination, tax, title, license and registration.



RLX with Technology Package shown. Learn more at acura.com or by calling 1-800-To-Acura. ©2013 Acura. Acura, RLX and Precision All-Wheel Steer are trademarks of Honda Motor Co., Ltd.

From the Editor

Seven over 70

For over a decade, we've celebrated innovators under the age of 35. We choose to write about the young because we want to introduce you to the most promising new technologists, researchers, and entrepreneurs. But I often hear: You really think older people can't innovate?

Of course they can. We meet extraordinary older innovators all the time, who after a lifetime of creativity are still solving big problems, generating wealth, or expanding our conception of what it means to be human. Below, in reverse alphabetical order, are seven innovators over the age of 70, chosen arbitrarily, because I am attracted to their lives, work, and character, and not according to the formal nomination and judging process that selected the 35 Innovators Under 35 (see page 26).

George Whitesides, 74, is a cofounder of more than 12 companies (including Genzyme) whose combined value is more than $20 billion, and is named on more than 50 patents. Amongst his inventions are cheap paper microfluidic chips, which can be used for diagnostic tests in the poor world. At Harvard, he runs one of the world's most productive chemistry and materials science labs, whose objective is "to fundamentally change the paradigms of science."

The electrical engineer **Carver Mead**, 79, has been responsible for an implausibly long list of innovations in microelectronics, including the first software compilation of a silicon chip. Halfway through his career, he switched his research to how animal brains compute, and established the field of neural networks. After cofounding more than 20 companies, he is only notionally retired; today, he is thinking about better ways to teach freshman physics at Caltech, where he has worked for more than 40 years, by means of a "reconceptualization of electrodynamics and gravitation."

Barbara Liskov has been awarded both the Turing Award for her work on the programming languages and methodology that led to object-oriented programming and the John von Neumann Medal for her contributions to programming and distributed computing. At 73, she leads MIT's Programming Methodology Group, which is exploring how to build distributed and fault-tolerant systems that continue to work even when some of their components don't.

The physician and biologist **Leroy Hood** helped create the fields of genomics and proteomics by inventing the protein sequencer, the protein synthesizer, the DNA synthesizer, and, most important of all, the automated DNA sequencer. He later founded the Institute of Systems Biology in Seattle and, at 74, is still its president; the institute seeks to understand diseases by considering human biology holistically as a "network of networks."

Nick Holonyak invented the first practical light-emitting diode in 1962 when he was a researcher at General Electric, but his innovations are not limited to the replacement for the incandescent lightbulb. He also created the electronic element of the light dimmer switch and the laser diode, which is used in DVD players and cell phones. Holonyak, 84, is still a full-time researcher at the University of Illinois, where he works on quantum-dot lasers, which could be used for a variety of novel display and medical technologies.

The nanotechnologist **Mildred Dresselhaus**, 82, was the author of 39 papers in 2012 and most days is in her office at MIT by 6:30 A.M. Her research involves the physics and properties of carbon nanomaterials, including nanotubes and graphene. Among her many accomplishments, Dresselhaus was the first scientist to exploit the thermoelectric effect at the nanoscale, which could allow for devices that harvest energy from temperature differences in materials that conduct electricity.

Stewart Brand's contributions to technology have been as an intellectual and founder of organizations, rather than as an inventor. But Stewart (who is a friend) has been tremendously influential: he was the publisher of *The Whole Earth Catalog*; cofounded the first electronic community, the WELL; and is today the president of the Long Now Foundation, which promotes "slower/better thinking." At 74, he is working on the revival of extinct species.

I'll conclude this list with an extra name, from my own profession. Now 83, **Robert Silvers** has edited the *New York Review of Books* for more than 40 years. His is my favorite publication, because it is reliably surprising, delightful, witty, and humane. When asked why he doesn't retire, Silvers once joked, "I don't have a very full sense of time." He then more seriously added that work was an extraordinary opportunity, and that "you'd be crazy not to try to make the most of it."

GUIDO VITTI


We create chemistry that makes “wow” love “why”
Do you know kids’ most popular reaction to chemistry? It’s “Wow!” One simple word with great scientific experience behind it. We’ve heard it many times, in more than 30 countries, at BASF Kids’ Lab. For one day, kids become scientists. They experiment in a playful manner and learn why and how the world’s marvels work. Because we believe that one day these kids will wow us in return.
When science can be seen as a foundation of wonder, it’s because at BASF, we create chemistry.
www.wecreatechemistry.com
BASF
The Chemical Company

Contents

Front

SEPTEMBER/OCTOBER 2013

35 Innovators Under 35
2013

Back

BUSINESS REPORT

REVIEWS

DEMO

33 YEARS AGO

ON THE COVER:
Photo by Ryan Donnell for *MIT Technology Review*

Infinite Designs, One Platform

with the only complete system design environment

NI LabVIEW is the only comprehensive development environment with the unprecedented hardware integration and wide-ranging compatibility you need to meet any measurement and control application challenge. And LabVIEW is at the heart of the graphical system design approach, which uses an open platform of productive software and reconfigurable hardware to accelerate the development of your system.

LabVIEW system design software offers unrivaled hardware integration and helps you program the way you think–graphically.

>> Accelerate your system design productivity at ni.com/labview-platform

800 453 6202

NATIONAL INSTRUMENTS

CUSTOMER SERVICE AND SUBSCRIPTION INQUIRIES
National: 800-877-5230

International: 818-487-2088

E-mail: technologyreview@pubservice.com

Web: www.technologyreview.com/customerservice

MIT Records: 617-253-8270 (alums only)

Permissions: Jennifer Martin
jmartin@wrightsmedia.com
281-419-5725

———

Technology Review
One Main Street, 13th Floor
Cambridge, MA 02142
Tel: 617-475-8000
Fax: 617-475-8043

———

MIT Technology Review identifies the new technologies that matter—explaining how they work, deciphering their impact, and revealing how they'll change our lives. Founded at the Massachusetts Institute of Technology in 1899, we are a digitally oriented global media company that publishes serious journalism in magazines and on websites and mobile devices. We also host events around the world. Technology Review, Inc., is an independent nonprofit 501(c)(3) corporation wholly owned by MIT; the views expressed in our publications and at our events are not always shared by the Institute.

De Technologia non multum scimus. Scimus autem, quid nobis placeat.

Whoosh:
Sounds cool, feels cooler.

"As an engineer, I know what good manufacturing looks like. I've always been impressed with Big Ass Fans' products, and Haiku's Whoosh mode shows real innovation. Whoosh brings the feeling of a natural breeze indoors."

Paul E., New York

Different in every way, the Haiku® ceiling fan exceeds all expectations.

Case in point: Whoosh®. Mimicking the variations in natural breezes, Whoosh doesn't just sound cool–it will make you feel up to 40% cooler than constant airflow*. Set Haiku on Whoosh and enjoy the ocean breezes–even if you're surrounded by four walls.

Whoosh is just one example of how Haiku is (literally) the coolest ceiling fan in the world. With its patent-pending motor design that is both silent and powerful, Haiku is certified by ENERGY STAR® as the world's most efficient ceiling fan. Meticulously handcrafted of the highest quality materials–five layers of sustainable Moso bamboo or durable, glass-infused matrix composite—Haiku Thin Sheet™ airfoils are precision balanced so you'll receive the very best ceiling fan, without the wobble. Guaranteed.

Winner of 11 international design awards, the 60-inch Haiku ceiling fan is everything you expect from a Big Ass Fan®, designed specifically for your home.

LIFETIME LIMITED WARRANTY

Visit **haikufan.com/OFFER** and use **promo code MIT913** to receive a free Haiku info kit.

HAIKUFAN.COM/OFFER 855-651-3009

reddot design award winner 2012

POPULAR SCIENCE what's new

BEST OF YEAR HONOREE 2012

DESIGN AWARD

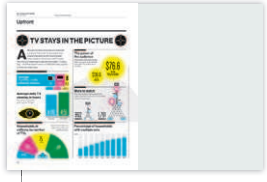
BIG ASS FANS® No Equal.

*Human thermal sensation to air movement frequency, Yizai Xia, Rongyi Zhao and Weiquan Xu (2000)

Feedback

Five Most Popular Stories

MIT Technology Review Volume 116, Number 4



1

How Technology Is Destroying Jobs

I'm 49 and work in a car factory. We're increasingly becoming automated, and I see two consequences: less need for human workers and fewer consumers to buy the products. Those consequences will lead to some type of economic collapse if they're not corrected – the magnitude of change is beyond the ability of our government and financial institutions to survive. The corporate need for ever-increasing profit will accelerate the use of robotics. I believe this is inevitable and unstoppable. Sounds like a good plot for some hard-core science fiction. **– Geoff S. Jones, Bennington, Vermont**

2

The World as Free-Fire Zone

The thrust of Fred Kaplan's article "The World as Free-Fire Zone" is ill-conceived and absurdly biased. Would the author rather we suffer the consequences of not eliminating key terrorists? Would the author volunteer to go in and do manned missions instead? Colin Powell and many others have said what a majority of Americans would agree with – the U.S. does not want a "fair" war. The U.S. wants an unfair advantage, and if the author or any of his friends or family were in harm's way carrying out missions, they would surely agree. **– Rick Bridges, Dublin, California**

3

TV Stays in the Picture

This is a nice infographic, but it lacks the thoughtful dynamic of online video as a "TV" channel. Increasingly, platforms like YouTube are viable media channels for professionally produced content. And people increasingly view Web-based media via their Web-connected TVs. Some demographics view more content on mobile devices than they do on their TVs. Figures like number of channels or number of TVs are interesting, but they're not insightful. Still, the point is valid: TV is huge – but TV as we know it is changing dramatically. **– kevinrfoote**

4

Thad Starner: Google Glass's Mastermind

The privacy angle will probably give way to the legal realities of our sue-happy culture. How many high-profile legal battles would have been sorted out in days if a few of the primary people involved had video recordings of their actions? Already juries are discovering how terrible eyewitness testimony is. California's highest court has ruled the public now has a right to videotape the police for its own records and defense. The real value in savings of legal costs is going to be more compelling than notions of privacy. **– Sanescience**

5

The Secret to a Video-Game Phenomenon

My daughter does two things simultaneously: she watches YouTube videos, and she plays Minecraft in creator mode, designing the worlds she sees in her mind. The YouTube I could fathom. Minecraft? I had to examine that one a bit: Minecraft is easy. It's simple. It's transparent. It's visually appealing, in a grand, 10,000-foot kind of way. In the end it's creativity at its most primitive. While YouTube is a total mind suck, her Minecraft playing seems to even out the time-wasting aspect, making the two together rather a time-sink wash. **– anonymole**