

# MOST SIGNIFICANT BITS

Newsletter of the Paul G. Allen School of Computer Science & Engineering  
University of Washington

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## Construction and fundraising milestones reached for new Bill & Melinda Gates Center for Computer Science & Engineering

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2018 Alumni Impact Award winners  
Yaw Anokwa and Eileen Bjorkman

UW Reality Lab launches to advance  
augmented and virtual reality

# Message from the director

Greetings friends,

This time last year, I celebrated the news of our transformation into the Paul G. Allen School on the occasion of our 50<sup>th</sup> anniversary. Since then, we have reached two new milestones that are cause for celebration: the completion of fundraising and the ceremonial "topping out" for our second building, the Bill & Melinda Gates Center for Computer Science & Engineering.

Last fall, we announced the official naming of CSE2 for the Gateses after Microsoft and friends and colleagues of the couple came together to provide a naming gift in their honor. It was a wonderful way to recognize Bill and Melinda's many contributions to our region and to the world — and also a wonderful show of support for the Allen School and our potential for impact. The couple followed with their own gift to officially bring fundraising for the building to a close. In December, they and their fellow donors joined us to celebrate the "topping out," the placement of the final steel beam of the structure which marked the halfway point of construction. I'm happy to report that we remain on schedule to complete construction by the end of 2018.

Our attention now shifts to filling this wonderful new space. Thanks in no small part to the efforts of professor Ed Lazowska and one of our most ardent champions, Microsoft President Brad Smith, the Washington State Legislature followed through on its commitment to increase Allen School enrollments in the latest state budget. As a result, we will be on track to double our annual degree production as we expand over two buildings. We are well on our way: we now serve more than 1,100 students across our two undergraduate majors. At the graduate level, we had an incredible response to our prospective student visit days in March, and I am pleased to report that we will welcome 74 new Ph.D. students next fall to the Allen School family.



Speaking of grads, last year, we started a new tradition at our graduation celebration by featuring a local tech leader offering advice and inspiration to our students as they prepared to go out and do great things with their degrees. In 2017, serial entrepreneur Rich Barton, who co-founded Expedia, Zillow, and Glassdoor, advised the members of our first graduating class as the Allen School to pursue "big, audacious dreams." This year, we are thrilled to welcome our good friend Harry Shum, Executive Vice President of Microsoft's Artificial Intelligence and Research Group, who exemplifies the spirit of innovation and giving back to society that we hope to instill in all of our students.

It's the same spirit that we honor with our Alumni Impact Awards (previously known as the Alumni Achievement Awards). Our 2018 recipients, who are being recognized during our graduation event, are Ph.D. alumnus Yaw Anokwa and Bachelor's alumna Eileen Bjorkman. Yaw's work with the late professor Gaetano Borriello

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*Cover photo:* The final steel beam is hoisted atop the Bill & Melinda Gates Center for Computer Science & Engineering.

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Editor: Kay Beck-Benton  
Contributors: Ed Lazowska, Hank Levy, Kristin Osborne  
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on the Open Data Kit has had immeasurable impact on underserved communities around the globe who rely on ODK to collect and share data about public health, conservation, human rights, and more. Eileen's career really took off after she graduated — she put her computer science degree to work for her country as an officer in the United States Air Force and one of the first female flight test engineers.

Our faculty and students are also flying high. Professor and alumna Franziska Roesner was recognized with a TR35 Award — given by *MIT Technology Review* to the top technologists under the age of 35 — for her work on privacy and security of augmented reality systems. Zach Tatlock and Yin Tat Lee received NSF CAREER Awards for their work in distributed systems and optimization algorithms, respectively, while Maya Cakmak earned a Sloan Fellowship for her efforts to develop assistive robots that are programmable by end users. Her robotics colleague, Sidd Srinivasa, was elevated to Fellow of the IEEE, while Steve Seitz of the Graphics & Imaging Lab was selected as a Fellow of the ACM. (Sidd and Steve were joined by several alumni, including newly minted IEEE Fellow Tao Xie and ACM Fellows Gail Murphy and Geoff Voelker.) We are also proud of professor and alumnus Kurtis Heimerl, who earned the College of Engineering Diamond Award for Early Career Achievement for his work on technologies for the developing world, and undergraduate Kaitlyn Zhou, who earned the prestigious Engineering Dean's Medal. You can read about these and other impressive achievements later in this issue.

In other news, Steve Seitz teamed up with GRAIL colleagues Brian Curless and Ira Kemelmacher-Shlizerman to establish the UW Reality Lab. The new lab brings together faculty and students from a variety of research groups to drive new advancements in augmented and virtual reality. You will also meet our exciting crop of recent faculty hires, including Jennifer Mankoff and alumnus Jon Froehlich, who were part of a cluster hire in human computer interaction; Kevin Jamieson, the first to hold the Guestrin Endowed Professorship in Artificial Intelligence & Machine Learning; and alumna Lauren Bricker, a lecturer who is also leading some of our K-12 outreach.

We are incredibly proud of our faculty, students, and alumni for their many contributions to creating a better world. We look forward to building on our track record of producing exceptional graduates and high-impact research in our expanded home beginning early next year.

Until then, thank you for your continued support and engagement with the Allen School!

Warm regards,



Henry M. Levy, Director and Wissner-Slivka Chair  
Paul G. Allen School of Computer Science & Engineering



Long-time Allen School supporter Bill Gates, Sr. (center) joined professors Ed Lazowska (left) and Hank Levy (right) on a visit to the construction site of the new Bill & Melinda Gates Center for Computer Science & Engineering, where he signed his name to the final steel beam in preparation for the topping out.

# Allen School marks construction and fundraising milestones for new Bill & Melinda Gates Center

As 2017 drew to a close, the Allen School capped off a memorable year with the celebration of two new milestones: the "topping out" of its second building to accommodate its ongoing expansion, and the official conclusion of fundraising in support of the project. The new building, which will be known as the Bill & Melinda Gates Center for Computer Science & Engineering, is on track for completion in December and will provide sufficient space for the Allen School to achieve its goal of doubling annual degree production.

Hundreds of building donors and other members of the Allen School community gathered for the topping out ceremony to mark the placement of the final steel beam on top of the structure. The topping out is a tradition in the building trades; for the Gates Center, it signaled roughly the halfway point in construction, when crews were ready to begin work on the enclosure and interior of the building. Before general contractor Mortenson hoisted the beam to be welded into place, supporters were invited to sign their names in permanent purple ink — memorializing their role in the school's quest for growth and impact.

"This new building is vital to Washington," said Microsoft President Brad Smith, who spearheaded the school's capital campaign. "More than 300 donors contributed to the project because they believe in the importance of preparing students for not just today's world, but tomorrow's."

Joining Smith and the other signatories were the building's namesakes, Bill and Melinda Gates. The moment was



Melinda and Bill Gates (foreground) sign their names to the final beam before it is hoisted onto the building that bears their name as professor Ed Lazowska (left) and UW President Ana Mari Cauce (second from left) look on.



Aerial rendering by LMN Architects of the Bill & Melinda Gates Center for Computer Science & Engineering, looking west towards the Allen Center.

made all the more poignant by the fact that the couple's own gift was not what inspired the structure's new moniker. Over the summer — before the Gateses had a chance to put pen to checkbook — more than two dozen of their friends and colleagues banded together with Microsoft to name the building in their honor. The gift came as a complete surprise to the couple, who were told of it at the time they made a gift of their own toward the project.

"That was a really, really special day for us, and we really appreciated that," Melinda Gates recalled while addressing the assembled guests. "We couldn't be more proud to have our names on the building."

The Gateses made a \$15 million gift to officially bring the fundraising campaign to a close. It was the latest example of the family's long history of support for UW and the Allen School, which have been instrumental to the growth of Microsoft and of the Puget Sound region as a global center of computing innovation. As Bill Gates told the crowd at the topping out, his hopes for Microsoft and his hopes for UW were intertwined from the company's early days.

"We had big ambitions, so we were hoping that the university would grow along with us — that its size and its ranking would make it the best in the world. And in fact, that's exactly what happened," Gates said. "It was a good computer science department; it's now a great computer science department. If there's ever been a clear win-win for this region, for Microsoft, for

the companies here, and for the students, it's got to be investing in great computer science."

That investment will enable the Allen School to serve more students — in particular, preparing more students from Washington for our state's high-demand, high-impact careers — and build upon its reputation for offering a world-class education and research experience. Among the building's highlights are an undergraduate commons intended to serve as a "home away from home" for the more than 1,100 students enrolled in the major, a state-of-the-art laboratory to house the school's growing robotics effort, and multiple classroom, collaboration, and meeting spaces.

Melinda Gates looks forward to seeing how the new building's student-focused design will enable the Allen School to build on its success in expanding the participation of underserved groups in computer science education and careers.

"Sometimes, when you agree to a gift, you have to push people in a certain direction," Gates explained at the topping-out ceremony. "This is a case where because of the work that Ed Lazowska has done and Hank Levy to make sure there are multiple and many pathways for young women and minorities into computer science, we don't have to do anything except be along for the ride."

Like the Paul G. Allen Center before it, the Bill & Melinda Gates Center was designed by the Seattle-based firm LMN Architects and funded through a public-private partnership. Over the course of a three-year campaign, the school assembled \$110 million in support of the project from more than 300 friends and alumni, the Washington State Legislature, UW, and companies including Microsoft, Amazon, Google, and Zillow.

"We're gratified by the way the community has come together to support this project and to honor the tremendous global impact of Bill and Melinda Gates," UW President Ana Mari Cauce said. "The Gates Center will enable us to prepare more students to be the innovators and entrepreneurs of tomorrow — and to follow the Gateses' example in seeking to positively affect people's lives and invest in communities near and far."

With fundraising for the physical structure complete, the Allen School turns its attention to filling the space with the people and initiatives that will drive the future of computing forward.

"Just as construction of the new building has entered the next phase, we are looking toward the next phase of the campaign to fuel our continued growth," said Ed Lazowska, Bill & Melinda Gates Chair in Computer Science & Engineering. "We look forward to working with

our amazing community of alumni and friends to ensure we can attract the best and brightest to the Allen School regardless of means, spark exciting new collaborations across the campus and beyond, and maximize our real-world impact through education and research."

## The "Friends of Bill & Melinda" honor the Gateses by naming CSE2 in their honor

What do you give a couple who already has it all? If you're longtime friends and colleagues of Bill and Melinda Gates, you name a building after them. And not just any building — one devoted to computer science education and innovation and located at the University of Washington.

Last summer, 13 couples teamed up with Microsoft to assemble a \$30 million naming gift in the Gateses' honor. Calling themselves the "Friends of Bill & Melinda," the group was organized by Allen School campaign leaders Brad Smith and his wife, Kathy Surace-Smith, and Charles and Lisa Simonyi. In response to this outpouring of support and in consideration of the couple's own legacy of giving to UW, the university's Board of Regents approved the naming at its October 2017 meeting.

"There is a wonderful symbolism in having the Bill & Melinda Gates Center for Computer Science & Engineering across the street from the Paul G. Allen Center for Computer Science & Engineering on the University of Washington campus. As teenagers, Bill and Paul roamed UW computer labs. They went on to change the face of Seattle and the world," Smith said at the time. "I can't think of a better way for those of us who have had the privilege of working alongside Bill and Melinda to express our gratitude and admiration than to name this building for them."

At the topping out celebration in December, Smith recounted a message he received shortly after the Friends of Bill & Melinda had rallied around the gift. The message indicated the Gateses intended to make a gift of their own, unaware at that point of what their friends had done.

"We said, 'We'll take their money, but they can't change the name.'"

### Friends of Bill & Melinda

Jim & Catherine Allchin  
Rich & Sarah Barton  
Jeff & MacKenzie Bezos  
Lloyd & Janet Frink  
Craig & Marie Mundie  
Satya & Anu Nadella  
Jeff & Tricia Raikes  
Rob Short & Emer Dooley  
Harry Shum & Ka Yan Chan  
Brad & Jan Silverberg  
Charles & Lisa Simonyi  
Brad Smith & Kathy Surace-Smith  
John Stanton & Terry Gillespie  
Microsoft Corp.



# Allen School launches UW Reality Lab to advance augmented and virtual reality

The Allen School has partnered with leading technology companies to create a new center at the University of Washington focused on augmented and virtual reality. The UW Reality Lab — established with \$6 million in combined support by Facebook, Google, and Huawei — will advance the state of the art in AR/VR by pursuing leading-edge research and preparing the next generation of innovators.

Professors Brian Curless, Ira Kemelmacher-Shlizerman, and Steve Seitz of the Allen School's Graphics & Imaging Laboratory (GRAIL) are co-directing the lab, which will establish UW as a hub for new academic and industry collaborations in this rapidly expanding research area. The UW Reality Lab will build upon the Allen School's expertise in a variety of disciplines spanning computer vision, object recognition, stream processing, human-computer interaction, game science, computer architecture, databases, privacy and security, and more. The benefits of a close partnership with industry go beyond the financial, with broad collaborations and with several leading figures in the AR/VR community serving on the lab's advisory board to help guide its activities and ensure it remains at the forefront of the field.



One goal of the UW Reality Lab — funded with initial investments from Facebook, Google and Huawei — is to achieve telepresence, allowing one to have a lifelike conversation with a person in a remote location.

"Having an opportunity to be at the leading edge of this industry is really exciting," said Curless. "It's big, it's happening now, and there's a lot of research to be done. We're thrilled to take a leading role in making it all happen."

"It" encompasses the technologies that will power the next generation of AR/VR applications. While AR/VR is growing in popularity, developments have largely been focused on gaming and entertainment. Seitz believes that academia, with its focus on education and fundamental research, has a central role to play in helping the industry to take AR/VR to the next level and unleash its full potential.

"We're seeing some really compelling and high quality AR and VR experiences being built today," said Seitz, who divides his time between the Allen School and the Google team responsible for Google Jump and the Cardboard Camera app for Android. "But, there are still many core research advances needed to move the industry forward — tools for easily creating content, infrastructure solutions for streaming 3D video, and privacy and security safeguards — that university researchers are uniquely positioned to tackle."

In addition to its research expertise, the Allen School team is well positioned as an educational leader after successfully launching the first AR/VR capstone course for undergraduates using the Microsoft HoloLens in spring 2016. In the course, students worked in groups using the latest devices to produce a range of creative, functioning AR applications, which they demoed at a showcase event attended by members of the industry and the public. The experience led Kemelmacher-Shlizerman — who is also a research scientist at Facebook — and her colleagues to conclude that there was an opportunity to accelerate AR/VR innovation through a sustained initiative accompanied by regular engagement with companies.

"This opened our eyes to the potential of investing deeper in development of algorithms and applications for AR and VR," she said. "We realized there were many cool things we could do if only we had more resources, more time, and more devices."

The UW Reality Lab has already begun putting those additional resources to work in pursuit of its goals. The lab recently hosted its first research proposal competition, in which teams of faculty and students were invited to pitch their projects to a panel of judges

drawn from the lab's advisory board. The panel selected 15 teams, representing more than 30 researchers from the Allen School and beyond, to receive funding. The lab is also preparing to launch a speaker series, "The Reality Lab Lectures," that will bring leading researchers and practitioners to campus to discuss their work in AR/VR and its implications for the rest of the field.

"Allen School faculty have produced pioneering research in many of the areas that underpin AR and VR technologies," said Hank Levy, Allen School Director and Wissner-Slivka Chair in Computer Science & Engineering. "Through our partnership with Facebook, Google, and Huawei, the Allen School and UW will be at the forefront of the next great wave of AR and VR innovation."



The UW Reality Lab will focus on developing next-generation virtual and augmented reality technologies and educating an industry workforce. In this holographic chess game developed by UW students, opponents move pieces that can only be seen through a virtual reality headset.

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## Franziska Roesner recognized with TR35 Award



Allen School professor and alumna Franziska Roesner (Ph.D., '14) was recognized with a TR35 Award as part of *MIT Technology Review's* annual list of "Innovators Under 35," which celebrates exceptional early-career scientists and technologists whose research has the potential to change the world. Roesner was

honored in the "Inventors" category highlighting individuals who are creating breakthroughs and building technologies that will shape the future.

As co-director of the Allen School's Security and Privacy Research Lab, Roesner analyzes the potential risks of existing and emerging technologies and develops tools to safeguard end users. Her latest work focuses on augmented reality (AR) technologies in order to support the design of systems that mitigate vulnerabilities in these platforms, which are gaining popularity for entertainment as well as assistive purposes such as heads-up windshield displays. Roesner explores issues associated with both inputs and outputs, from the potentially sensitive sensor data these platforms collect

on users from their interactions, to the impact of visual ad content on the safety of users and bystanders.

Roesner previously has produced pioneering research in web privacy and security, including the first comprehensive measurement of third-party tracking on the web. She built an anti-tracking tool, ShareMeNot, code from which was incorporated in the Electronic Frontier Foundation's PrivacyBadger browser add-on. Millions of people subsequently have used that and similar tools inspired by ShareMeNot to safeguard their privacy online.

Roesner also collaborated with experts from the journalism community on a study of the computer security needs of journalists and lawyers. Those findings guided the development of Confidante, an encrypted email client built by Roesner and her team that offers the security of traditional encryption technologies without the friction of traditional key management and verification. It is the latest example in a long line of projects that Roesner has developed with the user in mind.

"Ideally, we'd like to design and build security and privacy tools that actually work for end users. But to do that, we need to engage with those users to understand what they need, and not build technology in isolation," Roesner said. "As our technologies progress and become even more integral to our lives, the push to consider privacy and security issues will only increase."

# Yaw Anokwa and Eileen Bjorkman earn 2018 Alumni Impact Awards

Each year, the Allen School recognizes two alumni who have made outstanding contributions to computing and to society. Previously known as the "Alumni Achievement Awards," as of this year the honor has been recast as the "Alumni Impact Awards" to highlight more directly how our former students are using their Allen School education to change the world for the better. Each of our 2018 recipients, Yaw Anokwa and Eileen Bjorkman, exemplify this principle — demonstrating how a computer science education offers multiple avenues to achieving success and making an impact.

## Yaw Anokwa (Ph.D., '12) engineers solutions with a global reach

In January 2018, Somalia's Federal Ministry of Health announced a campaign to vaccinate more than 726,000 young children in the Banadir region against poliovirus. Although no new cases of polio had been reported at the time of the announcement, several sewage samples



taken in the nearby capital city of Mogadishu had recently tested positive for the virus. The Somali government, aided by the World Health Organization and UNICEF, hoped to stave off a public health emergency by vaccinating children who were either too young or had been passed over in previous campaigns due to ongoing conflict in the region.

The rapid mobilization was justified. Prior to the introduction of effective vaccines in the mid-20th century, polio was responsible for hundreds of thousands of cases of childhood paralysis in industrialized countries each year. While the Global Polio Eradication Initiative has made great strides toward eliminating the virus worldwide, there are areas of sub-Saharan Africa, Southeast Asia, and the Middle East where political instability, inadequate infrastructure, and other challenges cause polio to remain a threat even today. Banadir had proved particularly vulnerable; it reported the highest number of poliovirus infections — 72 out of a total 199 cases — during the Horn of Africa outbreak just four years earlier.

To provide public health officials with timely and accurate information as the campaign progressed, more than 200 personnel were trained on a set of open-source mobile data collection tools known as the Open Data Kit, or

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ODK. The software that powers ODK had been started roughly a decade ago and half a world away, by a team of researchers at the University of Washington. That team included 2018 Alumni Impact honoree Yaw Anokwa.

Anokwa was born in Ghana and moved to the United States when he was 10 years old after his father, a college professor, accepted a job at Butler University in Indianapolis, Indiana. Anokwa knew from a young age that he wanted to be an engineer — "I broke a lot of toys as a kid, trying to see how they worked" — but once he discovered programming in college, his interest switched from hardware to software. He went on to simultaneously earn bachelor's degrees in computer science and electrical engineering from Butler University and Indiana University–Purdue University Indianapolis, respectively. When it came time to choose a graduate school, Anokwa admitted he didn't have a particularly strong feeling about UW. Not, that is, until he attended prospective student visit days.

"Everyone was friendly, kind, thoughtful," Anokwa recalled. "The people I met at UW CSE treated me as a person who had something of value to contribute."

When he arrived in Seattle in fall 2005, Anokwa thought he would study artificial intelligence. He abandoned that notion fairly quickly after he developed a rapport with professor Gaetano Borriello, who sparked his interest in ubiquitous computing and human-computer interaction. Shortly after he began working with Borriello, Anokwa stumbled onto information and communication technologies for development, or ICTD, because of the groundbreaking research Tapan Parikh (Ph.D., '07) was doing with his CAM system in rural India. Anokwa's interest reached a high during a colloquium featuring alumnus Neal Lesh (Ph.D., '97). Lesh, who was pursuing a second graduate degree in international public health at Harvard at the time, had returned to his alma mater to deliver a talk titled "Gadgets for Good: How Computer Researchers Can Help Save Lives in Poor Countries."

"Neal was this sort of wandering guru of ICTD, and his presentation on how a little bit of tech from one person could have a direct and positive impact in the service of social justice blew me away," said Anokwa. "The point of most academic research is to explore questions for which a solution might be 20 or 30 years away."

"Maybe that's why I was never a great researcher," he continued. "I saw plenty of current problems, so why



worry about future problems? Let's build stuff that's useful today! ODK is a great example of this; from day one, people found it useful."

Inspired by Lesh's example, Anokwa took a break from UW after earning his Master's degree and traveled to Rwanda to work with an organization called Partners in Health. The group was deploying an electronic alternative to paper medical records, called OpenMRS, in the small town of Rwinkwavu. In Rwanda, Anokwa observed how the reliance on paper records hindered the care of patients with chronic diseases such as AIDS and tuberculosis — and saw how OpenMRS made things better.

While OpenMRS had real potential to streamline workflow and improve outcomes, the time and the training required of doctors and nurses trying to use the system proved to be obstacles. Since the point of the system was to improve direct care, Anokwa set about simplifying the interface for accessing patient information, mapped to clinical workflow. A new search module enabled providers to easily locate patients in the system by name, location, or cohort, while a new patient summary module offered a concise overview of patient data in an easy-to-read, printable format. Additional features, such as automated alerts and the ability to generate customized graphs for specific patient data points, provided more robust functionality.

What was intended to be a three-month break had turned into six, and then Anokwa heard from Borriello. His advisor informed him that he was taking a sabbatical from UW to work on a new mobile data collection project at Google; Anokwa's fellow graduate students, Carl Hartung and Waylon Brunette, planned to work on the project with him. The goal was to create a set of modular, customizable tools for data collection that would leverage the new Android operating system as well as the growth in mobile technologies. The tools would be built on open standards and be, in the team's words, "easy to try, easy to use, easy to modify, and easy to scale." After some back and forth, the three convinced Anokwa to return to Seattle and join them.

"Android was just coming out, but Gaetano already recognized its potential to drive innovation in the ICTD space," Anokwa explained. "From my experience with OpenMRS, and some convincing from Gaetano, Carl, and Waylon, I could see that it was a good problem to solve."

ODK started out as a set of two complementary tools: ODK Collect, a tool for survey-based data gathering that can be used even without network connectivity; and ODK Aggregate, a cloud-like service for storing, managing, and publishing data. While OpenMRS had

offered a desktop solution to the "paper problem" in healthcare, ODK enabled people to create and act on digital records for a variety of purposes in the field — sometimes literally. In one of the first deployments of the new platform, Google and the Grameen Foundation used ODK to gather data on the availability of phone-based services in rural Uganda to develop an app offering agricultural advice to farmers.

In another early example, Anokwa and Hartung traveled to Kenya to work with one of the largest HIV treatment programs in sub-Saharan Africa, AMPATH. By furnishing its community outreach workers with phones running ODK, the group was able to improve in-home testing and counseling for over a million people in rural parts of the country. Anokwa subsequently worked with AMPATH to field-test a mobile phone-based clinical decision system called ODK Clinic, which formed the basis of his Ph.D. dissertation under the guidance of Borriello and Parikh, then a faculty member at the University of California, Berkeley. ODK Clinic drew upon Anokwa's experience working on OpenMRS and ODK, providing physicians with point-of-care access to patient summaries and reminders to improve the quality of care for patients living with HIV.

The more people used ODK, the more uses people seemed to find for it. Since its inception, ODK has helped members of the Surui tribe and the Brazilian Forest Service to monitor conditions in the Amazon rainforest, the Jane Goodall Institute to track conservation efforts in Tanzania, The Carter Center to observe elections in the Democratic Republic of Congo — even an astronaut on the International Space Station to track the progress of the Carbon for Water program. As the user community grew, so did the tools, including a drag-and-drop form designer known as ODK Build developed by undergraduate researcher Clint Tseng (B.S., '10) and a form management tool called ODK Briefcase. To date, the ODK website has seen traffic from nearly every country, and Anokwa estimates that millions of users have used ODK or its derivatives worldwide.

Some of this growth has been spurred by Nafundi, a consulting company Anokwa co-founded with Hartung in 2011 when the pair realized how many large organizations wanted to use ODK but needed help. Nafundi provides that help in the form of software development and technical support. After Hartung departed in 2016 to focus full-time on a new startup company, Anokwa's partner in life, software engineer and former Allen School lecturer Hélène Martin (B.S., '08), stepped in and became his partner in business, too. Together, the couple manage Nafundi's small and distributed team of developers from their home base in San Diego, California.

# Alumni Impact Awards (continued)

Anokwa and Martin share the technical work and community leadership, and over the last year they have been focused on adding much needed functionality to the most widely deployed ODK tools and implementing community-oriented processes project-wide. As Anokwa explains, "We use a combination of grants and client work to feed the open-source project. Our hope is that the investments we are making now will enable other organizations to step forward and help make the ODK pie bigger."

***"ODK is helping to improve the lives of people in underserved communities around the globe, and Yaw's commitment is an example for all of us."***

*- Hank Levy, Director and Wissner-Slivka Chair*

Following Borriello's passing in 2015, Allen School professor Richard Anderson had assumed management of ODK. Now, he and his team are working with Anokwa and others in the ODK community to morph it into a stand-alone entity, with the hope that independence will lead to even greater impact. Anokwa is particularly motivated to ensure the transition is successful because, in his view, ODK represents Borriello's legacy to the world.

"ODK has become the de facto data collection tool for global development, and the project's continued success is a responsibility that I take very seriously," noted Anokwa. "It's what the folks who depend on ODK deserve, and it's what Gaetano wanted."

"Yaw's work in creating and supporting Open Data Kit shows the power of computer science to change the world," said Hank Levy, Allen School Director and Wissner-Slivka Chair. "ODK is helping to improve the lives of people in underserved communities around the globe, and Yaw's commitment is an example for all of us."

When asked why he thought ODK took off in the way that it has, Anokwa cited a variety of factors. "Luck and timing both played a part," Anokwa admitted, "but also, it was free — free as in no cost, and free as in no restrictions. Anyone can take ODK and adapt it to their needs."

"I would like to believe that the care and attention we provided to our user community was also a factor, because I've spent a lot of time responding to emails and giving talks about ODK," he laughed. But ultimately, he points out, software has to work.

Perhaps there is no better example of why the software "has to work" than the fight to eradicate polio. "The vaccinators in Somalia are putting their lives on the line, going house to house in one of the most dangerous places in the world," noted Anokwa. "They may only get one chance to vaccinate a child, so the software has to be deployable by regular people and work the first time, every time."

It's the users, then, who are the real heroes of this tale, in Anokwa's view — them, and the people with whom he has collaborated over the past 10 years.

"I get an unfair share of the credit for all of this," Anokwa said. "ODK's success is made possible by a community of contributors who believe that together, the little data collection project I helped to start can help make the world a better place."

According to one of his former Ph.D. advisors, Tapan Parikh, Anokwa's emphasis on community has been at the heart of ODK and its impact — even if he did take some convincing at first.

"I remember that Yaw was initially apprehensive about taking on the ODK project for his dissertation. He was concerned that there was not enough research content in an area that had already been well-explored by others, including myself," Parikh said. "I tried my best to tell him that there was a lot more left to do, and that the potential for impact was huge."

"I'm so glad that Gaetano was eventually able to convince Yaw to take this project on," he continued. "It is no overestimation to say that ODK is one of the most influential ICTD systems projects to come out of the academic realm, and that a large part of the credit for building and sustaining the open-source community around ODK should go to Yaw."

Looking back on what he has gained from his Allen School education, Anokwa observed, "UW in general, and Gaetano in particular, gave me the space to try things, even if they seemed unreasonable. I gained the confidence to head in the direction of the unknown, and to persevere. Along the way, I learned that I'm never going to be the smartest person in the room — as anyone who remembers me from algorithms class can attest! — but with a little luck, everyone can make their mark. I don't know if I deserve this award, but my hope is that the attention it brings can inspire someone to start their journey in the same way that Gaetano, Tapan, and Neal inspired me to start mine so many years ago."



## Eileen Bjorkman (B.S., '79) earns her wings

Alumni Impact Award recipient Eileen Bjorkman didn't set out to study computer science. When she first arrived at the University of Washington in 1975, she was looking forward to earning her degree in aeronautical engineering.



It was a reasonable plan; after all, jet fuel practically runs through Bjorkman's veins. Her father, Arnold Ebnetter, was an aviation enthusiast from an early age who spent more than 20 years in the Air Force as a pilot and engineer. Her mother, Colleen, was an amateur pilot, having been bitten by the flying bug while earning her Girl Scout aviation merit

badge. Growing up in various locations in the south and midwest, Bjorkman was surrounded by airplane books, airplane magazines — even miscellaneous airplane parts — vying for space alongside the usual detritus of family life. There was also the family plane, a Beechcraft Bonanza affectionately known as "Charlie," with seating for six. Bjorkman and her three sisters all flew before they could walk.

"One of the problems with growing up in an aviation family is that you don't remember your first flight," observed Bjorkman. "My father took me up in the family plane when I was three weeks old. Until I was eight or nine, I just assumed every family was like ours and flew airplanes on weekends."

After Ebnetter retired from the Air Force in 1974, he accepted a job as an engineer at the Boeing plant in Renton, Washington. Shortly after the family completed the move to the Pacific Northwest, Bjorkman enrolled in UW. Her sophomore schedule included statics — an introductory engineering course — and the FORTRAN programming language. For reasons she can no longer remember, she disliked statics so much that she decided she wasn't cut out for aeronautical engineering after all. Having discovered that she liked programming, she opted to pursue computer science instead.

One day on the bus, Bjorkman struck up a conversation with the late Ira Kalet, a faculty member in UW's Department of Radiation Oncology and, later, adjunct professor of Computer Science. Kalet suggested that Bjorkman apply for a job as a student programmer at the Northwest Medical Physics Center, which at the time was part of UW's Regional Medical Program. She

took his advice and soon found herself developing program interfaces to aid doctors in devising radiation treatment plans for cancer patients. Bjorkman liked the fact that her code was being used to save lives. The pay wasn't bad, either.

"I earned four dollars an hour, which seemed like a lot in those days," Bjorkman recalled with a laugh. "And the equipment was cool, too. Not only did my machine have a whopping 64K of memory, but it had 64K of graphics memory. That was a big deal."

After graduating from UW in 1979, Bjorkman accepted a full-time position at the center, where she obsessed over ways to reduce the runtime of such complex programs.

"Some of those programs could take as long as 45 minutes," she noted. "I was always looking for ways to cut that down. When I was able to reduce it to 30 minutes, wow — that was an exciting day!"

Bjorkman still felt her work was worthwhile, but she couldn't picture herself programming for the rest of her life. Looking to expand her professional horizons, Bjorkman headed to the UW placement center. And it was from there that her career took off in a new — and yet, familiar — direction.

"I went to the placement center to meet with a recruiter from Boeing," Bjorkman explained. "While I was waiting, I started chatting with an Air Force recruiter who happened to be there. The next thing I know, I'm filling out stacks of paperwork, and the Air Force is offering me a place in its accelerated engineering program."

Bjorkman enrolled in the Air Force Institute of Technology thinking she would earn a second bachelor's in electrical engineering, but her superiors had other ideas. She was directed to the aeronautical engineering program — the subject she had intended to study back at UW, before succumbing to FORTRAN's charms. Bjorkman couldn't believe it at first, but then everything clicked into place.

"The two degrees meshed together better than I ever thought they would," recalled Bjorkman. "And right around that time, airplanes started to become computerized."

At that point, Bjorkman faced another career-defining decision. By the mid-80's, the Air Force had reversed an earlier policy prohibiting women from flying, but she couldn't meet the stringent vision requirements to be a pilot. However, she could be a flight test engineer, which would still put her in the cockpit — just in the back seat gathering data, rather than in front at the controls. So in 1985, Bjorkman became only the sixth woman ever to enroll in the Air Force's Test Pilot

# Photo highlights



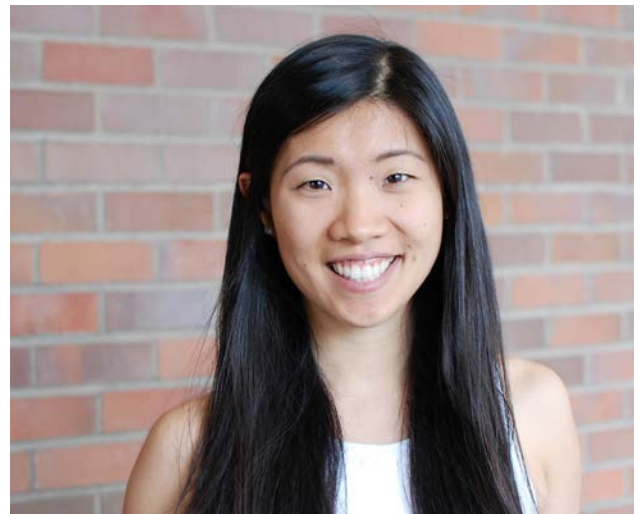
Graduating senior Pascale Wallace-Peterson (center) received the inaugural Lisa Simonyi Prize from Lisa (left) and Charles Simonyi at the Women in Computing Reception.



During the topping-out celebration, Melinda Gates posed with Allen School students she had met as part of her advocacy campaign to support more women in computing.



Team Sounding Board comprising faculty and students from the Allen School and Department of Electrical Engineering collected the inaugural Amazon Alexa Prize at AWS re:Invent 2017 in Las Vegas.



Kaitlyn Zhou, a senior in the Allen School and Department of Human Centered Design & Engineering, earned the Dean's Medal from the College of Engineering for academic excellence, leadership, and service.



The Allen School's undergraduate advisers earned the College of Engineering's inaugural "team award" in recognition of their extraordinary contributions to the Allen School community. Left to right: Pim Lustig, Crystal Eney, Lacey Schmidt, Raven Avery, Chloe Dolese, Maggie Ryan, Jenifer Hiigli.





The Allen School's annual ACM barbeque held in Sylvan Grove.



Some of the Allen School's biggest boosters signed their names to the beam in preparation for the topping out (left to right): Microsoft President Brad Smith, Melinda Gates, UW President Ana Mari Cauce, and Bill Gates.



The names of Allen School faculty and staff are memorialized on the steel beam, which was later welded into place atop the Gates Center.



Engineer and serial entrepreneur Rich Barton addressed the Allen School's first graduating class last June, advising the newly minted graduates, "You have brains. Take courage. Display heart."



Computer science major and Allen School peer adviser Christine Betts (left) accepted the Allen AI Outstanding Engineer Scholarship from Oren Etzioni (right), CEO of the Allen Institute for Artificial Intelligence.



Professor Ed Lazowska, the Bill & Melinda Gates Chair in Computer Science & Engineering, signed the beam before the topping out. Lazowska helped lead the campaign to raise funds for the new building.

## Alumni Impact Awards (continued)

School. By that point, she was used to being one of only a few women, if not the only woman, making her way in a male-dominated field.

"At UW, I got used to being the only woman in a lot of my engineering classes, and there were maybe three other women besides me studying computer science," said Bjorkman. "When I first graduated from Test Pilot School, I was the only female Test Pilot School graduate on base."

Bjorkman would go on to notch over 700 hours of flight time in more than 25 different aircraft as a flight test engineer, instructor, and test squadron commander. On the ground, she assumed a series of management and leadership roles focused on improving the safety and effectiveness of various Air Force systems. It was these mid-career positions, beginning in the early 1990s, that demonstrated just how useful her combination of degrees could be.

For her first assignment at the Pentagon, Bjorkman was put in charge of air-to-air combat modeling to evaluate how adjustments to a fighter jet's aerodynamics and systems would affect the outcome under various conditions. Bjorkman found herself once again using FORTRAN — this time, writing data scripts for a program simulating in-air dogfights — and managing a small network of computers. Her recommendations were used by the Air Force to help decide what to buy and modify for its fighter aircraft.

"I recognize the fingerprints of what I worked on 20, 25 years ago still being put into practice today," said Bjorkman. "It is gratifying to see that the simulations I ran back then are still contributing to a better Air Force."

Her next two assignments took her to Holloman Air Force Base in New Mexico, home of the Holloman High-Speed Test Track. The 10-mile, precision-aligned track enables the Air Force to field-test new systems before making them operational. As commander of the 846<sup>th</sup> test squadron, which operates the test track, she led the testing of high-speed missile delivery systems and new ejection seat designs — the latter intended to accommodate lower weight people, such as the women who were becoming more prevalent among the pilot ranks. The following year, she assumed command of the 746<sup>th</sup>, which was responsible for testing global positioning system (GPS) satellites and equipment.

At the time, GPS was on the cusp of making the leap from military to consumer applications. Looking back, Bjorkman finds this period of her career particularly satisfying in the knowledge that the systems she worked on wound up benefiting not just the Air Force, but the whole world.

Bjorkman retired from active duty as a colonel in 2010, at which point she began serving in a civilian capacity. Along the way, she earned two master's degrees from the armed forces — one in aeronautical engineering and the other in national resource strategy — followed by a Ph.D. in systems engineering from The George Washington University. She currently serves as the Air Force's Deputy Director of Programs, Deputy Chief of Staff for Strategic Plans, Programs and Requirements. In that role, she oversees the \$605 billion Future Years Defense Plan, the five-year budget plan for investing in technology, equipment, and personnel to maintain the Air Force's readiness and evolve its capabilities in line with new advances and emerging threats.

In her spare time, Bjorkman has clocked more than 2,000 hours of civilian flight time. Despite aviation's defining presence throughout her childhood, Bjorkman didn't learn to fly while she was growing up. This was partly because Charlie was too advanced for a novice pilot, but also, she admitted, "I wasn't that interested in flying until I joined the Air Force. Then I figured I better learn."

One activity that Bjorkman has consistently remained passionate about since childhood is writing. Her first published work came at the tender age of nine when, she said with lingering disbelief, "I wrote a stupid story and sent it into a kids' magazine — and they published it!" Her first paid writing assignment — outside of technical reports and military briefings — was a short piece that appeared in *Air & Space Magazine* titled "Maybe I Will Pass on That Coffee." The article relays a harrowing, yet humorous, firsthand account of being stuck in the back of an F-16 with a full tank of fuel and a full bladder, thousands of feet above the nearest bathroom. Since then, she has written numerous articles for *Air & Space*, *Aviation History*, the *Daily Herald* of Everett, and others.

Last March, Bjorkman published her first book, *The Propeller under the Bed: A Personal History of Homebuilt Aircraft*, after taking a non-fiction writing course

***"We always emphasize to students that a degree in computer science will prepare them for the broadest imaginable range of careers — Eileen exemplifies this."***

- Ed Lazowska, Bill & Melinda Gates Chair



through UW Continuing Education. The idea for the title originated with Bjorkman's mother, inspired by the wooden propeller that her husband had stashed under their bed when he dreamed of building his own plane. The book was a labor of love for Bjorkman, and while it took fewer than five years to complete, it was a lifetime in the making.

*Propeller* follows her father's journey as an aviation enthusiast and engineer who, at the age of 82, set a new world record for the longest nonstop flight, measured as a straight-line distance, in a lightweight C-1a1 class aircraft. On July 25, 2010, Ebnetter took off from Paine Field in Everett, Washington in his "E-1," an all-metal airplane that he designed and built himself. Around 2,328 miles and a little over 18 hours later, he touched down at Shannon Airport in Fredericksburg, Virginia. Ebnetter had beaten the old record by nearly 114 miles — overcoming a faulty fuel gauge and an uncooperative headwind along the way. As the story unfolds, Bjorkman weaves in a history of homebuilt aircraft and the people who dared to reach for the sky on their own terms. As it turned out, recounting the story of her father's dream was the perfect opportunity to fulfill one of her own.

"Writing a book has been a lifelong dream for me, but I never expected that it would turn into a project about my family and the dreams of thousands of other amateur aircraft homebuilders throughout the world," Bjorkman wrote on her blog at the time. "During my research, I gained a much better understanding of not only the history of aviation in the United States but also learned much about my own parents and other relatives. I feel very fortunate to have had this opportunity to document all of this for future generations to enjoy."

And what of that computer science degree Bjorkman earned nearly four decades ago — how did her time at UW influence and inspire the high-flyer she would later become?

"I've always thought of myself as an engineer, rather than a computer scientist, but there's no doubt that my CS degree gave me the building blocks for success. Time and again, I found I could do things with computers that my colleagues could not — or at least, took my colleagues longer to learn," Bjorkman explained. "Even today, that fundamental knowledge is still valid. But more important than the mechanics of learning to code, my degree gave me confidence to rise to the occasion when challenged and to accomplish things that I didn't think I was capable of doing."

"We always emphasize to students that a degree in computer science will prepare them for the broadest imaginable range of careers — Eileen exemplifies this," said Allen School professor Ed Lazowska, Bill & Melinda

Gates Chair in Computer Science & Engineering. "She proved that with a CS degree, the sky's the limit — literally and figuratively! She was also a trailblazer for women in the service of her country. We're incredibly proud of all that Eileen has accomplished, and we're delighted to be able to recognize her with our 2018 Alumni Impact Award."

Asked what advice she would offer students today, Bjorkman harkened back to the words of her examiner when she earned her private pilot's license.

"He impressed upon me that earning my license was not the end of my education as a pilot, but the beginning — that it is actually a license to learn," she recounted. "Whatever you get your degree in, view that as your license to learn."

"And to students of computer science: don't think of yourself as just a 'computer scientist,'" she urged. "Think of yourself as a person with a computer science degree, which opens up all kinds of possibilities for you to go out and do great things."

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## Allen School Bay Area meetup: Join us at the Computer History Museum!

This year's Allen School Bay Area alumni meetup will be hosted at the **Computer History Museum** in Mountain View.

Please plan to join us on **Thursday, July 12<sup>th</sup>, from 6:30-8:30 p.m.**

Eat! ... drink! ... connect with faculty, alumni, and friends!

For more information, please contact Kay Beck-Benton at [kbeck@cs.washington.edu](mailto:kbeck@cs.washington.edu).

RSVP is requested: [tinyurl.com/UWCSECHM2018](https://tinyurl.com/UWCSECHM2018)



# New faculty arrivals build the Allen School's leadership in HCI, machine learning, and CS education and outreach

As part of its ongoing expansion, the Allen School has continued to build its expertise in core and emerging areas of the field through a series of strategic faculty hires. This past year, the school added to its strength in human-computer interaction with two exciting new hires — Jennifer Mankoff from Carnegie Mellon University and Jon Froehlich from the University of Maryland — and continued to build its renowned machine learning group with the arrival of Kevin Jamieson from Berkeley. Last but not least, the Allen School welcomed faculty lecturer Lauren Bricker, an experienced educator and enthusiastic evangelist for computer science at the undergraduate and K-12 levels.

## Jennifer Mankoff, HCI



Jennifer Mankoff joined the UW faculty as the Richard E. Ladner Endowed Professor in Computer Science & Engineering — named in honor of Allen School professor emeritus and leading accessibility researcher Richard Ladner — from CMU's Human Computer Interaction Institute. Earlier in her career, Mankoff was a

member of the Electrical Engineering and Computer Sciences faculty at University of California, Berkeley. With Mankoff's arrival, the Allen School adds an exciting new dimension to its accessibility research that will complement the existing efforts of its HCI research group and the Taskar Center for Accessible Technology.

Mankoff leads the Make4All Lab, where she and her collaborators combine empirical methods and technical innovation to solve problems in accessibility, health, and sustainability. Most recently, her work has focused on 3D printing and its potential for creating personalized assistive technologies for people with disabilities. Mankoff and her colleagues have demonstrated how a 3D printed physical interface can augment a screen reader to improve interaction speed by a third. This do-it-yourself theme is carried over into her work with e-NABLE, a collaborative effort to engage volunteers and clinicians in the design and fabrication of upper-limb assistive technologies. Mankoff's assistive technology work extends beyond fabrication with projects exploring navigation aids for the blind and mobile sound capture and transcription tools for the deaf.

As tends to be the case with accessibility research, the results of Mankoff's people-centric approach to technology and novel use of 3D printing are likely to benefit everyone. Mankoff has studied and developed solutions for addressing uncertainty in measurement during 3D printing, prototyping of custom assistive technologies, and attaching adaptations to everyday objects through projects such as Encore and Reprise. Another line of work aims to explore more natural materials, including embedding textiles in 3D printing, creating knitted objects programmatically, and printing using layers of fabric. Mankoff's work has also extended to chronic illness through projects that investigate the impact of chronic disease on quality of life, predictors of trust in peer versus professionally produced health content, visualization techniques for infant oxygen monitoring, and the design of mobile and web tools for managing chronic illness and physical therapy.

## Jon Froehlich, HCI

Alumnus Jon Froehlich, who earned his Ph.D. from the Allen School in 2011 working with professors James Landay and Shwetak Patel, returned to his alma mater after spending five years on the Computer Science faculty at University of Maryland, College Park. As director of the Makeability Lab,



Froehlich focuses on the design of interactive tools and techniques that span the virtual and the physical to address challenges in accessibility, education, and environmental sustainability. He aims to invent or reappropriate methods for sensing physical or behavioral phenomena, leveraging techniques in computer vision and machine learning to interpret and characterize the data. He then builds software and hardware tools that are uniquely enabled by this approach for people of different ages and abilities.

One of Froehlich's recent projects is MakerWear, a modular toolkit that enables children without prior programming knowledge to create their own interactive wearables using tangible plug-and-play modules. The toolkit enables children aged five years and above to create their own diverse, personally meaningful designs while developing computational thinking. Another project, BodyVis, explores how wearable sensing technology can help children to develop scientific inquiry



skills while learning about anatomy and physiology. For that project, Froehlich and his team created a custom e-textile shirt that senses the wearer's physiology in real-time and then visualizes the information via responsive anatomical models.

Froehlich is also interested in developing assistive technologies that support independent living. For example, as part of the HandSight project, he and his colleagues repurposed tiny, endoscopic cameras to augment a blind person's hand with computer vision. The technology enables users to sense non-tactile information about the world — such as color, texture, and printed text — to support the activities of daily living and increase their independence. Froehlich also initiated Project Sidewalk to collect street-level accessibility information and develop new location-based tools to assist people with disabilities in navigating their communities.

Mankoff and Froehlich joined the Allen School faculty as part of a larger set of hires that builds upon UW's leadership in HCI. The group of new arrivals included Anind Dey, the new dean of the Information School and former director of CMU's Human Computer Interaction Institute; Human Centered Design & Engineering professor Leah Findlater, previously a faculty member at the University of Maryland's College of Information Studies and Institute for Advanced Computer Studies; and Alexis Hiniker, who joined the Information School faculty after earning her Ph.D. in Human Centered Design & Engineering at UW. The cross-campus collaboration in HCI — known as "DUB" for "design/use/build" — has positioned UW as a national leader in the field.

## Kevin Jamieson, Machine Learning



Kevin Jamieson's arrival at UW also represents a homecoming of sorts; he earned his bachelor's degree in electrical engineering on the Seattle campus before pursuing graduate studies at Columbia University and University of Wisconsin, Madison. He joined the Allen School faculty as the first Guestrin Endowed

Professor in Artificial Intelligence & Machine Learning — named for professor and Turi founder Carlos Guestrin following the company's acquisition by Apple — after completing a postdoc at University of California, Berkeley.

Jamieson's research focuses on adaptive data collection algorithms for machine learning, exploring how to leverage already-collected data to inform what future measurements to make next in a closed loop. He has

demonstrated in both theory and practice that adaptive data collection — or active learning — can extract richer insights than any measurement plan fixed in advance and using the same statistical budget. This is particularly valuable for machine learning applications when training data is time-consuming or expensive to collect, as is the case when labeled examples are provided by humans. Jamieson's work has been adopted in a range of applications, from choosing hyperparameters for deep neural networks, to measuring human perception in psychological studies, to recommending what beer to try next.

Jamieson also led the development of NEXT, an open-source software system that facilitates the development, testing, and deployment of active learning for online, real-time applications. *The New Yorker* magazine employs the NEXT platform to crowd-source its cartoon caption contest, in which readers view captions submitted by other readers one at a time online and rate how funny they are — or not, as the case may be. It's a contest for the algorithms as well as the readers: behind the scenes, a suite of different active-learning algorithms compete against each other to identify the captions that are consistently rated as funny, and to stop showing those that are unfunny. The exercise provides Jamieson and his collaborators valuable information about which algorithms work best in practice, and which can be discarded.

## Lauren Bricker, Computer Science Education

Lauren Bricker (Ph.D., '98) also returned to her roots by joining the Allen School faculty nearly two decades after she earned her degree working with professor Steve Tanimoto on computer-supported collaboration. Prior to her latest arrival at UW, Bricker built a career as a software engineer, program manager, researcher, and educator.

As a faculty lecturer at the Allen School, Bricker develops and teaches a number of undergraduate courses and workshops, including an updated web programming course and a new pre-CSE course. The latter is part of the College of Engineering's STARS program, which helps aspiring computer science or engineering majors

from underserved communities to succeed in college-level coursework. Bricker also leads various efforts to engage more K-12 students and teachers in computer science. She works with staff and undergraduate ambassadors as part of the DawgBytes K-12 outreach



*Continued on page 20*

# Allen School faculty and alumni recognized for their contributions to computing

## Siddhartha Srinivasa and Tao Xie named Fellows of the IEEE

Allen School professor Siddhartha "Sidd" Srinivasa, an expert in robotic manipulation and human-robot interaction, and alumnus Tao Xie, a faculty member at University of Illinois at Urbana-Champaign who specializes in software testing and analytics, were named Fellows of the Institute of Electrical and Electronics Engineers (IEEE), the world's largest technical professional organization focused on advancing technology in service to humanity. Srinivasa was selected for his "contributions to robotic manipulation and human-robot interaction," and Xie was recognized based on "contributions to software testing and analytics."

Just one-tenth of one percent of the total voting membership in IEEE can be elevated to Fellow status in a given year. A total of 15 Allen School faculty members have earned the distinction.

"I am grateful for the honor," said Srinivasa about his elevation to Fellow. "It truly belongs to the fantastic students, staff, and colleagues that I have had the pleasure of working with every day, and to my family for supporting and inspiring me."



Srinivasa arrived at the Allen School last fall as the Boeing Endowed Professor from the faculty of Carnegie Mellon University, where he was a member of the Robotics Institute and founding director of the Personal Robotics Lab. He has made pioneering contributions to two fundamental areas of robotics, robotic

manipulation and human-robot interaction (HRI), with the aim of enabling robots to perform complex tasks with and around people. A full-stack roboticist, Srinivasa has built several end-to-end systems — including HERB, ADA, HRP3, CHIMP, Andy, and more — that integrate perception, planning, and control in the real world.

Srinivasa's groundbreaking work in manipulation has enabled robots to push, pull, and sweep objects under conditions of clutter and uncertainty through non-prehensile, physics-based interactions. He is also credited with having created the field of algorithmic HRI through his efforts to build the formal mathematical foundations of human-robot interaction. While these innovations could transform human-robot cooperation

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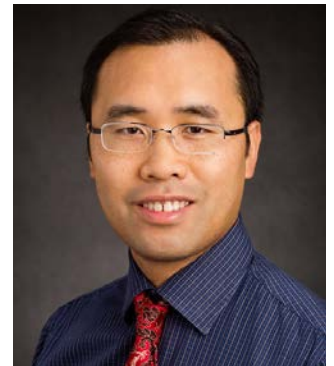
on the factory floor, Srinivasa is most inspired by their potential closer to home.

"I care deeply about building robots that can actually help people in need of care, performing the delicate, dexterous, and mundane activities of daily living with the same fluency and seamlessness as we humans perform so effortlessly each day," he explained. "I want to get robots out of the factories and into people's homes!"

To that end, Srinivasa and his team built HERB, the Home Exploring Robot Butler, to serve as a realistic testbed for new algorithms enabling human-robot collaboration. In addition to his role in the lab, HERB has become an ambassador of sorts for Srinivasa and his team — and for the field of robotics, generally. "Sidd's robots are more famous than he is," observed Allen School Director Hank Levy. That's just fine, as far as Srinivasa is concerned.

"I still cannot believe that I get paid to build robots — something I would do for free any day!" he said.

Joining Srinivasa in the most recent class of Fellows was Allen School alumnus Tao Xie, who earned his Ph.D. in 2005 working with the late professor David Notkin. Xie is currently a professor and Willet Faculty Scholar in the Department of Computer Science at University of Illinois at Urbana-Champaign, where he heads the Automated Software Engineering Lab. His research interests span software testing and analytics, program analysis, software security, and educational software engineering.



Xie earned the Distinguished Paper Award from ACM SIGSOFT and Best Paper Award from the IEEE/ACM International Conference on Automated Software Engineering in 2009 for "Inferring Resource Specifications from Natural Language API Documentation." In that paper, Xie and his co-authors presented Doc2Spec, a novel approach for inferring resource specifications from application programming interface (API) documentation to detect software bugs.

As a visiting researcher at Microsoft Research — a frequent collaborator throughout his early career — Xie contributed a core search algorithm for the IntelliTest automated test generation feature that shipped as part of Visual Studio



2015 Enterprise Edition. Xie has also engaged in multiple joint projects with MSR's Software Analytics group in China, which has produced more than 60 high-profile publications in automated test generation, software analytics, and computer science education.

"I would like to express my great appreciation to the late David Notkin and to UW CSE for their support during my Ph.D. there from 2000 to 2005, and in my faculty career afterward," said Xie.

The IEEE has more than 420,000 members in 160 countries. The IEEE Board of Directors confers the grade of Fellow upon individuals who have amassed an outstanding record of technical accomplishments that have advanced engineering, science, and technology while delivering significant value to society.

### **Steve Seitz, Gail Murphy, and Geoff Voelker named Fellows of the ACM**

Allen School professor Steve Seitz and Ph.D. alumni Gail Murphy and Geoffrey Voelker were named Fellows of the Association for Computing Machinery (ACM). They were among just 54 computer science educators, researchers and practitioners honored in the latest class of Fellows based on their outstanding technical accomplishments and service.



Steve Seitz was recognized by the ACM for his "contributions to computer vision and computer graphics." As a member of the Allen School's Graphics & Imaging Laboratory (GRAIL), Seitz has made a number of important technical contributions to advance the state of the art in computer graphics and vision and enable new

capabilities in augmented and virtual reality. These include DynamicFusion, the first dense simultaneous localization and mapping (SLAM) system capable of real-time reconstruction of dynamic scenes that feature subjects in motion. The project represented a major leap forward in both SLAM and 3-D reconstruction, earning Seitz and his collaborators — former Allen School postdoc Richard Newcombe and professor Dieter Fox — the Best Paper Award at the 2015 International Conference on Computer Vision and Pattern Recognition (CVPR).

Seitz worked with Allen School Ph.D. alumnus Ricardo Martin Brualla and Google's David Gallup to pioneer a new method for creating videos from photos. Using a process called time-lapse mining, the team was able to compensate for variations in camera angle and lighting to create videos depicting changes to important ecological and historical sites over time. In addition, Seitz

has contributed to a line of research spearheaded by Ph.D. alumnus Supasorn Suwajanakorn and professor Ira Kemelmacher-Shlizerman aimed at developing new tools for creating realistic digital personas, including total moving face reconstruction, creation of 3-D digital personas, and photorealistic audio-to-video conversion.

"I'm really excited about the field of virtual and augmented reality and putting a lot of my energy into this area," Seitz said. "I mean, how often do you get a chance to help define the next computing platform?"

Seitz is particularly excited about inspiring students to explore AR/VR. He and Kemelmacher-Shlizerman developed the curriculum for the Allen School's Virtual and Augmented Reality Capstone to give students a chance to experiment with the latest technology and software. The two also co-founded the UW Reality Lab along with their GRAIL colleague, Brian Curless, to advance AR/VR research and education.

Seitz splits his time between the Allen School and Google Seattle, where he leads a 3-D vision team responsible for developing the Google Jump professional VR video system and Cardboard Camera, which turns an Android smartphone into a virtual reality device to bring VR to the masses. His enthusiasm for using virtual reality as a means of transporting people somewhere they are not earned him the title "teleportation director."

In a way, his recent recognition from the ACM has transported Seitz back in time; the news of his selection has enabled him to reconnect with people who have been important throughout his career. "The best part is getting these warm emails from so many friends and colleagues that I've worked with over the years," he said.

Seitz is the 21<sup>st</sup> Allen School faculty member to be named a Fellow of the ACM. He was joined in the most recent class of Fellows by Allen School alumni Gail Murphy (Ph.D., '96) and Geoffrey Voelker (Ph.D., '00).

Murphy is a professor in the Department of Computer Science and Vice President for Research & Innovation at the University of British Columbia. She was recognized by the ACM for "contributions to recommenders for software engineering and to program comprehension."



Murphy has devoted her research career to helping software developers and other knowledge workers to work smarter and better, inspired by her own experience

*Continued on page 20*

## Recognition (continued)

as a software developer before she came to the University of Washington to earn her Ph.D. working with the late David Notkin. To that end, she and her team at UBC study how software is developed and design and evaluate tools for developers to manage large, complex software systems. Murphy's approach has been described as one that puts people first and tools second. It is an ethos she put into practice at Tasktop Technologies, a company she co-founded a decade ago with Ph.D. student Mik Kersten and researcher Rob Elves. Together, they set out to streamline software development and delivery at the enterprise level through a suite of integrated tools for enhancing communication and collaboration.

"A big challenge today is connecting the people involved in large software developments," Murphy explained when she was recognized with the Allen School's Alumni Achievement Award in 2014. "When people are not connected, software development lags and problems get introduced into the software."

Voelker completed his Ph.D. working with professors Anna Karlin and Hank Levy before joining the faculty of the University of California, San Diego, where he is a member of the Systems & Networking and Security & Cryptography research groups. He was selected as an ACM Fellow based on his "contributions to empirical measurement and analysis in systems, networking and security."

For one of his early contributions, Voelker collaborated with another Allen School alumnus, Stefan Savage, and Ph.D. student David Moore on a study of denial-of-service attacks — the process by which attackers overload

servers connected to the internet with messages. The team's work, which represented the first time anyone had publicly measured the extent of DoS activity on the internet, earned the Best Paper Award at the 2001 USENIX Security Symposium. The enduring relevance of Voelker's and his colleagues' research to the field of network security was recognized with the USENIX Test of Time Award last year.



Since that pioneering research, Voelker has made contributions in a variety of areas, including cellular networks, machine virtualization, cloud storage, and cybercrime. Roughly a decade after the landmark DoS study, Voelker worked with Savage and a group of colleagues at UCSD, University of California, Berkeley, the International Computer Science Institute, and the Budapest University of Technology and Economics on an ambitious project to map the spam value chain. Voelker and his colleagues discovered that 95 percent of spam-advertised pharmaceutical and software purchases are funneled through just a handful of banks and credit card processors — a bottleneck that could be used by financial institutions and regulators to shut spammers down.

With more than 100,000 members worldwide, the ACM is the world's largest computing society devoted to advancing computing's technical, educational, and social impact. Fellows are selected by their peers and represent the top one percent of ACM's overall membership.

## Faculty arrivals (continued)

program to build connections with area schools and community groups, promote student participation in programming contests, and support professional development for teachers. As the liaison responsible for the introductory programming component of the UW in the High School initiative, Bricker approves new courses, trains new and existing instructors, and monitors course quality. She also serves on the Allen School's diversity committee, a coalition of faculty, staff, and students focused on cultivating and maintaining a welcoming and inclusive background for people of all backgrounds.

Bricker has a variety of research and teaching interests, including human computer interaction, educational technology, computer-supported cooperative work and collaborative learning, rapid prototyping and 3D

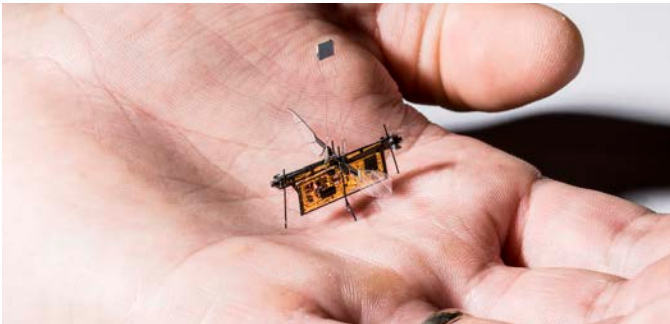
modeling and printing, and graphics and animation. Before joining the Allen School faculty, Bricker spent 10 years on the faculty of Lakeside School, where she taught in both the middle and high school and built the program from one honors-level computer science course to a sequence that included advanced programming and projects courses as well as a 3D modeling and printing course. Outside of the classroom, Bricker has contributed to Code.org's Computer Science Discoveries curriculum and co-led workshops for elementary, middle, and high school teachers.

This outstanding group joins an impressive list of recent faculty hires who have enhanced the Allen School's research and teaching over the past couple of years, including robotics manipulation expert Siddhartha "Sidd" Srinivasa; pioneering chip designer Michael Taylor; and Yin Tat Lee, a rising star in theoretical computer science.



# Research roundup: World's first wireless robotic insect, merging machine learning and medicine, #MemoriesInDNA, and more

## RoboFly takes off



A team led by Allen School professor Shyam Gollakota and Mechanical Engineering professor Sawyer Fuller have achieved liftoff of the world's first wireless insect-sized drone, RoboFly. The researchers took their inspiration from nature in designing the diminutive robot, which takes flight with the aid of dual flapping wings driven by a pair of piezoelectric actuators and powered by an onboard system that converts light from a laser beam into electricity. As the lightest-ever wireless robotic insect, RoboFly represents a milestone in autonomous flight that could launch a new wave of innovation in aerial robotics.

*Johannes James, Vikram Iyer, Yogesh Chukewad, Shyamnath Gollakota, Sawyer B. Fuller*

## TVM bridges deep learning and hardware innovation

Deep learning has become indispensable for a broad range of applications, but adoption has been hindered by the engineering effort and expense required to adapt existing, specialized systems for multiple platforms. A group of Allen School researchers developed the TVM framework to bridge the gap between deep learning systems that are optimized for productivity and the various programming, performance and efficiency constraints enforced by different types of hardware. TVM enables the rapid deployment of deep learning applications on a wide range of systems — mobile phones, embedded devices, and low-power specialized chips — without sacrificing battery power or speed. The team also released the NNVM compiler, a tool that simplifies the design of new front-end frameworks and back-end hardware that is built upon the TVM stack.

*Tianqi Chen, Thierry Moreau, Haichen Shen, Luis Ceze, Carlos Guestrin, Arvind Krishnamurthy, Ziheng Jiang*

## Crowdsourcing images with #MemoriesInDNA

What do you want to remember forever? That's the question researchers in the Molecular Information

Systems Laboratory, co-led by Allen School professor Luis Ceze and Microsoft Senior Researcher Karin Strauss, hope will inspire people around the world to submit original photos to the #MemoriesInDNA Project. Through a partnership between UW, Microsoft, and Twist Bioscience, researchers aim to crowdsource 10,000 images to be used in the development of new DNA-based data storage and processing capabilities. The team recently published a paper in *Nature Biotechnology* describing its system for large-scale random access and the science behind its record-setting achievement in storing digital data in synthetic DNA.

*Lee Organick, Siena Dumas Ang, Yuan-Jyue Chen, Randolph Lopez, Sergey Yekhanin, Konstantin Makarychev, Miklos Z. Racz, Govinda Kamath, Parikshit Gopalan, Bichlien Nguyen, Christopher N. Takahashi, Sharon Newman, Hsing-Yeh Parker, Cyrus Rashtchian, Kendall Stewart, Gagan Gupta, Robert Carlson, John Mulligan, Douglas Carmean, Georg Seelig, Luis Ceze, Karin Strauss*

## Machine learning and medicine MERGE

Allen School and Genome Sciences professor Su-In Lee and Ph.D. student Safiye Celik are co-lead authors of a paper that appeared in *Nature Communications* presenting MERGE, a machine learning algorithm that prioritizes genes based on how they drive disease progression and drug response in patients with acute myeloid leukemia. MERGE — short for Mutation, Expression hubs, known Regulators, Genomic CNV, and methylation — uses a combination of patient and drug sensitivity datasets to identify reliable biomarkers for drug response. Lee and Celik worked with researchers in UW Medicine to evaluate MERGE, which will enable physicians to deliver targeted treatment to cancer patients based on their individual molecular profiles. The team's approach that could improve outcomes for patients with other diseases in an era of precision medicine.

*Su-In Lee, Safiye Celik, Benjamin A. Logsdon, Scott M. Lundberg, Javad Hosseini, Timothy J. Martins, Vivian G. Oehler, Elihu H. Estey, Chris P. Miller, Sylvia Chien, Jin Dai, Akanksha Saxena, C. Anthony Blau, Pamela S. Becker*



# Datagrams

## Students

**Joseph Redmon**, a Ph.D. student working with professor Ali Farhadi on computer vision research, was named a 2018 Google Ph.D. Fellow. He was recognized for his efforts to develop faster, better, and more useful computer vision tools for real-world applications.

Ph.D. students **Deepali Aneja** and **Eric Whitmire** were named 2018 Adobe Research Fellows. Aneja works with professor Linda Shapiro in the Graphics and Imaging Laboratory and Creative Director Barbara Mones in the Animation Research Labs, where her research focuses on computer vision, the intersection of vision and machine learning, and computer graphics and animation. Whitmire works with professor Shwetak Patel in the UbiComp Lab, where his research focuses on the intersection of hardware and software to enable new capabilities in wearable sensors, interaction, and mixed-reality systems.

Four Allen School students were recognized as part of the National Science Foundation's Graduate Research Fellowship Program. Winners included Ph.D. students **Terra Blevins**, who works with professor Luke Zettlemoyer in the Natural Language Processing group; **Matthew Johnson**, who works in the Information and Communication Technology for Development Lab with professor Kurtis Heimerl; and **Eunice Jun**, who works in human computer interaction with professor Katharina Reinecke. **Max Willsey** earned honorable mention for his application of programming language techniques to problems in computer architecture and synthetic biology.

**Kimberly Ruth**, **Preston Jiang**, and **Deric Pang** were recognized as part of the Computing Research Association's 2018 Outstanding Undergraduate Researcher Awards. Ruth, a junior double-majoring in computer engineering and mathematics, was named a finalist for her work on security of augmented reality platforms with professors Tadayoshi Kohno and Franziska Roesner in the Security and Privacy Research Lab. Jiang, a senior who works with professor Rajesh Rao, earned an honorable mention for his work on brain-computer and brain-to-brain interfaces. Pang, who is enrolled in the combined bachelor's/master's program, earned an honorable mention for his contributions to projects on fault localization, programming by natural language, and software testing working with professors Michael Ernst and Luke Zettlemoyer.

Ph.D. students **James Bornholt** and **Eunsol Choi** won 2018 Facebook Fellowships. Bornholt works with professors Emina Torlak, Dan Grossman, and Luis Ceze in the Programming Languages & Software Engineering research group, where his research focuses primarily on

programming languages and formal methods, with an emphasis on the development of automated program synthesis and verification tools. Choi works with professors Luke Zettlemoyer and Yejin Choi in the the Natural Language Processing group, where her research interests broadly span natural language processing, computational social science, and machine learning.

Three Allen School juniors were recognized as part of the 2018 Goldwater Scholarship competition. Winners included **Nelson Liu**, who is majoring in computer science, statistics, and linguistics and works with professor Noah Smith of the Natural Language Processing group; and **Kimberly Ruth**, who is pursuing a double major in computer engineering and mathematics and works with professors Tadayoshi Kohno and Franziska Roesner in the Security and Privacy Research Lab. **Andrew Luo**, who earned an honorable mention, is a double major in computer science and bioengineering and has worked in the UbiComp Lab with professor Shwetak Patel.

Undergraduates **Amanda Chalfant**, **Aishwarya Mandyam**, **Melissa Medsker (Galloway)**, and **Kimberly Ruth** were selected as members of the 2018 class of the Husky 100. Chalfant, who will graduate with interdisciplinary honors in June, is a senior majoring in computer science and has served as a teaching assistant and, more recently, as a peer adviser. Mandyam is a junior majoring in computer science and philosophy who has exemplified UW and Allen School values through her strong leadership and commitment to diversity, serving as an officer of the UW chapter of the ACM and student ambassador to the Allen School's Diversity & Inclusion Committee. Medsker (Galloway), a senior majoring in computer science and human centered design and engineering who will enter the Allen School's fifth-year master's program in the fall, has contributed to improvements in teaching and learning outside of the classroom. Ruth is a junior majoring in computer engineering and mathematics and works with professors Tadayoshi Kohno and Franziska Roesner in the Security and Privacy Research Lab, where she focuses on privacy and security issues associated with augmented reality and has taken the lead on a new project focused on security and privacy of multi-user AR platforms.

## Faculty

Five Allen School faculty members earned Google Faculty Research Awards. **Magdalena Balazinska**, a member of the Database Group and director of the UW's eScience Institute, earned an award to support the development of a new system for managing virtual, augmented, and mixed reality data at scale. **Shyam Gollakota**, who leads the Networks & Mobile Systems Lab, received an award to focus on the development of new capabilities in computer networking, user interfaces, mobile health, and ubiquitous computing. **Hannaneh Hajishirzi**,



who will join the Allen School this summer, received an award to address the problem of open-domain question answering using maximum similarity search. **Michael Taylor**, who holds a joint appointment in the Allen School and Department of Electrical Engineering, earned an award to support his work with the Bespoke Silicon Group. **Xi Wang**, a member of the Computer Systems Lab and Programming Languages & Software Engineering group, earned an award to support his work on the development of provably secure operating systems using formal verification techniques.

Professor emeritus **Richard Ladner** was recognized with the Strache Leadership Award from the Center on Disabilities at California State University, Northridge, for his significant and lasting impact on assistive technology through education and research.

Professor **Maya Cakmak**, director of the Human-Centered Robotics Lab, earned a 2018 Sloan Research Fellowship from the Alfred P. Sloan Foundation. Cakmak's research focuses on the development of general-purpose robots that can be programmed by their end-users, including people living with motor impairments, older adults who wish to age in place, and others who may require assistance in order to maintain their independence.

Professor **Michael Ernst**, a member of the Programming Languages & Software Engineering group, earned the 2018 CRA-E Undergraduate Research Faculty Mentoring Award from the Computing Research Association. He was recognized for his combination of research accomplishments and caring demeanor, as well as his record of mentorship across multiple institutions, projects, and publications. Ernst has mentored 123 undergraduate students over the course of his research career, co-authoring more than 50 publications with them along the way.

Professor **Kurtis Heimerl** (B.S., '07) was recognized with a 2018 Diamond Award for Early Career Achievement from the UW's College of Engineering. Heimerl is a member of the Information & Communication Technology for Development Lab, which focuses on improving the lives of underserved populations in low-income communities through technology. He is particularly interested in harnessing the potential for technology to alleviate poverty by bringing mobile internet access to people in some of the most remote regions on earth.



Allen School professor **Jeffrey Heer**, who leads the UW Interactive Data Lab, earned the 2017 IEEE Visualization Technical Achievement Award from the Institute of Electrical & Electronics Engineers for his contributions to the "design, development, dissemination and popularization of languages for visualization."

Professor **James Lee** of the Theory of Computation group was named a Simons Investigator by the Simons Foundation's Division of Mathematical and Physical Sciences in recognition of his leadership in exploring the mathematical phenomena that underlie optimization problems and related computational processes and his effective mentorship of junior scientists.

Two Allen School faculty received CAREER Awards from the National Science Foundation. Professor **Yin Tat Lee** of the Theory of Computation research group received an award to develop faster, more efficient algorithms for solving convex and other optimization problems. Professor **Zachary Tatlock**, a member of the Programming Languages & Software Engineering group, earned an award to advance the development of a practical verification framework and other methods for improving the reliability of distributed software systems that form the backbone of modern computing applications.

**Laura Pina**, a postdoctoral research associate who works with professor James Fogarty and HCDE professor and Allen School adjunct faculty member Julie Kientz, was recognized with the 2018 Postdoc Mentoring Award from the UW Graduate School. She earned recognition for her technical leadership, as well as her patience and compassion in mentoring aspiring researchers.

## Alumni

**Cynthia Matuszek** (Ph.D., '14), a professor in the Interactive Robotics and Language Lab at the University of Maryland, Baltimore County, was named one of "AI's 10 to Watch," a list of rising stars in artificial intelligence published by *IEEE Intelligent Systems*, for her work at the intersection of robotics, natural language processing, and machine learning.

**Gail Murphy** (Ph.D., '96), professor of computer science and Vice President Research & Innovation at the University of British Columbia, was recognized by the IEEE Computer Society with its Harlan D. Mills Award, which honors individuals for significant contributions to software engineering research and practice through the development and application of sound theory. Murphy earned the 2018 award for "outstanding research on understanding software-development practices and tools that improve the productivity of developers."

# MOST SIGNIFICANT BITS

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Paul G. Allen School of Computer Science & Engineering  
University of Washington  
Box 352350  
Seattle, WA 98195-2350

ADDRESS SERVICE REQUESTED

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## Stefan Savage wins MacArthur "Genius" Award

Alumnus Stefan Savage (Ph.D., '02), a CSE faculty member at the University of California, San Diego, was named a 2017 MacArthur Foundation Fellow. The program — commonly known as the MacArthur "Genius" Awards — recognizes exceptionally creative individuals whose accomplishments indicate the potential to make significant advances through future work. Savage was recognized for his groundbreaking research focused on "identifying and addressing the technological, economic, and social vulnerabilities underlying internet security challenges and cybercrime."

Savage's work combines computer science with social science, going beyond the technical details of a cyberattack to focus on the ecosystem that motivates the attackers. For example, rather than seeking to develop a technical solution to keep email spam out of people's inboxes, Savage targeted the economic motivation of the senders. He and his team worked with financial institutions and regulators to set up a system to track the flow of money to spammers' accounts. The banks were then able to shut the accounts down. Savage employed a similar approach for online drug trafficking, tracing the credit card transactions from buyers to the banks that were processing the charges.

After hitting cybercriminals where it hurts — their wallets — Savage hit the road, teaming up with Allen School professor Tadayoshi Kohno to investigate how the emergence of OnStar and other systems for connecting automobiles to the internet made them vulnerable to attack. With the help of student



researchers — including current Allen School professor Franziska Roesner and research scientist Karl Koscher — they discovered that by hacking into such systems, they could interfere with the driver's control and essentially take over the vehicle. Savage has since directed his attention to potential vulnerabilities in other modes of transportation, such as aircraft.

"What I think is most remarkable about Stefan is his creativity," said Allen School professor Tom Anderson, one of Savage's Ph.D. advisors. "You can look at almost anything he's done and say, wow, that's university research at its best."