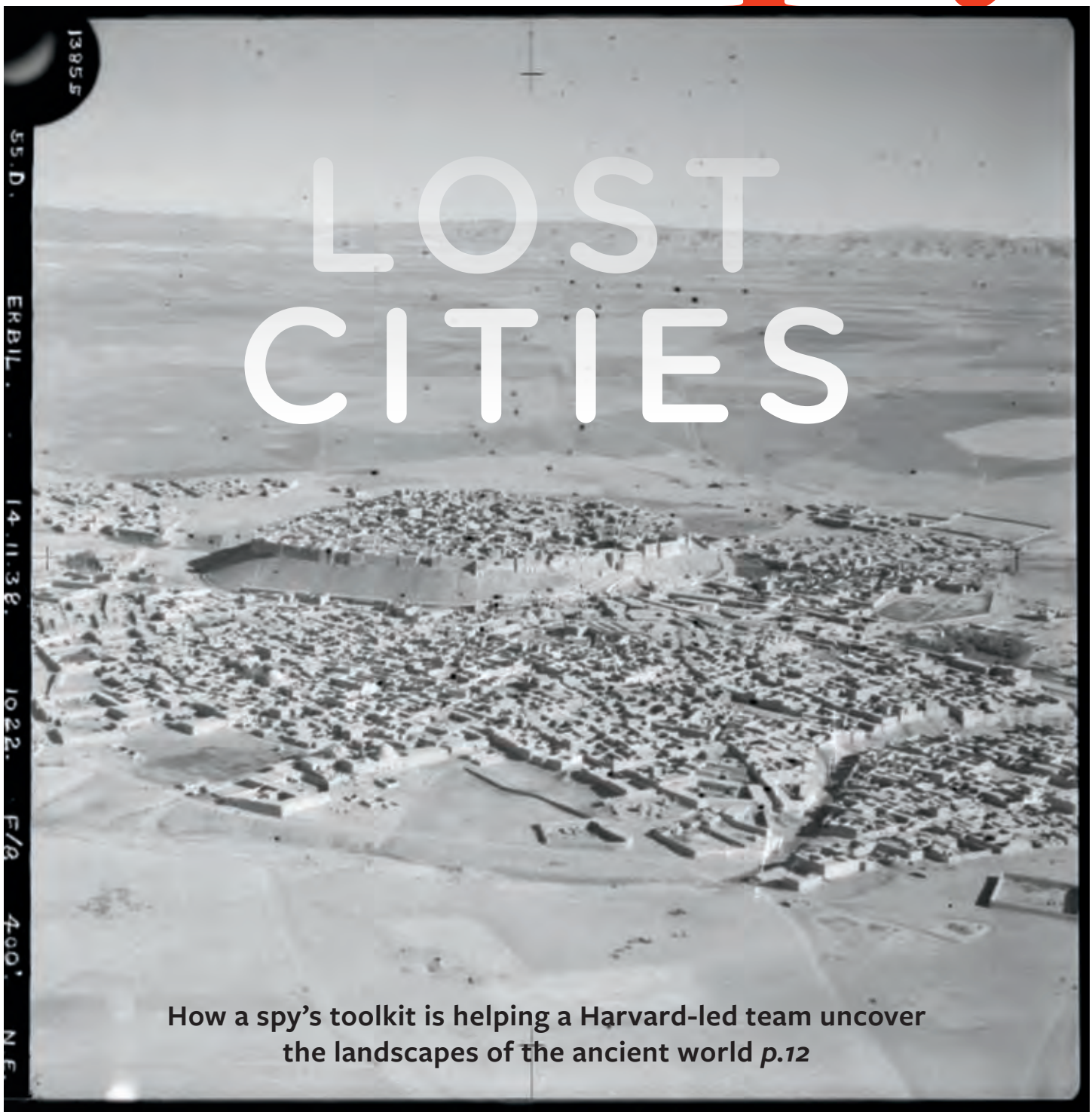
TRY THIS AT HOME *p.18*

TELLING THE STORY OF SCIENCE *p.22*

SPRING 2014

Colloquy

The GRADUATE SCHOOL *of* ARTS AND SCIENCES | HARVARD UNIVERSITY



LOST CITIES

How a spy's toolkit is helping a Harvard-led team uncover the landscapes of the ancient world *p.12*

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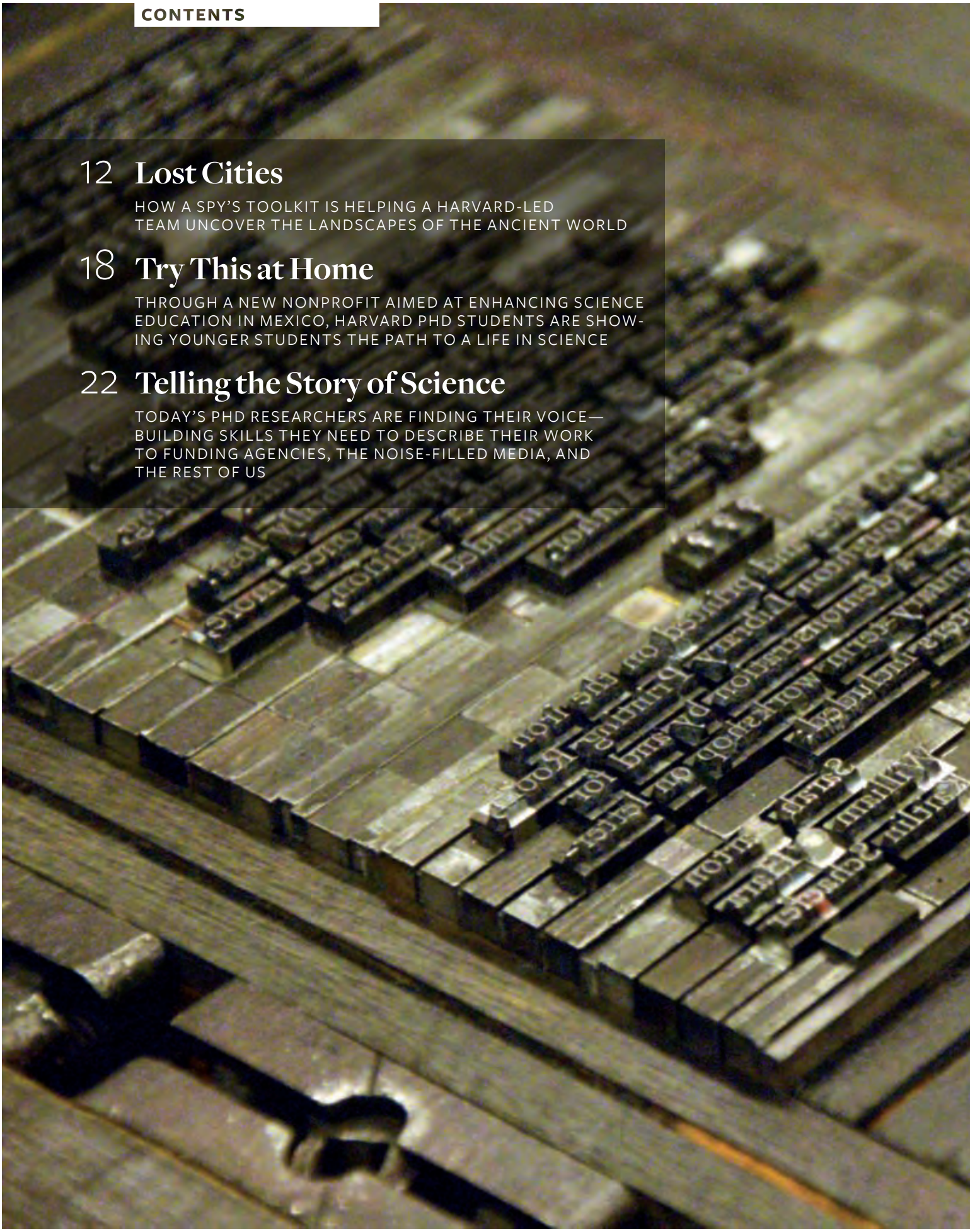
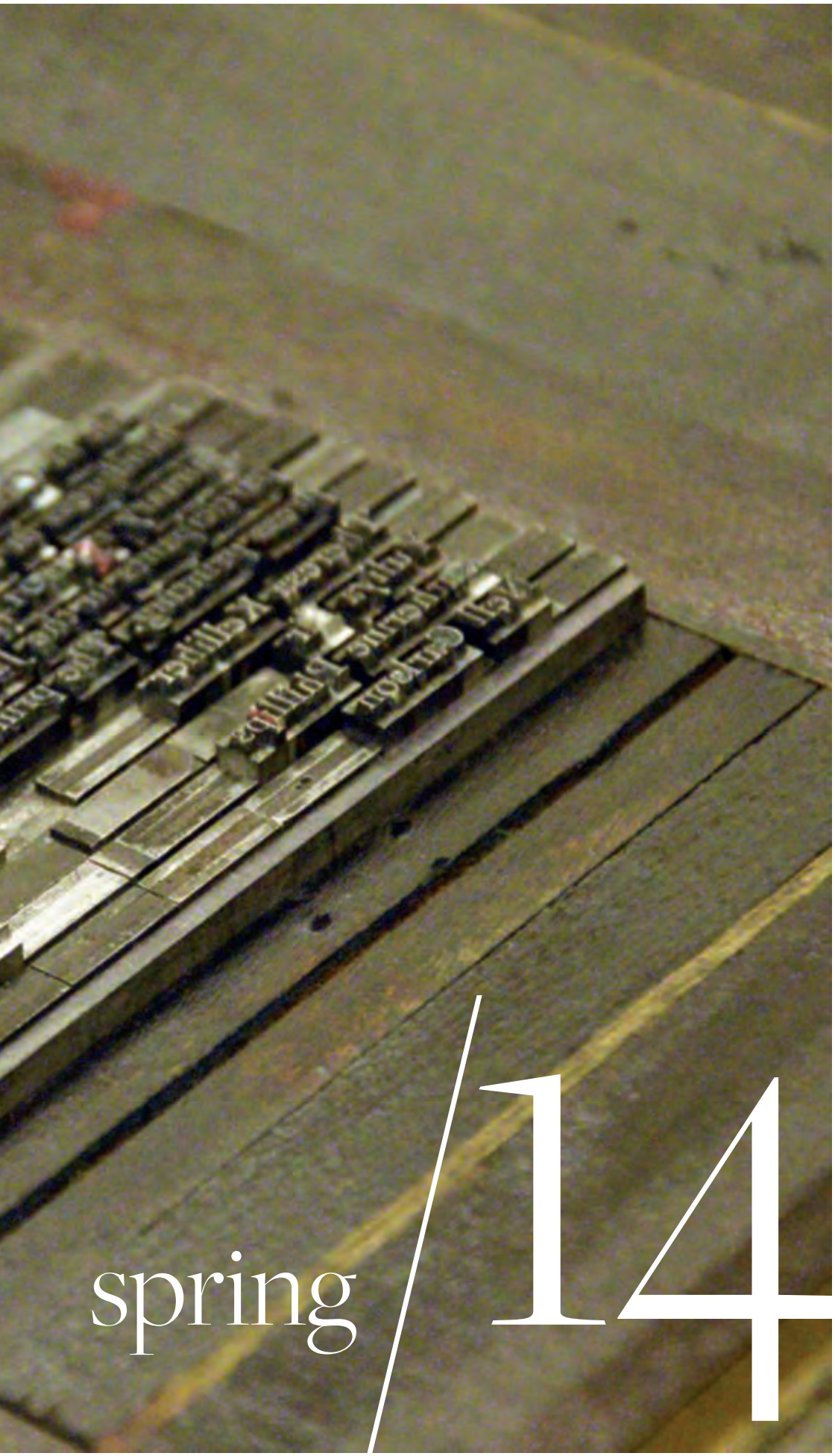




spring /14

Colloquy

An alumni publication of Harvard University's Graduate School of Arts and Sciences

Cover image: An aerial view of the city of Erbil, Iraq, taken by the British Royal Air Force in 1938. The image shows the ancient citadel mound, which dates back to the Assyrians and earlier, and the small modern town around it. The city has expanded dramatically since the picture was taken. For more on how satellite imagery is helping archaeologist Jason Ur to uncover hidden contours of ancient civilizations, see "Lost Cities," on page 12. *Image is courtesy of Jason Ur.*

Facing image: A moveable (type) feast, as Houghton Library opened its printing and graphic arts room to graduate students for a January session on the book as a physical object. *Photograph by Molly Akin.*

Colloquy

CONTRIBUTORS

The Berlin-based illustrator **Tina Berning**, who created a drawing of Mario Small for our conversation feature, studied graphic design and illustration in Nürnberg. After designing album covers and band posters for a record company and working for the magazine of the German daily *Die Süddeutsche Zeitung*, she began to focus full-time on illustration and works for a variety of commercial and editorial clients.

Siddhartha Mitter, AB '89, who wrote our cover story about landscape archaeologist Jason Ur, is a New York–based journalist whose work spans international development, public affairs, education, urban culture, and the arts and music. He is an arts correspondent for the *Boston Globe* and the former culture reporter for WNYC public radio.

Nicholas Nardini is a PhD candidate in English. He wrote this issue's feature about fellow PhD students returning to their native Mexico to improve science education. Nick is the founder and host of Veritalk, a podcast highlighting the ideas of Harvard PhD students, and he is the project coordinator for the 2014 iteration of Harvard Horizons.

Visual Dialogue is the Boston-based firm that designs *Colloquy*. Creative Director Fritz Klaetke won a Grammy Award in 2013 for his album design for *Woody at 100*, a boxed set from Smithsonian Folkways Recordings. The firm recently completed an ad campaign for the city of Cambridge ("Cambridge Is for Squares"), celebrating its diverse neighborhoods.

growing season

STEPHANIE MITCHELL/HARVARD STAFF PHOTOGRAPHER

As winter turns to spring here in Cambridge, our anticipation extends beyond the fervent hope for warm weather. This is admissions season at the Graduate School, the time of year when we meet with faculty from all 57 of our degree programs — from African and African American studies to systems biology — and chart the future direction of their academic endeavor at Harvard.

During these annual gatherings, we examine the status of current students in each program, using our discussions as a way to gauge the vibrancy of the programs and to measure challenges. Then we talk about how the programs' candidates for admission will contribute to the mix.

Now we have taken these always-lively conversations a step further. Starting this year, we have asked programs to complete a Program Overview, which encourages them to do a thorough self-review prior to their admissions meeting. The questions encompass a range of topics, from the admissions and recruitment process, to advising and mentoring efforts, to teaching and research training, to professional development opportunities, and to alumni outreach and engagement.

Programs share the responses with us before our meetings, so our conversations can be more informed. We hope this new process will further enhance communication not only between the Graduate School and the degree programs, but also within the programs; we think it can serve as an impetus for an annual self-examination and internal planning, and for better communication between a program's current and future leadership.

We are working closely with the Dean of the Faculty of Arts and Sciences on this initiative, and we're grateful for his endorsement. Fostering an FAS-wide recognition of the connections between faculty growth and the size of the graduate student body will aid in prudent planning.

In the past, these two constituencies — faculty and graduate students, interrelated in obvious ways — have often blossomed independently of one another, since faculty recruitment happens along pathways quite distinct from those governing graduate admissions. The needs of incoming faculty, who may bring research programs that will attract significant interest (or require significant contributions) from graduate students, have not always played a role in admissions planning. Rather than being proactive, we've often had to play catch-up.

Xiao-Li Meng, PhD '90, Dean, Graduate School of Arts and Sciences, Whipple V. N. Jones Professor of Statistics

We hope this new process will further enhance communication between the Graduate School and the degree programs.

The Program Overview, which includes forward-looking questions about new developments in the fields, provides another channel of communication directly between GSAS programs and FAS leadership in our effort to more closely align these two planning processes.

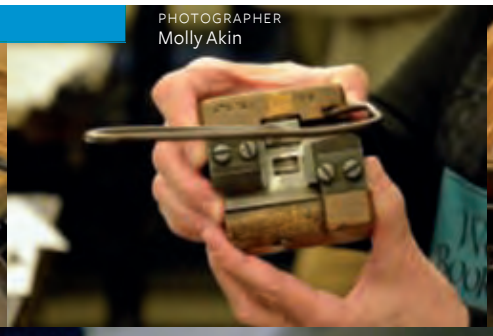
This spring also brings the blossoming of a newer GSAS tradition: Harvard Horizons. We have selected our second annual cohort of Horizon Scholars, eight outstanding PhD students whose ideas have the potential to transform their disciplines and even society at large. These scholars will receive in-depth training on how to communicate their scholarly ideas effectively and professionally to diverse audiences. They'll learn to hone their arguments so that their most essential idea can shine; they'll gain techniques in oral communication that will allow them to be heard (in all senses of the word); and they'll work with experts on how best to structure their presentations.

It all leads up to the second annual Harvard Horizons Symposium, scheduled for April 22, when they will take the stage at Sanders Theatre in front of a University-wide audience that will include President Drew Faust.

But the training they receive will have longer-lasting benefits. Our inaugural Horizon Scholars, selected in 2013, told us that their experiences clarified their research questions, helped shape their dissertations, prepared them for the job search, and made them more confident in every aspect of their scholarly lives. As we enter year two of the Horizons initiative, I look forward to watching our new cohort flower in similar ways — and to sharing the results with you in the next edition of *Colloquy*.

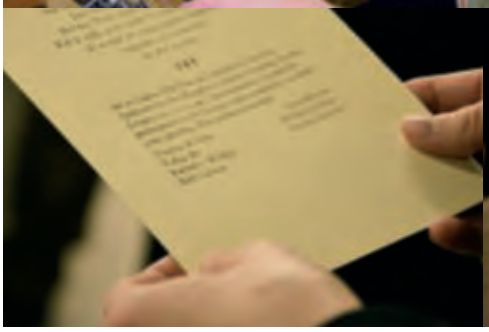
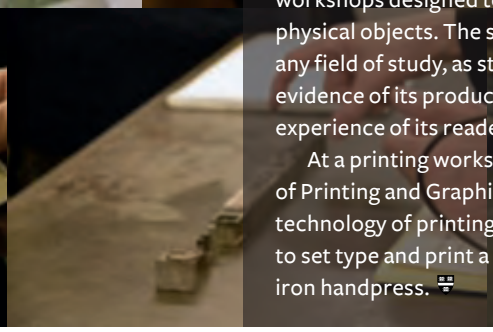
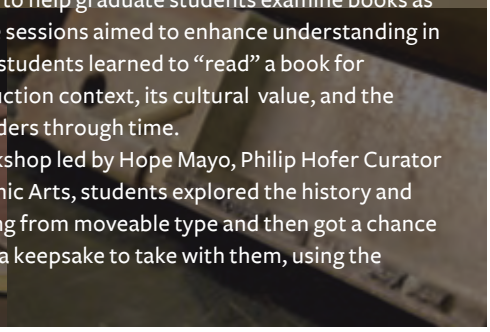
PHOTOGRAPHER
Molly Akin

LONG LIVE PRINT





As part of January@GSAS, Houghton Library offered a series of workshops designed to help graduate students examine books as physical objects. The sessions aimed to enhance understanding in any field of study, as students learned to "read" a book for evidence of its production context, its cultural value, and the experience of its readers through time.

At a printing workshop led by Hope Mayo, Philip Hofer Curator of Printing and Graphic Arts, students explored the history and technology of printing from moveable type and then got a chance to set type and print a keepsake to take with them, using the iron handpress.

HOW THEY LEARN

An effort to prepare future faculty to assess undergraduate learning

The innovative classroom assessment workshop offered to students as part of January@GSAS, the Graduate School's inter-term skill-building series, couldn't have had a more apt and pointed title: "What Are My Students Learning?"

Twenty-four PhD students, selected after an application process, gathered "to explore what it means to examine your students' learning in a robust and valid manner" across the disciplines, according to the course organizers. Participants discussed and evaluated various methods of studying their students' learning and produced tangible examples of assessment techniques they could use in current or future teaching roles.

The workshop was offered by the Graduate School of Arts and Sciences in conjunction with the Derek Bok Center for Teaching and Learning and the Harvard Medical School Curriculum Fellows Program. It was sponsored by a grant to GSAS from the Council of Graduate Schools (CGS) and the Sloan Foundation.

"Graduate students often feel inadequately prepared, or not prepared at all, for their first experiences teaching their own classes," says Johanna Gutlerner, the associate director of the Curriculum Fellows Program at HMS and a workshop leader. By teaching future faculty to "identify their learning goals (*what I want my students to know*) and assessments (*how will I know if they learned it*) ahead of time, we can set them up for a much more successful first experience in the university classroom," she says.

Workshop leaders wondered whether they could effectively teach an interdisciplinary group of graduate students about classroom-based learning assessments, Gutlerner says, since so many of the examples were discipline-specific. But "it turned out that having students from many disciplines meant that we could all learn from each other about best practices across fields, and it made us all more creative in thinking about ways of applying new types of assessment tools in our classrooms."

By comparing and contrasting various strategies for formative assessments, students helped shape discussions of "how assessment can affect learning, in addition to measuring it," says John Girash, another course leader and associate director of the Derek Bok Center for Teaching and Learning.

"We wanted participants to leave able to compose learning goals and associated specific, measurable objectives that are reasonable for the class time, cover various levels of learning, from comprehension to creativity, and are both skill- and content-based," says Girash. "We wanted them to be able to align both teaching technique and assessments with those goals and objectives, for both target or capstone tasks, as well as building blocks along the way."

Going into the workshop, Gutlerner says, organizers weren't certain how interested participants would be in exploring "how assessment data could be used for classroom-based research projects. But students seemed really excited by this aspect of the course. I was thrilled about this, because we need more rigorous scholarship of teaching and learning in the university classroom to continue to discover how to best teach our students for deep, long-lasting understanding."

SCIENCE LOUD & CLEAR

A grassroots, student-led effort to train PhD scientists to describe their research with clarity and eloquence draws interest from far and wide

When Nathan Sanders thinks about an average day in his life as a graduate student — answering e-mail from students or his advisor, mapping out a new course he's teaching, finessing a presentation of his research results — he sees that the skill he draws on most is one he hasn't been taught since his first year in college: communication. As a scientist for whom public outreach has always been important, Sanders realized early in his PhD program that for scientists to succeed not only in building their careers but in teaching their students and advocating for their work, the ability to talk with broad audiences is key.

It's why he and fellow PhD students in the Department of Astronomy founded Astrobites, a daily astrophysical literature journal (www.astrobites.org) written by graduate students for undergraduates, aiming to promote interest in careers in astronomy.

And it's why he and peers at Harvard and MIT launched Communicating Science (ComSciCon), a series of conferences and workshops for fellow graduate students focused on the clear and persuasive communication of complex and technical concepts. ComSciCon held a national conference last June, drawing more than 700 applicants for 50 slots and bringing in an impressive array of faculty members and professional science communicators for workshop sessions and mentoring. The group offered a smaller-scale, local workshop in January for Harvard and MIT students, again drawing more applicants than it could accept. That event culminated in a keynote address by NPR correspondent David Kestenbaum (PhD '96), which was open to the general public and attended by about 300 people.

ComSciCon will convene its second national workshop this June, to be held once again in the Cambridge offices of one of its sponsors, Microsoft New England Research and Development Center. Applications increased by 20 percent over last year, to 878, for just 50 slots.

"Understanding how to communicate the motivations for, methods of, and results of research is a critical skill in the 21st-century practice of science," Sanders says. "It's critical because the most important outcomes of research come from convincing nonspecialists — the general public, policymakers, and entrepreneurs — that what we do is important and relevant; because the support for current research depends on public awareness and appreciation of the research we do; and because the future of our field depends on the engagement of young people."

For the Graduate School of Arts and Sciences, an early sponsor of ComSciCon, such student-led efforts provide important professional development skills even as they encourage the sharing of knowledge. "Our students are future leaders in their fields, and they have the potential to be future policy leaders as well, advocating for the essential role of science in addressing a wide variety of societal challenges," says GSAS Administrative Dean Margot Gill. "Communication skills will be vital to their success — to their professional growth and to their ability to advance the impact of new discoveries."

Kara Manke, ComSciCon's other co-chair (and a chemistry PhD student at MIT), agrees: "If my own experience is accurate, encouraging more scientists to communicate directly with non-scientists will not only benefit the public's understanding of the field, but will also help improve the quality of scientific research by forcing scientists to think more critically about their own work."

For Sanders, ComSciCon's student-to-student ethos is key. "It's hugely significant that only 1 in 5 attendees of our January workshop — a population highly self-selected for interest and engagement in outreach and education programs — report that they regularly communicate about research with people outside of their field," he says. "The problem is that few opportunities exist to do this, even though graduate students are the broad base of the academic research pyramid and better positioned than any other group to serve as ambassadors for science and scholarship. Programs like ComSciCon, and the student-led initiatives and collaborations that spin off from it, are the best way to create these opportunities for young researchers." *—Bari Walsh*

▶▶ Four pieces written by Harvard PhD students during the January ComSciCon workshop were selected for publication in this issue of *Colloquy*, serving as examples not only of strong science writing but of fresh thinking across a range of research areas. See "Telling the Story of Science," page 22. Learn more at comscicon.com.

PHOTO COURTESY COMSCICON

The Play's The Thing

On December 4 and 5 of last year, the Dudley House Arts Fellows presented *Inherit the Wind*, a production directed by Ursula DeYoung (AB' 04), produced by Trisha Urmi Banerjee, a PhD student in English, and performed entirely by GSAS students.

"When I became one of the Arts Fellows at Dudley House last fall," wrote Banerjee in a reflection she published in the February edition of the *GSAS Bulletin*, "there hadn't been a graduate student theater production in recent memory. It was uncertain not only that a play could or would be produced, but that it was even worth trying." But the semester-long endeavor to stage the play yielded unexpected joys. "To my gratification, former strangers became conspirators, working together voluntarily on a complex aesthetic scheme," she wrote. The successful outcome (two sold-out shows) provided "a taste of what I hope — what every PhD student hopes — to feel at the end of graduate school: that the work has been play, and that the play has been worthwhile."

Alumni Reconnections

HarvardX FOR ALUMNI

The Harvard Alumni Association and HarvardX have paired to launch HarvardX for Alumni (HAA1x), an experimental online learning and engagement opportunity curated for Harvard graduates. Launched in beta mode in late March and set to run for an initial 14-week period, HAA1x will offer a wide sampling of the intellectual riches and dynamic voices of the Faculty of Arts and Sciences, while connecting alumni to the latest innovations in teaching and learning.

This free online educational experience will be guided by HarvardX faculty director and GSAS alumnus Robert A. Lue, PhD '95. It will offer seven individual online segments, launching every two weeks:

- Neuroscience, with David Cox
- The Poetry of Early New England, with Elisa New
- Einstein Revolution, with Peter Galison
- The Ancient Greek Hero, with Gregory Nagy
- China, with Peter Bol and William Kirby
- Tangible Things, with Laurel Ulrich
- Computer Science, with David Malan

Register at any point during the course run by visiting alumni.harvard.edu/x. Once posted, course materials will remain in place for the duration of the course.

A scene from *Inherit the Wind*, produced and performed by GSAS students.

LULU LIU

Q+A Mario Small

Within the isolation of the nation's poorest neighborhoods, a sociologist gets to the heart of inequality

Mario Luis Small is a leading investigator of the roots of urban poverty, the nature and effects of social and economic inequality, and the impact of support networks in poor neighborhoods. Small's work has also examined the relationship between qualitative and quantitative social science methods; he has sought to develop alternative ways of thinking about generalizability in case studies, such as ethnographies of a single neighborhood or historical studies of one organization. A recipient of the C. Wright Mills Best Book Award (2005 and 2010), the Robert Park Best Book Award (2005), and the Jane Addams Best Article Award (2004), Small is the author of *Villa Victoria: The Transformation of Social Capital in a Boston Barrio* (2004, University of Chicago Press), *Unanticipated Gains: Origins of Network Inequality in Everyday Life* (2009, Oxford University Press), and numerous articles.

Small is John Matthews Manly Distinguished Service Professor and dean of the division of social sciences at the University of Chicago. In July, he will return to Harvard as the Grafstein Family Professor of Sociology.

There's a debate ongoing about what government should do about income inequality, with some arguing that inequality is a fact of life — spurring people to want to do better. How would you respond?
I think it's an extremely important question, and it's the right question to ask. Why is inequality so bad? I would answer that some inequality is probably good. If you can imagine a completely equal society, where everybody had the same income, a lot of economists would argue that people would not feel optimally motivated to compete, to invest in acquiring education and skills, and to perform to the best of their abilities. So we probably need some inequality for the country to keep making progress.

I think the problem comes when inequality is so extensive, when the gap between the richest fifth and poorest fifth of the income distribution is so large that it actually has negative consequences. One of the most important of those negative consequences, which you'd want to worry about regardless of your politics, is the impact on growth. There's some evidence that high income inequality is bad for growth.

How does income inequality play out in the real world, and how does it hamper growth or mobility?
Think about real estate. In a place like Manhattan, where you have some people with exceptionally large incomes, there are people willing to pay high sums for real estate. When that happens, real estate gets more expensive for everyone, not just the people who are buying the luxury condos. Eventually the effect gets felt across the board, so it gets harder and harder for the middle class and the poor to find decent and affordable housing.

Income inequality has an impact on many other kinds of goods. Higher education, for instance, has become extremely expensive; but at the same time, there are more people willing to pay $50,000 per year for a college education. Because the rise in income inequality has been accompanied by a rise in the rewards of education and skills, you need a college degree, or a master's degree, more than you did in the past. But it's much more difficult to make the human capital investment required to attain middle class status.

The growing importance of technology is another example. Think of the range of consumer goods that you're expected to possess, just as a function of operating in normal society. You're expected to be accessible in a way you weren't before, which means that you're expected to have a cell phone even to apply for many types of jobs and a computer just to participate in everyday society.

What about for disadvantaged communities, which have been your area of focus?
When you start going down the income distribution, the problems get magnified. The difficulty in finding affordable housing in a major city; the difficulty in finding a realistic path to higher-quality education. The need for consumer goods and technology that make you reachable by potential employers.

But there are also different problems. One of the most important has to do with prolonged exposure to

Q+A ID

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Sociology

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Tina Berning

high-poverty neighborhoods — neighborhoods in which everyone is poor. The school you are likely to have access to is more likely to be of subpar quality. Your exposure to crime and its negative consequences for health and well-being is greater. The potential for victimization — the stress associated with everyday life, the stress associated with raising your kids — is greater. Many of those secondary effects have been found to be associated with inequality.

Your work has centered on how networks and organizations can ameliorate inequality's effects.
This particular work grew out of thinking about the most disadvantaged members of the population. Not just the poor, but people who are poor and have a criminal record. Or people who are poor and undocumented.

The way we have often focused on this population, in the social sciences, is by looking at them as individuals and seeing how poverty affects their lives, how rising income inequality affects their capacities, and how they decide where to put their kids in school. Recently, with the work of scholars like William Julius Wilson and Robert Sampson, there has been a large focus not just on individuals but on neighborhoods — do they live in high-poverty neighborhoods or low-poverty neighborhoods? Do they live in neighborhoods that are racially segregated or not?

I think these are essential parts of any analysis. What I'm arguing, though, is that people also participate in institutions and systems of various kinds, and those have a big impact on their well-being. So if we take the poor person with a criminal record, for sure you want to study whether that person's going to have a harder time getting a job. And for sure you want to study what's going to happen when they go back to the low-income community that they came from. But you also want to ask, how do regulations about what you can do while you're on parole or probation affect your life chances? How much power does the judge have to decide whether a minor infraction is consequential or not? These are all based on institutional rules, and the effects are not something you can measure just by asking someone's income.

In a poor community, how do effective organizations help?
Health is a really simple example. At the bottom of the income distribution, your health is a function of the particular health care system in your state, the reinforcements on Medicaid, and the institutional rules governing the system. In the early 2000s, the state of New York was allowed to institute facilitated enrollment for Medicaid, allowing a third-party organization to request the forms for you and fill them out on your behalf. Many of the state-funded childcare centers in New York started doing this for parents when they would come in to enroll their kids, and Medicaid enrollment numbers shot up. That was an institutional and an organizational process, not an individual or neighborhood one.

Say more about childcare centers.
One of the things I was interested in, in this project on networks and institutions, was social support, and how low-income and middle-income parents form social networks. We have a lot of evidence to support the idea that the better connected you are to others, the better you're going to do. So how do you become a person who has a strong support network? I found quite a bit of evidence that the way a childcare center organizes itself and its activities — how effectively it enlists parents as volunteers — had a measurable, observable impact on the extent of social connectedness among the parents. And that this connectedness had an observable impact on their mental and material well-being.

Now you're doing a broader study in three different cities, focusing on low-income mothers.
We're looking at the experience of low-income mothers in three high-poverty neighborhoods: Central Harlem, in New York; Woodlawn, in Chicago; and Sunnyside, in Houston. Each has a similar high-poverty rate, each is very segregated, and each has the high rates of dependency on unemployment that you would expect — and yet they are extremely different neighborhoods.

"It's now much more difficult to make the human capital investment required to attain middle class status."

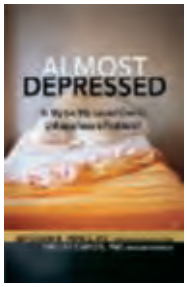
Woodlawn is a highly isolated neighborhood with a low population density of about 12,000 people per square mile and a low prevalence of everyday organizations. It's hard to find a grocery store, a pharmacy, a childcare center, and so on. Central Harlem has the same poverty rate, the same everything, but the population density ranges from about 55,000 to 130,000 per square mile. It not only has more childcare centers, pharmacies, and grocery stores, but it has more per capita. So the greater density contributes to the flourishing of organizations in a way that doesn't happen in Woodlawn.

Sunnyside is even sparser, more isolated. It has just 6,000 people per square mile on average, and there is almost nothing there, except for churches: There are more churches per capita than in either Woodlawn or Harlem.

What I'm studying is the relationship between networks and neighborhoods today. In a digitally connected world where there's Facebook and mobile technology and you can have a friend anywhere, what is the role that neighborhoods play in people's support networks? How do the differences across these neighborhoods affect the networks of the poor? We're looking at patterns of interaction to see if we can understand what kinds of poor neighborhoods there are out there, and how they affect people in these cities.

REVIEWER
James Clyde Sellman, PhD '93, history

Shelf Life



Focusing on Japanese war crimes in World War II–era China, ***Evil Men*** (Harvard University Press, 2013) is a meditation on the making of monsters. **James Dawes** (PhD '98, English) concentrates not on victims but perpetrators — aging Japanese veterans who were imprisoned and "reeducated" after the war in the People's Republic of China. Dawes grapples with issues of atrocity, complicity, and forgiveness. Does it matter that these men ultimately became dedicated peace activists? Does their brutal training — the hothouse nationalism, dehumanization of victims, and, above all, repetition that rendered the unthinkable routine — mitigate their actions? Dawes also questions his own role: is his narrative a sort of "human-rights pornography" reinforcing the glamor of evil?

Marianne Novy (AM '67, English) challenges post-1960s scholarship on Shakespeare's portrayal of social outsiders. Unlike earlier interpretations, which had generally highlighted the Bard's social empathy, post-1960s scholarship has grounded him firmly in Elizabethan racial and gender prejudices. ***Shakespeare and Outsiders*** (Oxford University Press, 2013) calls for a more nuanced and generous view. Novy's analysis of Shylock, Othello, Kate in *The Taming of the Shrew*, and King Lear (consummate insider cast into the abyss of outsider-hood), among others, reveals Shakespeare's rich and complex representations of "the other."

In ***Forgetting the Art World*** (MIT Press, 2012), **Pamela Lee** (PhD '96, fine arts) argues that the art world deserves forgetting (or at least skeptical distance) because this nexus of creativity and commerce has itself forgotten — or failed to examine — its own role in the post-industrial power structure. This thoughtful and well-illustrated volume critiques modern art as both product and agent of globalization. Paralleling that cultural critique, Lee singles out various contemporary artists whose work goes against the tide, including Thomas Hirschhorn's unruly sculptural installations; Takashi Murakami's morphing, anime-inspired Mr. DOB character; and deep-focus depictions of industrial society by photographers Andreas Gursky and Allan Sekula.

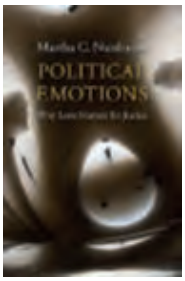
Louis Kaplow (JD '81, PhD '87, economics) views the Sherman Antitrust Act of 1890 as a creaky structure badly in need of renovation. In ***Competition Policy and Price Fixing*** (Princeton University Press, 2013), he explores the act and its refinement in case law. Currently, anti-price-fixing actions take a "communications-based" approach, focusing on the actions or decisions that restrain trade. But that approach entails a struggle with slippery, hard-to-prove concepts — collusion, agreement, and conspiracy, to name several. Kaplow proposes an alternative approach to price-fixing regulation, one grounded in objective price measurements rather than subjective language. Empirical evidence interpreted through the lens of game theory–based economic analysis, he believes, would offer a more promising way to regulate price fixing.

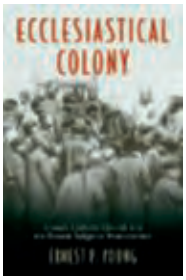
Almost Depressed (Hazelden, 2013) examines the range of ills that aren't full-blown depression but that sap one's psychic and physical well-being — and may spiral downward. Jefferson Prince, MD, and **Shelley Carson** (PhD '01, psychology) explain that depression isn't unitary, but a spectrum. "Almost depression" can arise from a mix of immediate triggers (stress, grief, serious illness or injury) and vulnerabilities genetic or experiential (e.g., a family history of depression, alcoholism, or sexual abuse). The authors review strategies to ameliorate this near- depression, including physical activity, mindfulness and stress reduction, creative pursuits, healthy sleep patterns and diet, strengthening one's social network, and medication. The book also features personal accounts of those who've faced and overcome their own such challenges.

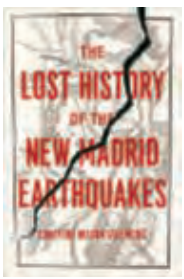
The Civil War was a horror show of bone-shredding Minié balls and misunderstood contagions. ***Marrow of Tragedy: The Health Crisis of the American Civil War*** (Johns Hopkins University Press, 2013) recounts how North and South alike struggled to care for their sick and wounded soldiers. **Margaret Humphreys** (PhD '83, history of science; MD '87) brings to her study a mastery of 19th-century medicine (with its reliance on mercury-based purgatives, opium, and amputation) and offers a thorough analysis of the vital role that northern women played in the wartime health effort. For instance, the nominally male-led US Sanitary Commission marshaled a veritable army of women as nurses (or, rarely, surgeons); providers of medical supplies; and outspoken advocates for healthier hospitals and better care.

Neutrino Hunters: The Thrilling Chase for a Ghostly Particle to Unlock the Secrets of the Universe (Scientific American/Farrar, Strauss, and Giroux, 2013) is a book that makes good on its title. **Ray Jayawardhana** (PhD '00, astronomy) describes how scientists theorized, identified, and continue teasing out the implications of these next-to-invisible subatomic particles. (A neutrino could shoot through a

Alumni authors: Would you like your book (general interest, published within the past year) considered for inclusion? Send it to *Colloquy*, Harvard Graduate School of Arts and Sciences, Suite 350, 1350 Massachusetts Avenue, Cambridge, MA 02138. Questions? E-mail gsaa@fas.harvard.edu.







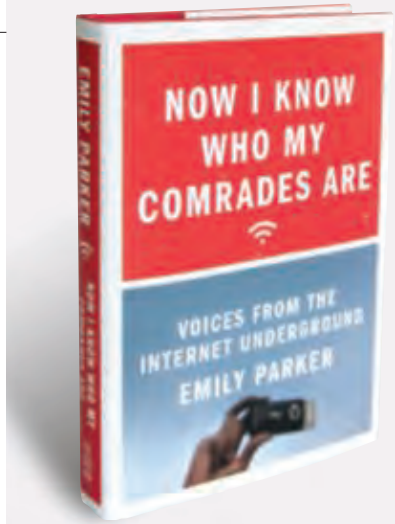
"light-year's worth of lead" without a single atomic-level fender-bender.) Neutrinos have advanced the "new physics" that is pushing beyond current paradigms. They've served as harbingers of supernovas and evidence for the workings of stellar furnaces. Neutrino-based imaging technologies — with capabilities far beyond visible-light or radio telescopes — may yet allow us to "see" events from near the origins of the universe.

Economists, pundits, and politicians have struggled to understand the precipitous post-1960s decline in American manufacturing jobs. Some have argued that it's just natural economic selection, from farming to building to innovating. **Suzanne Berger** (PhD '67, government) disagrees. In ***Making in America: From Innovation to Market*** (MIT Press, 2013), she reports on the findings of MIT's Production in the Innovation Economy Research Group. Beginning in the 1980s, she shows, large, vertically integrated corporations changed into or were displaced by leaner organizations, under a mantra of "focus on your core competency." Today's firms, with few exceptions, avoid basic research and hands-on manufacturing. But manufacturing has complex and positive consequences, Berger declares, arguing that "learning by making feeds back into new innovation."

Political Emotions: Why Love Matters for Justice (Harvard University Press, 2013) plumbs the promise and shortcomings of two socially complex democracies, India and the United States. **Martha Nussbaum** (PhD '75, classical philology) ranges widely, drawing on Mozart operas and J. S. Mill, Rawlsian theory and the sensual poems of Rabindranath Tagore — even Willie and Joe (cartoonist Bill Mauldin's scruffy World War II–era GIs) and effervescent Bollywood films. Above all, Nussbaum focuses on the creation of "civic compassion," maintaining that beyond economic infrastructure, juridical processes, and sociopolitical discourse, nations need heart. *Political Emotions* teases out the role of humor and playfulness in countering the forces of fear, envy, shame, and radical nationalism.

Ecclesiastical Colony: China's Catholic Church and the French Religious Protectorate (Oxford University Press, 2013) recounts a little-known aspect of European imperialism. The French Religious Protectorate, which emerged in 1860 after Britain's Second Opium War and ended with the French debacle in World War II, asserted France's claim of guardianship over Catholics in China. The Protectorate gave France responsibility for defending Catholics (of every nationality) throughout the country, also offering a pretext for extending French control over Chinese territory. **Ernest Young** (PhD '65, East Asian history) notes that the French Protectorate had complex and ironic consequences, triggering violent protests, serving as a flash pan for modern Chinese nationalism, and stirring opposition from some Catholic missionaries in China, particularly Father Vincent Lebbe (1877–1940).

In 1812, the mighty Mississippi briefly flowed backward, due to mid-continent earthquakes that rang church bells as distant as Charleston, South Carolina. **Conevery Bolton Valencius** (PhD '98, history of science) revisits this near-forgotten disaster in ***The Lost History of the New Madrid Earthquakes*** (University of Chicago Press, 2013). The book explores "American vernacular science" (which welcomed the contributions of non-experts) and modern seismological research (these events don't fit the dominant plate tectonics bumper-car model). Native Americans were particularly affected by the tremors. As a portent, they helped Shawnee leader Tecumseh build an inter-tribal confederacy to resist further white encroachments. The quakes also encouraged natives (and many whites) to abandon an epicenter area marred by "earthquake cracks" and swampy "sunk lands."



Now I Know Who My Comrades Are: Voices from the Internet Underground (Farrar, Straus, and Giroux, 2014) describes how Twitter, blogs, and other new media platforms channel resistance to authoritarian regimes. Although she writes after the Arab Spring and its ambivalent coup d'tweet, **Emily Parker** (AM '03, regional studies, East Asia) focuses her lens on China, Cuba, and Russia, nations profoundly shaped by communism. Parker writes that authoritarian governments rule by instilling fear, apathy, and isolation, which undermine any serious resistance. But the connectivity of the Internet is rewriting this political calculus; dissidents are using Twitter and other social media, despite efforts to censor or block their posts (for instance, by the "Great Firewall of China"). Now protesters can reach a global audience and rally likeminded citizens in domestic opposition.

However, there are limits to this Internet activism. It tends to produce "leaderless" movements and seems best adapted for discrete or limited protests, whether online or on the ground. Can social media catalyze revolutionary change and replace autocratic regimes with democracy? Here the jury is still out. At best, revolution by flash mob is in its beta version, in Parker's deft assessment of the Internet's democratic promise and problems. Written with zest and uncluttered by high-tech jargon, her book isn't really about technology; it's about human aspirations. What lingers are her stories of men and women — courageous protesters, dissident bloggers, rebels all.

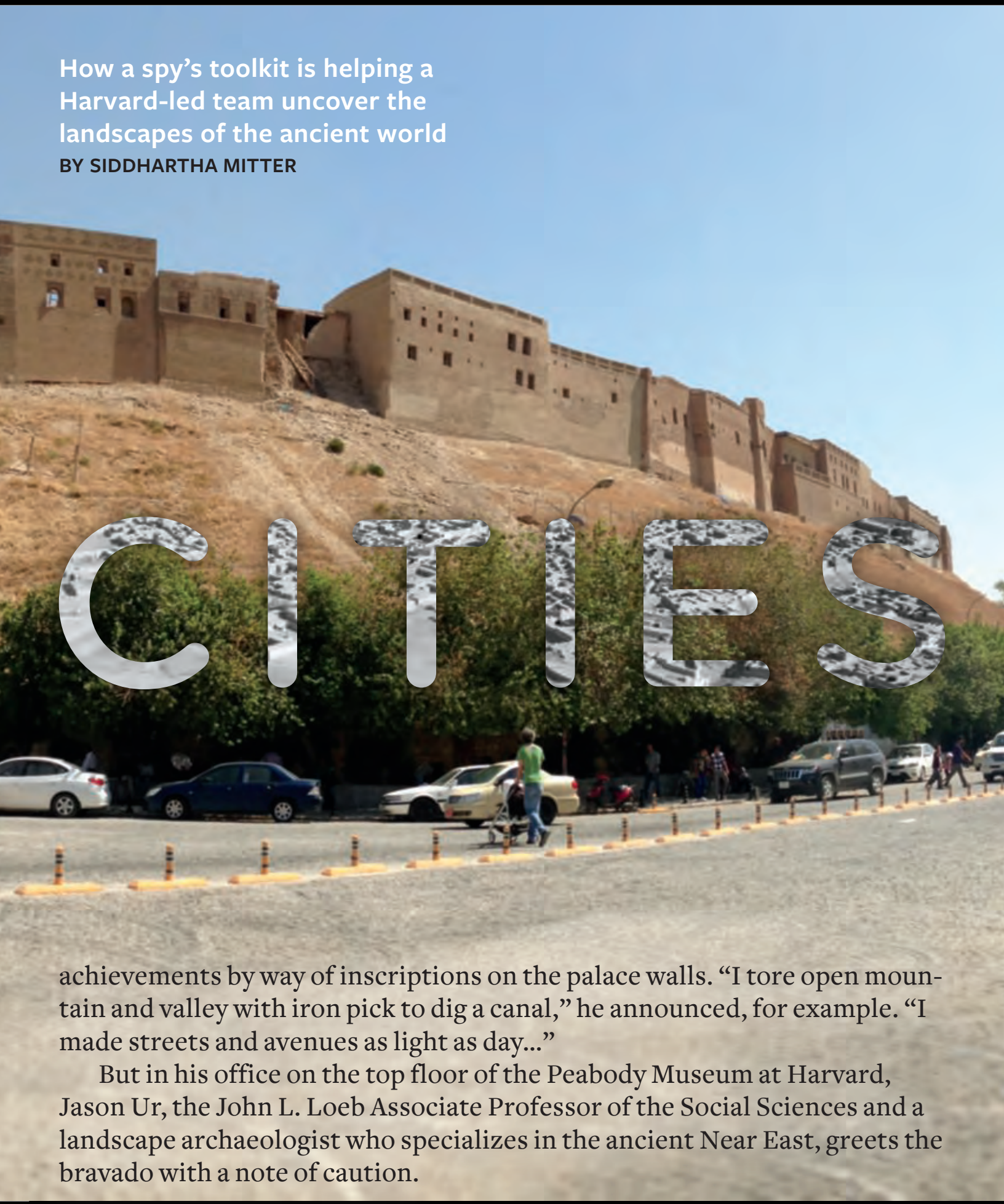
The Neo-Assyrian kings talked a big game.

They had plenty to brag about. In the seventh century BC, the Neo-Assyrian Empire was at the crest of its power. It had conquered lands from the Caucasus to Egypt, and forcibly relocated whole villages from Palestine to northern Mesopotamia. In Nineveh, the world's largest city, the king Sennacherib, who ruled from 704 to 681 BC, led the development of an elaborate system of irrigation canals that fed the capital's grandiose gardens.

Like his father Sargon II, Sennacherib informed posterity of his

How a spy's toolkit is helping a Harvard-led team uncover the landscapes of the ancient world

BY SIDDHARTHA MITTER



achievements by way of inscriptions on the palace walls. "I tore open mountain and valley with iron pick to dig a canal," he announced, for example. "I made streets and avenues as light as day…"

But in his office on the top floor of the Peabody Museum at Harvard, Jason Ur, the John L. Loeb Associate Professor of the Social Sciences and a landscape archaeologist who specializes in the ancient Near East, greets the bravado with a note of caution.

A panoramic view of the citadel at Erbil, Iraq — a modern city with an ancient Tell (artificial mound), which grew over 6,000 years of inhabitation. *Photos, captions courtesy Jason Ur, except as noted.*

LOST CITIES

"Royal inscriptions are ideologically suspect," Ur says. "Kings lie; emperors lie. In the past we have been eager to take these inscriptions at face value. But they were highly propagandistic and designed to promote a particular royal ideology."

Ur unrolls a large photographic print and flattens it on the conference table. It is an aerial photograph, in black and white, of a landscape about fifty kilometers squared. Two rivers are apparent, along with a city, and many fields. Hills rise near the photograph's edge. This is the Erbil Plain, in what was the heart of Assyria and is now Iraqi Kurdistan.

"Sennacherib made these unbelievable claims about canals and irrigation, moving water from all over the Empire and bringing it in the direction of Nineveh," Ur says. "These are things that would require vast amounts of control and labor — by humans and donkeys. So my contribution here was to take a look at whether I could find the canal evidence."

Archaeologist Jason Ur in his office in the Peabody Museum.

On the aerial photograph, the shades of gray reveal nuances and interruptions that emerge as one trains the eye. As Ur points out examples, it becomes clear that the rural Erbil plain, away from the ancient city, is replete with locations to investigate.

"You see that white blob? It's almost certainly a mound. I can tell it's shedding moisture because it's reflecting white. I'm 99 percent sure it's an archaeological site." His fingers move across the map. "This here is a massive canal. It would have enabled irrigation of all this area between these two natural drainages. So the working hypothesis is that this is one of the big irrigation systems that the kings claimed."

But the photograph is modern; to be precise, it's a declassified American spy satellite photo taken in the late 1960s. And the intriguing hints it offers aren't clearly delineated by historical epoch. Scanning the image, Ur points out the signs of settlements, canals, and the underground waterways known as karez, which appear as dotted lines that show the shaft locations. Some of these landscape modifications could date back to the Bronze Age, long before Sennacherib. Others could be as recent as medieval times.

"IF THE LOCAL PEOPLE ARE GOING TO WRITE THEIR OWN HISTORY — WHICH I THINK EVERYBODY SHOULD BE ABLE TO DO — THEY NEED TO KNOW WHERE THESE PLACES ARE."

"I can identify these features and make hypotheses about what they say about the society that produced them, but I need to get to the ground and pull apart these landscapes into periods of time," Ur says. "There are limits to what you can do just from space."

Since 2012, Ur has led the Erbil Plain Archaeological Survey (EPAS), an international project that seeks to inventory 1,200 sites in the region on the photo, a diamond-shaped area of some 3,200 square kilometers with Erbil — the capital of Iraqi Kurdistan — at its center. The team is visiting each site to assess its value, collect evidence, and attribute activity to the appropriate era, from the Neolithic to the present.

The team will produce maps of successive roads, waterways, and settlement patterns on this terrain. The painstaking work is already yielding an appreciation of the landscape's modification over time, in response to political, demographic, and economic forces. Sennacherib's canals, for example, turn out to be a much larger network than expected, and one that fed many rural zones, not just Nineveh, demonstrating a region-wide, large-scale agricultural infrastructure policy.

Funded by the National Science Foundation (NSF), National Geographic Society, and Dumbarton Oaks, the five-year EPAS initiative is building a database that will serve scholars as well as local antiquities officials in a region where rapid development threatens to disrupt or overrun many as-yet unexplored sites.

"The Erbil plain has a denser archaeological landscape than any other surveyed place in Greater Mesopotamia," Ur says. "It's a fantastically rich environment — and one that we knew nothing about a few years ago."

Most of Iraq has been well surveyed, Ur says, but not this part. Successive Iraqi regimes marginalized the Kurdish community and discouraged research in the restive region. The Ba'athist regime that took over in 1968 emphasized southern Mesopotamian cultures of ancient Sumer and Babylon — not Assyria, in the north — in the country's official history.

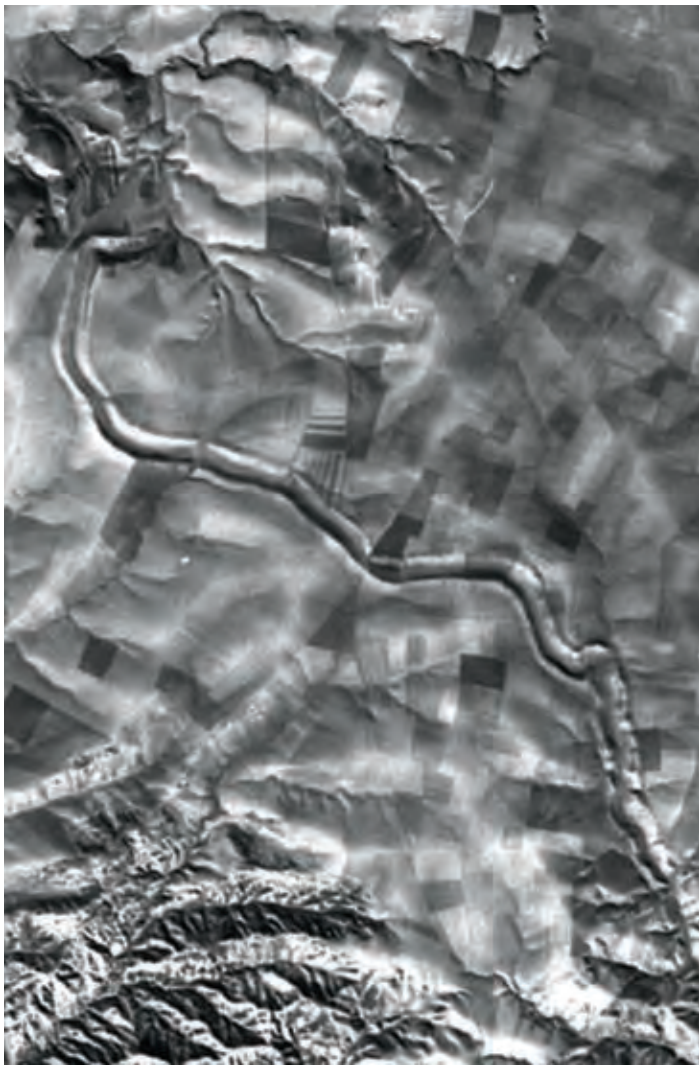
ROSE LINCOLN/HARVARD STAFF PHOTOGRAPHER

As Saddam Hussein's rule hardened, things got worse, as repression culminated in the depopulation of the Kurdish countryside and in chemical weapons attacks on rebellious villages in 1988. Needless to say, foreign archaeologists were not welcome.

"There is a real gap in knowledge of the history of the Kurdish region," Ur says. "And if the local people are going to write their own history — which I think everybody should be able to do — they need to know where these places are."

What makes the work possible now, crucially, is the calm that prevails in the region. Iraqi politics are fraught, and security in the south remains volatile, but the Kurdish region is autonomous and generally stable and safe. Westerners, and particularly Americans, are welcome. An oil boom has attracted investment. Direct flights to Erbil from Vienna, Istanbul, or Dubai allow visitors to bypass Baghdad altogether.

The other key to the work is the aerial photographs that allow Ur and his team to identify the locations to visit across a sprawling, mostly agrarian terrain. They come from a trove of 800,000 photographs from CORONA, America's first spy satellite program in the 1960s. The photos, and a subsequent set from a spinoff program called KH-7, were declassified starting in 1995 and became available to researchers a few years later.



A declassified spy satellite image of one of Sennacherib's largest canals, near the village of Bandwai. It is 100 meters wide and over 20 meters deep, and it moved water from the far hinterlands inward toward the imperial capital city at Nineveh (modern Mosul).

THE IMAGES COME FROM A TROVE OF 800,000 PHOTOGRAPHS FROM CORONA, AMERICA'S FIRST SPY SATELLITE PROGRAM IN THE 1960S, WHICH WERE DECLASSIFIED BEGINNING IN 1995.

A small Bronze Age mound on the Erbil Plain. The team identifies potential sites like this one, then visits them on the ground to collect surface artifacts and determine the site's age.

"It's a great victory for government openness," Ur says. "And I like that we can take the images to the people we spied on, and use them to work with our Iraqi colleagues."

The age of the images is not a handicap. In fact, it helps that they show the landscape prior to disturbance by the last few decades of development. Combine them with contemporary tools like Google Earth and GPS locators to carry in the field, and archaeologists around the world are discovering new research vistas.

"A regional approach has grown, asking questions not of individual sites where you have to go and dig, but ones that demand a broader perspective: like the origins of cities and states, and how they work," Ur says. For research on Mesopotamia, he says, landscape archaeology and its new tools have brought about "a bit of a renaissance."

The timing was right for Ur. (His last name is Hungarian, and has nothing to do with Ur, the Sumerian city, although he allows that "it does make it look like I have taken a stage name.") He began his PhD studies in Mesopotamian archaeology at the University of Chicago just before the CORONA

images became available. His mentor, the landscape archaeologist Tony Wilkinson, who is now at Durham University in England, recognized the potential of the satellite photographs and urged his advisees to exploit them.

"Tony had bought the images — you couldn't get them digitally then," Ur says. "He projected them against a piece of paper taped to the wall and hand-traced the features. What his students have done is to run with this in a digital domain, in the same way that other social sciences are taking advantage of geospatial tools."

Ur's dissertation and later research took him to northeast Syria, where he joined, among other projects, a study of the Tell Brak site — one of the world's first cities, dating to the fourth millennium BC. Mapping and collecting fragments from a broad landscape, he helped show that Tell Brak did not grow out from a core, but filled in as a number of associated but separate settlements expanded toward one another. The finding challenged the conventional view that urban expansion resulted from centralized decision-making.

Top: An aerial view of the modern city of Erbil, showing the ancient citadel at the center — a residential area built up, in superimposed layers, over thousands of years.

Right: A typical small mound, built up over 1,500 years. It now hosts a small Kurdish cemetery on its southern slopes (left) and a water tank on top.

"IT'S A GREAT VICTORY FOR GOVERNMENT OPENNESS, AND I LIKE THAT WE CAN TAKE THE IMAGES TO THE PEOPLE WE SPIED ON, AND USE THEM TO WORK WITH OUR IRAQI COLLEAGUES."

It also confirmed Ur's instinct that the stories rulers tell about how they built cities and states need taking with a grain of salt. Landscape archaeology, as he sees it, can help correct a bias, which he describes with a modern-day metaphor.

"We are no longer limited to what the early excavators chose to focus on, which was disproportionately the 1 percent," he says. "We know the nooks and crannies of the great Assyrian palaces in a way that would probably horrify the kings themselves. But we know nothing about the rest of the population of Nineveh, let alone the villages that surrounded it or the countryside between the spaces.

"The new approaches allow us to fill in both geographically and socio-economically: you get a broader picture of society in these early states and civilizations."

On the ground, the work is arduous. For several weeks each summer, the team — which includes scholars and graduate students from the US, Canada, Netherlands, France, and more, with specialties in different periods of the region's history — sets out to scour sites that the remote-sensing analysis has identified.

"We stumble out of bed at 4 a.m. and prepare many liters of water," says Jon Clindaniel, a Harvard PhD student who has taken part each year and whose dissertation Ur will advise. "We drive out in the dark so we can get work in before it gets too hot. We're looking for pottery, for metal; this past year we found a tablet on the surface."

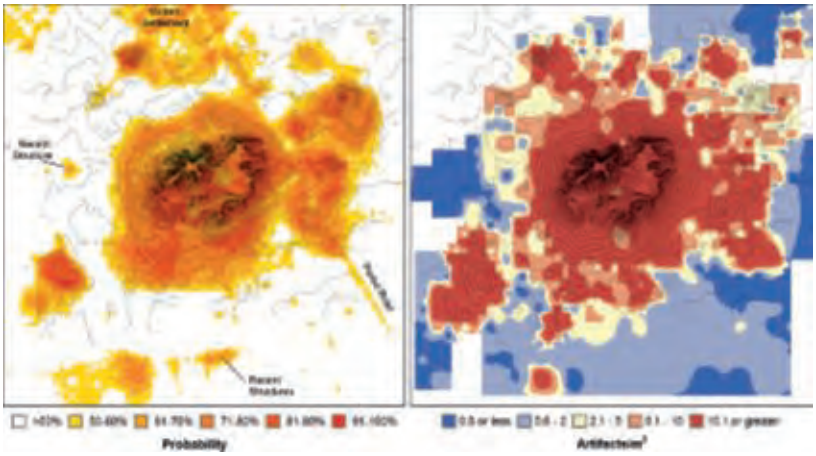
The work involves explaining to villagers why a dozen strangers want to criss-cross their fields, hunched over; placating aggressive dogs; and accepting many offers of tea. Some areas that looked uninhabited on the photos turn out now to be built-up villages.

"There, we shift to being more like anthropologists," Ur says. "Very often, the people living there don't understand the significance of the mound at the heart of their village. We try our best to explain, so people know that they live in a historically important place."

The survey is occurring in a changing landscape. A major challenge, Ur says, is the fast growth of Erbil, where stability and the oil boom are attracting workers and overseas Kurds investing back home. New neighborhoods are springing up with little regard for preservation of sites that people may not know exist in the first place. Construction also drives demand for river gravel for concrete, damaging sites along the region's waterways.

"We're homing in on the most threatened areas," Ur says.

TOP PHOTO: WIKIPEDIA COMMONS



The early city at Tell Brak, in northeastern Syria, documented via satellite remote sensing (left) and the density of artifacts on its surface (right).

"And we're incorporating a local training element, because there's no way one foreign team can stay ahead of a million-person city that's growing so fast."

The pressure compounds the complexity of a project that must also deal with the imperative of building local research capacity and with managing relationships with Kurdish antiquities officials and the typically cooler central authorities in Baghdad. The Syrian civil war, meanwhile, has led some of Ur's Syrian colleagues to take refuge in Erbil, and he is trying to find ways to involve them in the project.

Clindaniel says Ur navigates this milieu smoothly. "He's a great politician," Clindaniel says. "Half of archaeology is waiting around in offices. He always carries around his map canisters and will unfurl them in various offices. He has great showmanship, and he's good at visualizations."

One goal that Ur visualizes is a revival of research in Iraqi Kurdistan that his project — the first led by an American — can help seed. "I've been active in encouraging colleagues, especially those whose Syrian projects are on hiatus, to join me," he says. "After all, I know where the interesting sites are. I can give them precise coordinates.

"The intellectual justification is ultimately what drives me," he adds. "But shortly behind that is this element of doing the right thing for a part of the world that hasn't been well served in the past century. There are so many good reasons to be in this place."

THE WORK INVOLVES EXPLAINING TO VILLAGERS WHY A DOZEN STRANGERS WANT TO CRISS-CROSS THEIR FIELDS; PLACATING AGGRESSIVE DOGS; AND ACCEPTING MANY OFFERS OF TEA.

Sunrise over an ancient settlement mound on the Erbil Plain. The team starts fieldwork early in the morning, before temperatures get too hot.

try this at home

WRITTEN BY NICHOLAS NARDINI
PHOTOGRAPHS IN MEXICO BY
PAMELA CASTILLO

Through a new nonprofit aimed at enhancing science education in Mexico, Harvard PhD students are going home to become teachers and role models, showing younger students the path to a life in science

When GSAS students from Mexico get together, says Rogelio Hernandez-Lopez, a PhD candidate in chemical physics, the conversation always seems to come around to the same topic. "We always end up talking about what we can do for Mexico."

One such conversation happened this July, at the apartment of Adrian Jinich, a systems biology PhD student. When he was a master's candidate at the Center for Mathematical Research in Guanajuato, Jinich had organized informal science outreach programs for local high school students, leading Saturday workshops and inviting professors to give presentations. "I always had really great science teachers," Jinich says, "so I wanted to help give some of that back." The informal talks were soon formalized as the Clubes de Ciencia Mexico, a nonprofit organization that sponsored talks and workshops across the country. Reflecting on the success of this venture, Jinich asked himself whether it might be continued and expanded by tapping into the community of PhD students at Harvard.

Those he approached responded immediately to the idea. Every Mexican PhD candidate at Harvard receives funding from the Fundación México en Harvard, with the understanding that after graduation they will return to contribute to the social, economic, or scientific development of Mexico. "But we didn't want to wait until then," Jinich says of his colleagues. In the Mexico they had grown up in, they agreed, science was not a visible career option. The public education system rarely provides the resources necessary for laboratory work, and teachers often have little science education themselves. There are world-class research institutes, but their agendas are mostly determined by the immediate needs of industry, agriculture, and health.

In a Clubes de Ciencia project dedicated to plant biology and urban agriculture, PhD student Adrian Jinich helped students design a hydroponic vegetable garden on a rooftop.

"Science just doesn't have a place in the culture of Mexico," says Eduardo Martinez, a research fellow in cardiology at Harvard Medical School. "I never met a scientist until I went to college. In the US, you see advertisements for scientific projects on the train and in hospitals. In Mexico, science is something performed by smart people in some faraway place."

Through his Clubes de Ciencia, Jinich had seen firsthand the influence that personal exposure to working scientists could have on promising students. He remembered a student named Manuel Razo, who had stood out from his classmates for his passion and skill. Inspired by his time with the Clubes, Manuel sent an e-mail to Rob Phillips, a professor of biophysics at the California Institute of Technology. The e-mail led to a Skype conversation, which led to an invitation for Manuel to work with Phillips in the wet lab over winter break and a summer research stint at Cal Tech. Manuel eventually became first author on a paper about the metabolism of lactose in e. coli. And after returning to Mexico, Manuel organized a science club of his own.

Wanting to produce more stories like this, Jinich and his team drafted a plan for a pilot program that would bring graduate students and postdocs from American universities to Guanajuato, Mexico, to lead workshops of their own design, drawn from their own graduate work. For five hours a day for a week, students in these work-

try this at home

"If we can introduce students to people working in science, we hope they'll say 'I want to be where he or she is.'"

shops would pursue the kind of in-depth research otherwise unavailable to most Mexicans. The project won funding from the Fundación México en Harvard and the David Rockefeller Center for Latin American Studies, as well as a private donation from Juan Enriquez Cabot.

This January, Jinich and six other graduate students and postdocs at Harvard, as well as six more from other American universities, traveled to Mexico for the debut of what they hope will become a recurring program of science education and an enduring exchange between Harvard and Mexico. Sixty percent of participants were college students, and forty percent were in high school. Most students were local, but some traveled to Guanajuato by bus, staying in hotels or with friends for the duration of their workshop.

Topics explored this pilot year ranged widely. One centered on "how a worm thinks"; another was devoted to the analysis of millions of molecules, with the aim of perfecting materials for solar cells. Martinez led his students through the imaging of rodent neurons.

Jose Reyes, a PhD student in systems biology, led a workshop on the microscopy of mammalian cells. Based on recent work completed with Harvard postdoc Ran Kafri and PhD student Miriam Ginzberg, the workshop addressed the question of how cells measure their own size and determine their future growth rate, a difficult problem still the subject of much current research. While the topic might have intimidated graduate students, Reyes found that his undergraduates and high schoolers were unfazed by the challenge.

At top, the Clubes de Ciencia team at Harvard. Below, investigating how cells work by analyzing rodent neurons, led by instructor Eduardo Martinez.

"As a grad student, you get so immersed in your specialty. Teaching this workshop helped me get back to when I was always addressing broader topics."

"It helped me remember when I was an undergraduate and thought a lot of myself," he says. "As a grad student, you get so immersed in your specialty. Teaching this workshop helped me get back to when I was always addressing broader topics." His students were astonished, he remembers, to learn that the project they were replicating in a week had originally taken academics six years to complete.

Jinich led his students in a hands-on exploration of plant biology and the future of agriculture, highlighted by the construction of a rooftop garden. "We built the garden on top of the house of a student who wanted to teach urban gardening techniques to his aunt and uncle, farmers now too old to work in the field," he said.

While they worked planting corn, onions, radishes, and lettuce, the

GROUP PHOTO BY BEN GEBO

students learned about the water crisis and the depletion of the water table by industrial agriculture, a topic especially germane in the farming state of Guanajuato. In fact, a video Jinich showed his students from the Harvard Center for the Environment called out their home by name, noting that the water table in Guanajuato has been falling by an average of two meters a year. "I didn't know beforehand it would mention Guanajuato," Jinich says, "but they were amazed to hear it in this talk from Harvard." After the workshop, his students committed to building a garden on the roof of each of their homes.

Jinich recruited Ian Dunn, a senior in the College who works in his lab, as the only American to lead a workshop this year. A newcomer to Mexico, Dunn was amazed by the beauty of Guanajuato, a city of narrow alleys snaking up hills and brightly-painted houses hundreds of years old. He also enjoyed discovering the local food, especially

a Mennonite cheese famous in the area. Designing a class on the physics of waves, Dunn originally planned to focus on group work and mathematical derivation. "Pretty soon I realized, though, that it would be better to show students examples, things they could measure themselves." Using only simple household materials, Dunn designed a series of experiments allowing the students to measure the speed of sound and the wavelength of light, and to illustrate the behaviors constant across them both. Another turned purple cabbage juice green, to demonstrate principles of quantum chemistry.

> "We know we're privileged to be where we are, so we try to figure out ways to share that privilege."

Israel Pichardo-Casas, a PhD candidate in cell biology, led a workshop using polymerase chain reactions to identify the genetic heritages of his students. For him, the project was especially rewarding because it was conducted in an area so far from Mexico City, where opportunities for scientific learning are even scarcer than is common in the country. One of his students, a high-schooler named Laura, told him that she would never have been exposed to a subject like PCR reactions at her own school, and that she is now deciding between careers in biology and engineering.

The goal of Clubes de Ciencia is "to engage more students to decide on science as a long-term career," says Hernandez-Lopez. "People usually think that science is really difficult, and only a career for geniuses — but that's because there are still inefficiencies in the way we teach science. If we can introduce students to people working in science, we hope they'll say 'I want to be where he or she is.'"

"You find the best and the worst in Mexico," adds Jinich. "You have institutes with world-class researchers. But you also have the worst reading and math scores among OECD [Organization for Economic Cooperation and Development] countries." The burden often falls, Jinich and his colleagues say, on a small list of extracurricular organizations like the Science Olympiads. With Clubes de Ciencia, they hope to add a powerful member to that list.

"The dream is to recruit more tutors from more schools, and expand to other cities in Mexico," Jinich says, and Hernandez-Lopez agrees: "We want to take advantage of all our friends here in graduate school who are doing interesting research." Since returning from Guanajuato, they have been discussing the scalability of the project, thinking about expanding it even beyond Mexico. "Any good student can go to another country and improve science literacy there," says Jinich, pointing to Dunn's success. They are submitting Clubes de Ciencia to innovation challenges like one recently run by the Graduate School of Education, in which they won third prize.

"Everyone's excited about MOOCs [massive open online courses]," says Jinich, "and Clubes de Ciencia is like a MOOC with a human interaction component, promoting community." As they discuss their plans for the future, Jinich and Hernandez-Lopez are looking into using edX's open source software to add an online component to their project.

"We know we're privileged to be where we are," says Hernandez-Lopez, "so we try to figure out ways to share that privilege."

Top, Ian Dunn leads a course on the physics of waves; left, a student in Ian's club demonstrating physical waves; bottom, sampling drinking water for a test using polymerase chain reactions to study genes.

Clubes de Ciencia Mexico is currently led by Adrian Jinich, Rogelio Hernandez-Lopez, Roberto Olivares-Amaya (Harvard PhD '12), Alejandro Quiroz-Zarate (Harvard PhD '13) and Benjamin Sanchez-Lengeling. Contact ajinich@fas.harvard.edu to get involved.

TELLING THE STORY OF SCIENCE

Today's PhD researchers are finding their voice — building skills they need to describe their work to funding agencies, the noise-filled media, and the rest of us.

PHOTOGRAPHS BY BEN GEBO

Across the Graduate School's science disciplines, there is a growing recognition — often driven by students themselves — of the need to train young researchers to communicate complex or technical ideas in a way that makes them vivid and comprehensible to a broad audience. Whether that audience consists of federal agencies, hiring committees, or the general public, graduate students in the sciences are deeply interested in talking about their research with people outside of their immediate scholarly communities.

A workshop series held this January — called **ComSciCon Local** — exemplified the trend. The workshop was organized by Communicating Science, an organization founded and run by PhD students from Harvard and MIT. It seeks to encourage the kind of communication skills that students are increasingly hoping to acquire, sponsoring conferences that offer productive interaction with professional science communicators and lasting networks with peers. (See page 6 for details on the ComSciCon initiative, and visit www.comscicon.com.)

ComSciCon organizers asked the Harvard PhD students who participated in the January workshop to develop brief articles, aimed at a broad audience, that answered the question, **"What surprising role will your field take in explaining, shaping, or solving a problem faced by society this century?"** Four of the resulting pieces were selected for publication in *Colloquy*.

HOLLY ELMORE

The Story Behind the Story of Life

In my comparative genomics research, studying the genomes of fungi makes me feel like a detective getting to know a neighborhood. Sometimes the equivalent of graffiti on the walls or garbage in the streets can tell amazing stories — tales of trauma, death, desperate measures, and change that is occurring much faster than any of us once suspected. Take the fungal agricultural pathogen *Fusarium oxysporum*. I identified a possible defensive adaptation to a common pesticide without ever having studied the organism itself, just by following the leads in its genome.

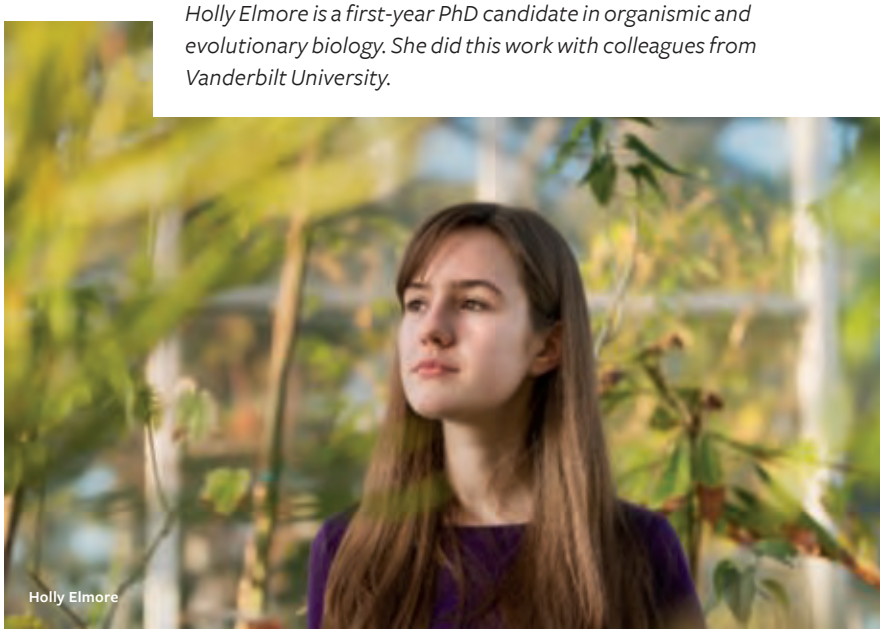
The characters in this story, the genes, can belong to a "family" of similar genes, a group of "colleagues" in the same metabolic pathway, and a "neighborhood" in the same physical location on the chromosome. Every strain of this fungus has the two genes that together combat this pesticide, but in some strains, the two are next-door chromosomal neighbors as well as colleagues. This physical proximity allows the genes to better work together, particularly when they are both needed on short notice to counteract a toxin. On top of that, this pair is ready to relocate together to new strains of the fungus on a mobile chromosome. Most chromosomes, like most neighborhoods, stay put. Mobile chromosomes, however, do not confine themselves to one lineage of parents and offspring, but can cross the borders between genetically distant individuals like a caravan, spreading the potential pesticide resistance to new strains. Their gain is our agricultural loss.

So, how did I piece all this together? Good, old-fashioned detective work aided by some fancy computational tools. Genomes are often described as a set of instructions to build and maintain an organism, but that is not the whole story. The working genes (the neighbors) represent only a sliver of the genome; the rest is a mixture of crucial genomic context (roads and buildings) and genetic garbage (trash and graffiti), that together form a historical record. I compare different genomes, all of which are variations on a common ancestor's theme, to better understand how evolution takes its many paths.

Curiosity drove me to investigate this case, but the results led me to some very practical conclusions. Before the genomic era, we did not appreciate how many avenues are available for resistance to evolve. The genes themselves are no different between strains, but their context — next-door neighbors on a mobile chromosome — can lead them to work together in very different ways, leading to differences in each strain's pesticide sensitivity.

Beyond even the practical lessons, there is something profound about exploring an organism's genetic environs. *F. oxysporum*'s genome bears the traces of the chaotic history behind an evolutionary arms race — a gripping and almost relatable account, for those who know how to interpret it. This kind of work was inconceivable just half a century ago, before we could read the genetic code. Through comparative genomics, I have the privilege of exploring a world that is both completely foreign and strangely familiar, following clues to solve mysteries that could lead to a better future and deeper understanding of the story behind the story of life.

Holly Elmore is a first-year PhD candidate in organismic and evolutionary biology. She did this work with colleagues from Vanderbilt University.



Holly Elmore

TELLING THE STORY OF SCIENCE


Grigori Guitchounts

GRIGORI GUITCHOUNTS

The Neuroscience Society

Despite the recent media frenzy about all things *neuro*, from neurolaw to neuromarketing and brain games, drinks, and apps, most neuroscience research today is conducted with the ultimate goal of curing brain diseases, which take a great economic and emotional toll on our society.

Curing disease is of paramount importance, but it may turn out to be one of the simpler endeavors of future neuroscience. Understanding how the brain works might be the more complicated part. And to really understand something, you have to build it.

While most current technical efforts are aimed at reverse-engineering the brain (figuring out how the brain works by taking it apart), future neuroscience will guide forward-engineering. Given our accumulated knowledge of how the brain works, we will be able to create machines that mimic or replace brain function.

At Harvard, David Cox's lab is working toward reverse-engineering the biological visual system by gathering neural data from experiments in rats, and then applying those lessons to forward-engineer better computer vision systems. Computer vision and facial recognition systems such as Facebook's, as well as neural prosthetics that replace faulty senses or add novel ones (like artist Neil Harbisson's "eyeborg"), are just a few examples of ground-breaking neural research already being put into practice.

In addition to advances in computation, understanding the brain as a machine could also provide solutions to mental illnesses faced by millions. Knowledge of the neural mechanisms behind common disorders like depression or anxiety could guide behavioral treatments that help afflicted people live happy, productive lives.

A recent study at MIT showed that old, deeply ingrained fear memories, typically difficult to forget, were easily extinguished with the help of a molecule that promotes malleability of neural circuits. When mice underwent fear-conditioning, their traumatic memories were malleable for a short period of time, during which neuronal chromatin — packets in which DNA is stored — was relatively plastic. If the memories were allowed to age, however, the associated chromatin lost its plasticity and the memories became hard to attenuate. Using a drug that promotes chromatin malleability, the researchers showed that the old fear memories became just as easy to extinguish as new ones. This research could one day be combined with PTSD therapy to help patients lose negative associations to known stressors.

We are still far from being able to reap the full benefits of neuroscience, but treating the brain like a machine will eventually allow us to fix or alter it to our liking. Humans have been striving to take control over nature since the dawn of time — by building fires and homes, by domesticating wild animals and cultivating the land, and by creating technology in all its forms. A deep understanding of the brain could give humans the ultimate control: control over the self.

And while this struggle for self-improvement is a familiar theme, the potential of neuroscience to make a positive contribution isn't well appreciated. We forget that our entire selves — our minds, personalities, and emotions — are a product of data-crunching neurons. Manipulating these neurons could not only relieve illness, but change what it means to be human.

Grigori Guitchounts is a first-year PhD candidate in the Division of Medical Sciences (neurobiology).

FLORENCE YONG

An Analytic Approach to Risk and Intervention

On a bright, sunny morning, the editor-in-chief of the scientific journal *Advances in Nanoparticles* was killed on her way to work by a reckless driver. The tragic crossing of their paths proves a common point: every day, we are exposed to various types of risk — from accident or disease, from crime or the environment. Our vulnerability to risk is ever-present in our increasingly volatile world.


Florence Yong


Katie Boronow

Do we simply wait for our fate to befall us? The increasing availability of "big data" — massive, complex volumes of data generated from genomics, from electronic medical records, and from social media, among other sources — has provided us with a golden opportunity to harvest useful information, reduce risk, and develop targeted treatment or intervention for undesirable outcomes. With the many resources spent in drug development, how can we identify the right group of patients for more effective treatment? With limited government resources, how can we efficiently help children at risk of abuse? With our modern transportation infrastructure, how can we reduce the number of people killed and injured in traffic crashes each year — a number that would fill Fenway Park 60 times over?

Led by Professor Lee-Jen Wei, my dissertation research aims at developing quantitative methods in personalized medicine. Combining advanced mathematical, statistical, and computational methods, we propose systematic procedures to build and evaluate risk-scoring systems according to how well they predict in an independent population.

We then optimally separate subjects into distinctive groups with a clinically meaningful risk difference between them. For example, four groups of patients with different characteristics may be identified with an average of six-month survival difference between neighboring risk groups. When employed in collaboration with subject-matter experts, such novel methods to stratify individuals can help practitioners develop a more personalized intervention strategy for people in each distinct risk group.

The data analytics team for the 2012 presidential election used uplift modeling to identify likely voters early on for fundraising and voter-mobilization efforts. In a similar spirit, early identification of sub-populations who are (or are not) likely to experience a treatment benefit can potentially save lives and resources, while alleviating adverse treatment effects. Our proposed concepts and procedures, now in active research, could be adapted in vast areas of application, ranging from identifying people with high risk of life-threatening disease to finding those who are at high risk of endangering themselves or other people. Intervention or therapeutic treatment programs can then be developed via multidisciplinary collaborations.

Imagine if that reckless driver had been identified earlier and had undergone anger management. Imagine if his smart phone or car had signaled his outrageous speed and controlled it. The scientist who died on that sunny morning — my beloved sister Virginia — might still be alive. The development of innovative analytic methods presents an exciting opportunity to avert crises across a range of areas. By harnessing the passion and prowess of subject-matter experts, and our ever-growing bank of available data, we can develop targeted and cost-effective strategies to deter harm and create a safer and healthier environment for all.

Florence Yong is a fourth-year PhD candidate in biostatistics.

KATIE BORONOW

A Tale of Two Lizards: How Behavior Can Buffer Against Climate Change

On a cold morning, 8,000 feet above sea level, the Caribbean island of Hispaniola looks and feels more like New England: Instead of palms, pine trees surround me, and I'm wearing a fleece and a rain jacket over my t-shirt to stay warm. I am here with fellow PhD student and head researcher Martha Muñoz and a team of undergraduates to study the lizards that live in this unusual environment. Unlike humans, these lizards can't just put on a sweater to stay warm. Genetic evidence indicates that these high-elevation lizards (*Anolis shrevei* and *A. armouri*) are descended from the same ancestor as another species that lives in the island's tropical lowlands (*A. cybotes*). By comparing the high-elevation species to their low-elevation relative, we hoped to identify differences between the species that could have resulted from adaptation to differing environments.

What we found surprised us: High- and low-elevation lizards are similar in fundamental ways. Crucially, Muñoz found no difference among the three species in either body temperatures recorded in the field or temperatures selected by lizards during a lab experiment that offered them a range of choices. How could high-elevation lizards living in a much colder environment still prefer the same temperatures as their tropical relatives?

We think the lizards have changed their behavior to compensate for the different temperatures in the two environments. At low elevation, lizards choose densely forested areas where they spend most of their day in the shade; at high elevation they spend almost all of their time in open areas in direct sunlight. But perhaps most important, the lizards switch from perching on tree trunks at low elevation to rocks at high elevation. Unlike tree trunks, rocks heat up rapidly, and it is only on rocks that high-elevation lizards can achieve body temperatures comparable to those of their tropical counterparts.

In this case, behavior appears to shield the high-elevation lizards from evolving a preference for cooler temperatures. This result challenges our assumptions of how animals will respond to global climate change. Scientists have often theorized that climate change will cause animals to migrate to areas matching their current environmental preferences, rather than stay put and adapt. This way of thinking forms the basis of models predicting how species' habitat availability will change under hypothetical climate scenarios. For many species, suitable habitat is predicted to shrink, sometimes to levels that threaten their survival.

But these models ignore how individuals can use behavior to construct their own microclimates. By burrowing deeper into the ground, retreating into the shade, or perching on a rock, an animal can manipulate its local environment and maintain its climatic preferences even in seemingly unsuitable habitat. Incorporating this understanding into models of habitat shifts will lead to more accurate predictions of the impact of climate change on animal communities — and perhaps lower the number of species predicted to become endangered. While global climate change threatens our environment, animals acting to buffer themselves from climatic shifts will be able to stand their ground.

Katie Boronow is a third-year PhD candidate in organismic and evolutionary biology.

Share your news. Send a note to gsaa@fas.harvard.edu, or write to *Colloquy*, Suite 350, 1350 Massachusetts Avenue, Cambridge, 02138.

Noted

Anthropology

Todd Disotell, PhD '92, is appearing on the Spike network's *10 Million Dollar Bigfoot Bounty*, as one of the show's resident primate and human evolution experts. Drawing on years of experience generating and testing hypotheses related to primate phylogeny, Disotell helped to determine the criteria that he and fellow judge Natalia Reagan would use to award the bounty to the show's Sasquatch-searching contestants. Disotell is a professor of anthropology at New York University, where his research interests span the fields of mammalian evolution, molecular systematics, phylogenetic analysis, human variation, and population genetics.

Applied Sciences

George Fikioris, PhD '93, together with his students, I. Tastsoglou and O. N. Bakas, has published *Selected Asymptotic Methods with Applications to Electromagnetics and Antennas* (Morgan & Claypool, 2014). The book was inspired by notes from a graduate course taught by Fikioris at the School of Electrical and Computer Engineering at the National Technical University of Athens.

Biophysics

Harvard Medical School professor **Gary Ruvkun, PhD '82**, is a co-recipient of the 2014 Wolf Prize in Medicine. The award recognizes Ruvkun for his role in the discovery of tiny molecules of RNA that control the activity of protein encoding genes in animals. He will be honored at a ceremony hosted by Israeli President Shimon Peres in May 2014. Ruvkun, a member of the National Academy of Sciences, is also a lead researcher in the search for extraterrestrial genomes, advocating the use of DNA amplification techniques in identifying extraterrestrial organisms.

Fine Arts

Diane Radycki, PhD '93, has published *Paula Modersohn-Becker: The First Modern Woman Artist* (Yale University Press, 2013), a monograph on the German painter known for her unconventional representations of the female body. The book draws from Modersohn-Becker's personal letters and journals, revealing a woman struggling to balance her career with her role as a mother and a lover. Radycki was first introduced to Modersohn-Becker in an undergraduate art history class at a time when few English-language studies of the artist existed. A recipient of Fulbright and AAUW (American Association of University Women) fellowships, Radycki was awarded a Millard Meiss Publication Fund grant by the College Art Association for the book. She is an associate professor at Moravian College, where she directs the Payne Gallery.

Geology

Timothy L. Grove, PhD '76, has been awarded the Geochemical Society's 2014 Goldschmidt Award for his "outstanding contributions to understanding magma genesis on Earth, other planets, and planetary bodies; his ability to combine exquisite and difficult petrologic experimentation with field work; and his creativity in driving thought on generation mechanisms of magmas in new directions." Grove is Cecil and Ida Green Professor of Geology at MIT, where he has been on the faculty since 1979.

Government

David Fott, PhD '93, has published a translation of Cicero's *On the Republic* and *On the Laws* (Cornell University Press, 2014), two of Cicero's most important works in political philosophy. Fott's volume is the first to be fully based on the latest critical edition of the Latin texts, which marks a significant departure from previous critical editions. He aids readers in following Cicero's treatment of concepts such as natural law by translating key terms consistently and by including an index of those terms. Fott is associate professor of political science at the University of Nevada, Las Vegas, where he founded and directs a great-books program.

Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation (Cambridge University Press, 2012) by **Jacques E. C. Hymans, AB '94, PhD '01,** has been awarded the 2014 Grawemeyer Award for Ideas Improving World Order. The book had earlier won the Louis Brownlow Book Award from the National Academy of Public Administration and the Don K. Price Book Award from the American Political Science Association. Hymans is associate professor of international relations at the University of Southern California.

Organizational Behavior

Harvard University has appointed **Rakesh Khurana, PhD '98**, as the next dean of Harvard College. Khurana is Marvin Bower Professor of Leadership Development at Harvard Business School, a professor of sociology

in FAS, and co-master of Cabot House, with his wife, Stephanie Ralston Khurana, MBA '96, MPP '96. Khurana has been an active member of the College community and an engaged contributor to discussions of issues related to undergraduate education. He is known for a commitment to teaching, having twice received the Charles M. Williams Award for Excellence in Teaching (2008, 2012). He will assume the deanship on July 1, 2014.

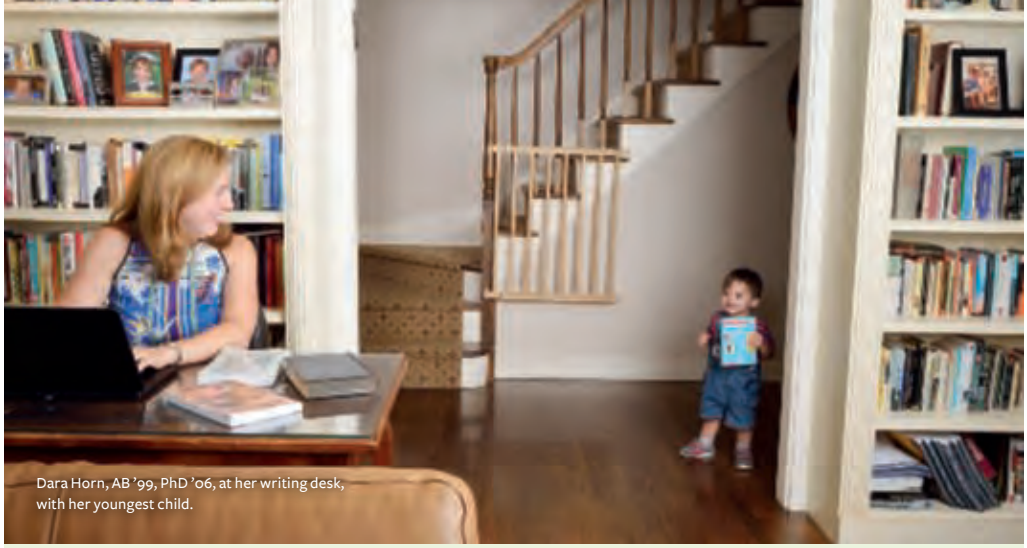
Physics

Rachel Pepper, PhD '09, a research fellow at University of California, Berkeley, has been appointed as the first William D. and Flora McCormick Chair in Biophysics at the University of Puget Sound.

Multidisciplinary

Spouses **Deborah Parker, PhD '85,** Romance languages and literatures, and **Mark Parker, PhD '84,** English, are co-authors of *Inferno Revealed: From Dante to Dan Brown* (Palgrave McMillan, 2013). The book offers an introduction to Dante's *Divine Comedy* and considers its influence on Dan Brown's *Inferno* (Doubleday, 2013). Deborah is professor of Italian at the University of Virginia, and Mark is head of the English department at James Madison University.

DARA HORN PHOTO BY TOM SPERDUTO



Dara Horn, AB '99, PhD '06, at her writing desk, with her youngest child.

A Novel Kind of Scholar

By the time she received her PhD in comparative literature in 2006 — and before she turned 30 — **Dara Horn** had already published two novels, *In the Image* and *The World to Come*, earning her two National Jewish Book Awards among other honors. She has since published two more novels that continue to explore themes of Jewish history and literature — and the intersections of both with contemporary, often secular Jewish life. Her most recent novel is 2013's *A Guide for the Perplexed*. She lives in New Jersey with her husband and four children.

How did your scholarly interests inspire your fiction?

I knew I wanted to be a writer, but I fell in love with Yiddish and Hebrew literature and just didn't feel like I was done studying it once I'd finished my BA. I was reading these authors who were writing in Hebrew and Yiddish, and I was very jealous — certainly not of their circumstances, which were far worse than anything I could imagine living through, but of how they were able to access religious tradition while writing secular texts. I write novels for a lot of reasons, but linguistically I am very interested in creating books about contemporary people living largely secular lives, but where the language is drawn from religious tradition.

I wrote my second novel, *The World to Come*, entirely while I was in the PhD program at Harvard, and the subject matter was directly related to my academic work. There are characters in the book who are actual Yiddish writers, and since they were also the subject of my dissertation, I knew all about their lives and circumstances. Marc Chagall, the painter, is also a character in the book, because he lived with many of these writers and illustrated a number of their works. I only knew this because I had seen it in Widener.

How did you manage to juggle your research and your fiction?

I was unusual in that I had gotten married the year after college, and my husband had a job in New York, so I was actually living there and commuting to Cambridge. I'd take a 7 a.m. flight on Tuesday and then come home on Thursday night. I stayed in Richards my first year, and I ended up paying someone to sleep on their couch the second year. It was unconventional. But I was living another kind of double life, in that while I was writing my dissertation, I was also writing the novel. So I'd focus on the novel when I was in New York and the dissertation when I was at Harvard.

The wonderful thing about a doctorate is that no one expects you to actually finish it — and that's true for novels as well — and I would use this to my advantage. I'd be working on the novel and would get stuck, and I'd procrastinate by working on the dissertation. And then I'd be working on the dissertation and hit a wall there and go back to the novel. I ended up working on both, but I always felt like I was procrastinating.

Did you ever feel you had to choose one path or the other?

Things changed when I started having children. It's very doable to have a career and small children, but you really can't have *two* careers and small children. In my case, I was teaching at Sarah Lawrence while writing the novels, and since I already had contracts for future novels, it didn't make sense to keep teaching at that time. But there's a tremendous amount of overlap between my scholarly work and my novelistic work, and because of that I've had academic opportunities that I never expected to. I've taught or spoken at close to 50 different universities now, almost always within the framework of academic Jewish studies. I've been able to create a career that doesn't follow the standard academic track, but that also doesn't follow the standard novelistic track. — *Emma Mueller*

GSAS Dean Xiao-Li Meng and FAS Dean Mike Smith toured the conservation studio of the Shanghai Museum. Guided by a museum conservator (and joined by FAS capital giving officer Timothy Brown, at right), they examined a scroll painting in the process of being restored.

CHINA VENTURES

The Graduate School hosted three University-wide alumni events in China in January, during a trip whose many highlights included the presence of Faculty of Arts and Sciences Dean Michael D. Smith, who was making his first visit to Asia.

GSAS Dean Xiao-Li Meng, a native of Shanghai, moderated a series of conversations — in Hong Kong, Shanghai, and Beijing — that featured remarks from Smith on current FAS priorities and innovations in teaching and learning. The events also featured animated dialogues between Meng and Mark C. Elliott, the director of the Fairbank Center for Chinese Studies and Mark Schwartz Professor of Chinese and Inner Asian History at Harvard. The two described Harvard's scholarly interests in China, as well as its many activities and collaborations across the country. More than 200 alumni from across Harvard schools attended the three events, which were cohosted by the Harvard clubs of Beijing, Hong Kong, and Shanghai, as well as the Harvard Center Shanghai, the Harvard Alumni Association, and the Fairbank Center.

Members of the Harvard delegation also met with top university officials in each city to exchange ideas and strengthen collaborative networks.

Several alumni leaders accompanied the deans: Donald van Deventer, PhD '77, the chair of the GSAS Alumni Council, and fellow Council members Daniel Johnson, AM '82, AM '84; and Mia de Kuijper, MPA '83, PhD '83.

Lending invaluable assistance and helping to host events in Beijing were Council members Lee Zhang, AM '01, and Jean Liu, SM '02. For more on the trip, see www.gsas.harvard.edu/china.

ALUMNI CAREER INITIATIVE

Two-day workshop sheds light on how PhD skills can be applied in nonacademic settings.

This January, 14 members of the Graduate School Alumni Association (GSAA) returned to campus to lead a robust, two-day workshop for current graduate students who are exploring careers in consulting, finance, nonprofit administration, and entrepreneurship. The workshop, called Business Applications of the PhD, drew more than 130 GSAS students eager to absorb professional insights and advice about the ways in which their PhD skills and expertise can be valuable in a variety of nonacademic settings. Presented as part of January@GSAS, the workshop was organized by the GSAA's governing board, the Alumni Council, with significant leadership from Karen Hladik, PhD '84, and Mia de Kuijper, MPA '83, PhD '83. It was co-sponsored by two of the Graduate School's most vibrant student organizations, the GSAS Business Club and the GSAS Consulting Club. See www.gsas.harvard.edu/alumnijanuary for the full list of alumni panelists.

Alan Kantrow, AB '69, PhD '79, led a session called "Making Strategy Actionable," during a segment on careers in consulting.

PHOTOS: JON PETITT (TOP); MARTHA STEWART (BOTTOM)

The Graduate School Alumni Association
Governed by its Alumni Council, the GSAA represents and advances the interests of alumni of the Graduate School of Arts and Sciences by sponsoring alumni events and by publishing *Colloquy* three times each year.

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A Team Effort

Peter Galison's cross-disciplinary collaboration with faculty and students is a testament to the central role of GSAS

ROSE LINCOLN/HARVARD STAFF PHOTOGRAPHER

At a time when technology is opening new possibilities for the way we teach and learn, faculty and students at the Graduate School of Arts and Sciences are finding compelling new ways to approach cross-disciplinary research and collaboration.

"It's an exciting moment in graduate education," says Peter Galison, PhD '83, Joseph Pellegrino University Professor and director of the Collection of Historical Scientific Instruments at Harvard. "People have such an extraordinary ability to move productively across disciplines."

Galison's approach to teaching is rooted in his own experience as a graduate student. As one of the first GSAS students to couple the study of physics with that of history and philosophy of science, he recalls how GSAS gave him the opportunity to explore and pursue cross-disciplinary research. Now, as a faculty member, Galison creates this opportunity for his own students.

For several years, Galison has partnered with Martha Minow, Morgan and Helen Chu Professor of Law and the dean of Harvard Law School. Through their research into "technoprivacy" and their joint HLS/GSAS course, "Doubt," Galison and Minow have collaborated to ask and answer questions around scientific and legal uncertainties. "These questions are incredibly relevant to our time and very much shape our contemporary world—they likewise have governed my work and influenced how I collaborate with students."

Galison has also collaborated with Robb Moss, chair and professor in the Department of Visual and Environmental Studies, on the production of several films (including *Secrecy*, a documentary that premiered at the 2008 Sundance Film Festival) illuminating the relationship between science and the visual arts. Together, they regularly teach "Filming Science," a course that draws students from the humanities, the sciences, and the arts.

"With filmmaking and written research, I'm committed and devoted to bringing graduate students into the process," says Galison. One of these students is his advisee Stephanie Dick, a 2013 Horizon Scholar who explores the history and philosophy of computing. "Stephanie is a wonderful example of a rising young scholar who, through her own research and through work we've done together on an exhibit in our museum of scientific instruments, has taught me a great deal," says Galison. "That's what we aim for in GSAS — we bring students with us to the forefront of knowledge. They contribute to it, we teach them, and they teach us. What could be better?"

Through his involvement with HarvardX, he is working closely with students to think about new ways to interact with information online — transforming the classroom and exploring a fundamentally new way of teaching in the digital world.

"GSAS has found a way to expand and integrate the interaction between teaching and research in this rapidly evolving world," notes Galison. "Even as research has changed enormously, GSAS has maintained that integration. Students are working on high-energy physics and history in new domains like nanoscience and neuroscience, and pursuing extraordinary new efforts in the human and social sciences, from literature and art to economics, psychology, and anthropology. These cross-disciplinary explorations are what make GSAS so remarkable, and our students' work a never-ending object of admiration for me and for my peers."

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The tools of a landscape archaeologist's trade.
Photograph courtesy of Jason Ur