

Annual Report

2017-18



School for
the Future
of Innovation
in Society

Arizona State
University

One of the reasons I love my job as director of the School for the Future of Innovation in Society is the wonderful, diverse faculty in the School.

The way I usually tell it, there are about 50 faculty members in the School – tenured and tenure-track, research, teaching and clinical, and professors of practice. While about one-third of them are shared with other academic units at ASU, they all call SFIS home. We share the same mission and vision, yet we come from about 40 different PhD disciplines and six non-PhD preparations.

Such unparalleled interdisciplinarity has several meanings for the School. In no particular order, it gives us an intellectually diverse way of approaching challenges and framing problems. Our faculty can see the world through a set of lenses that span the natural sciences and engineering as well as the social sciences and humanities. It also gives us a reflexive way of understanding the strengths and weaknesses of those disciplinary lenses, because one perspective can always remind another of lacunae in its vision.

The intellectual diversity within the School as a whole is reproduced in part through the creation of research teams and centers. SFIS faculty associated with the Center for Energy and Society, for example, have degrees in electrical engineering, regional science, American studies, aerospace engineering, public policy and law. The center has thus been able to productively link some of the technological aspects of energy innovation with the traditionally conceived social agenda of the alleviation of poverty.

It is also a great benefit to our students. Our interdisciplinary approach to graduate education and advising allowed Steven Weiner, a student in the School's doctoral program in Human and Social Dimensions of Science and Technology, to work closely with two faculty members in The Polytechnic School of the Ira A. Fulton Schools of Engineering on his way to winning a graduate research fellowship from the National Science Foundation. Undergraduate students expand their intellectual horizons through study-abroad trips to Greece, Ecuador and Nepal that take advantage of faculty members' interdisciplinary knowledge of futures and development.

This disciplinary diversity does make some of the bureaucratic tasks of academic life — annual evaluations and standards for promotion and tenure of faculty — a bit more difficult because faculty from different disciplinary traditions (or even none at all!) bring a different set of expectations to their own and their colleagues' performance. But it is certainly a lot of fun to work in an environment in which we're constantly challenged to learn from colleagues and from students who have different intellectual windows on the world.

The ASU Charter asks us to “assume fundamental responsibility for the economic, social, cultural and overall health of the communities [we] serve.” While disciplinary knowledge and approaches provide important support for positive influences on our communities, real-world challenges are not organized into disciplinary bins. The multiple disciplines in SFIS, blended into a singular mission and vision that emphasizes responsible innovation in its social context, help us to imagine and build a future that is for everyone.

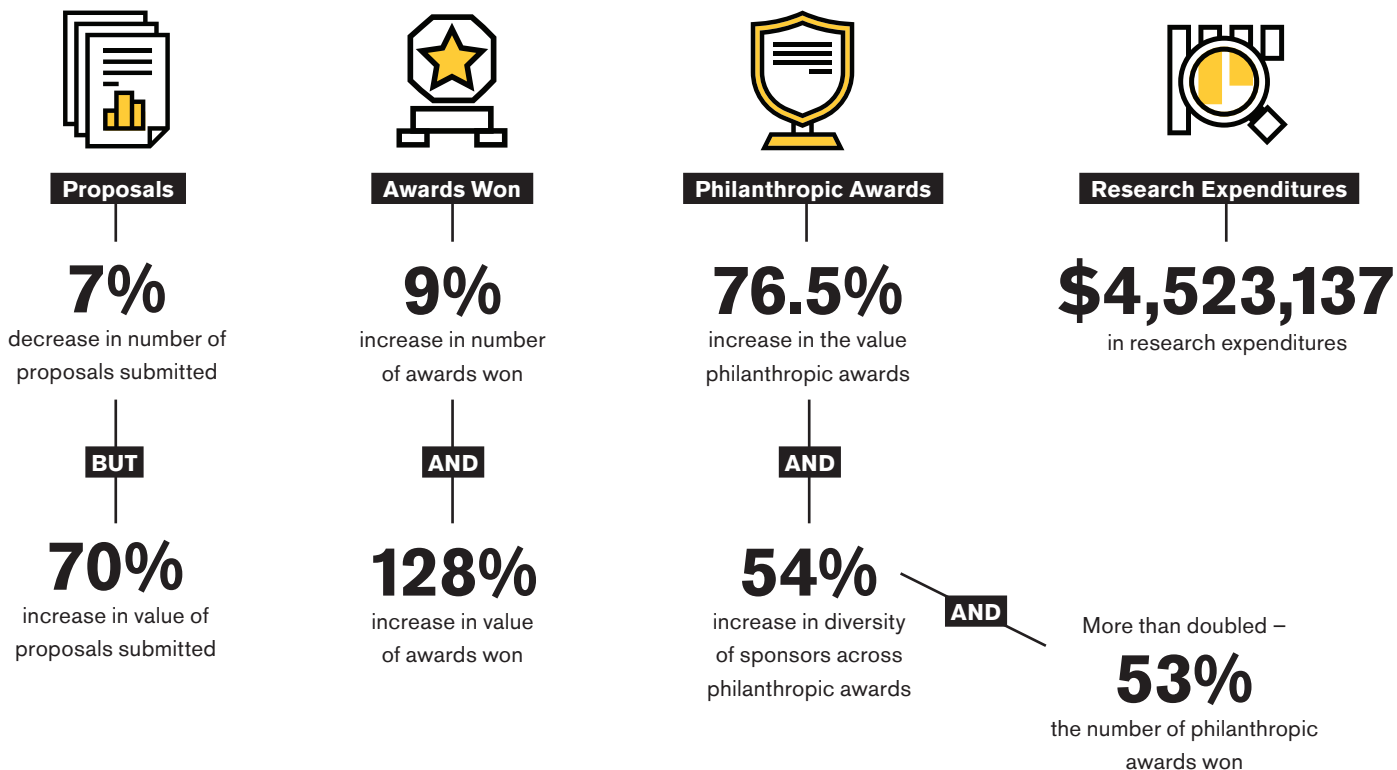


David Guston
Director and
Foundation
Professor

The School for the Future of Innovation in Society research portfolio is shaped by faculty commitment to radical interdisciplinarity, democracy, social justice and responsible innovation.

Our research projects reflect deep interest in how emerging technologies and scientific advancement are influencing our social fabric and our ability to build a future that is equitable for all. Each project has, at its core, a search for how to make the possibilities we have before us into realities that serve us all well. The result is a portfolio that encompasses more than research. It represents a collection of queries, tools, processes, dialogues and partnerships that disrupt conventional framing of societal

challenges and technological solutions. As the school has expanded the diversity and number of partnerships through which we are socially embedded on local and global scales, we have increased the number and value of awards won. This shift in effort from proposals to active research has spurred impressive growth in the range of sponsors investing in our activities, highlighted by a productive alliance with philanthropic partners.



Our Partners



Alfred P. Sloan
FOUNDATION



Serious play for a positive future

Fostering a lifelong love of learning



Imagine engaging millions of people from diverse communities in conversations about issues they might not consider in everyday life. How can we design learning experiences that captivate people of all ages and backgrounds? The Center for Innovation in Informal STEM Learning was created to investigate this question, and to develop new approaches to transform where and how people learn about science, technology, engineering and math (STEM) and their role in society.

Led by Research Professional Paul Martin and Associate Research Professor Rae Ostman, the Center partners with museums and other community organizations to bring together public audiences, educators and STEM experts. Museums and other informal education organizations specialize in creating learning experiences that are captivating, entertaining and relevant for people of all ages. By capitalizing on people's natural curiosity and creativity, informal education is an important complement to learning that takes place in the classroom.

Recognized leaders in the field of informal STEM education, Martin and Ostman first partnered with ASU through a pair of NSF-funded projects focusing on nanotechnology, one led by a group of science museums (with Martin and Ostman among the leadership team) and one led by ASU's Consortium for Science, Policy & Outcomes. When ASU formed the School for the Future of Innovation in Society, this long-term collaboration had already shown enormous potential for informal education to further the mission of the school — and vice versa.

"We were lucky that we found a group of people at ASU who were excited about what could happen in museums," said Ostman. "They understood it was a different kind of learning with a lot of potential, and we recognized the power of engaging audiences in learning about the relationship of STEM and society. This mutual benefit led to the idea for the Center." Prior to coming to ASU, Ostman worked with museums on a variety of projects, ranging from audio tours for museums, such as the Solomon R. Guggenheim Museum in New York, to new exhibits for the iconic

Exploratorium science museum in San Francisco and a game jam at the Royal Ontario Museum in Toronto.

One important focus of the Center is to help learners of all ages and backgrounds build 21st-century skills. Martin explained, "Learning to creatively solve problems — and consider the implications those solutions have for individuals, communities and society — are skills we all need to make a better future. Museums and other informal learning environments like libraries can provide great opportunities to develop these skills."

Martin became hooked on informal education at the Science Museum of Minnesota, where he visited as a child and eventually worked. Before moving to ASU, Martin was senior vice president for science learning at the museum. He has led teams that created exhibitions on diverse topics, including natural ecosystems and cultural treasures, such as the Dead Sea Scrolls. The exhibition "Race: Are We So Different?" engages museum visitors in thinking and talking about race and human variation.

"People learn throughout their lives, in

school but also many other places. There are over 850 million visits to American museums every year. That's more people than attend all major sporting events and theme parks combined," Martin said. "Museums and other informal learning organizations are an important part of our education system."

Ostman and Martin are part of the leadership team of the National Informal STEM Education Network (NISE Network). "With over 700 partner organizations in the United States, the NISE Network provides an incredible opportunity to develop

Arizona. Together with partners across the university and the state, the Center plans to build dynamic spaces where the next generation of educators and science communicators can participate in research, development, and evaluation of museum exhibits, programming, and media.

Ostman and Martin are particularly excited to integrate thinking and skills from futures studies into informal STEM learning. "Where does learning take place? How can educators design materials and environments that support learning by people of all ages and backgrounds? The new projects

"Exhibitions and programs within museums provide visitors unique opportunities to learn on their own terms about themselves, others, and the world we live in. Exhibitions like "Race: Are We So Different?" are powerful catalysts for both casual and facilitated conversations that most of us wouldn't have on our own. The Race exhibition traveled to over 50 communities across the United States allowing visitors to explore how science helps us understand what race is and is not, the history of the creation of race, and dealing with race and racism in contemporary society. The power of exhibitions like Race is to foster thousands of civil conversations between friends, family, co-workers and strangers. Audiences from casual visitors to civic, business and community groups are engaging in this discourse."

—Paul Martin

and widely implement innovative new approaches to informal STEM education," Ostman explained. "The Center leverages ASU's capacity for innovation and the NISE Network's ability to scale projects nationwide."

Martin and Ostman are also working to strengthen the Center's relationships with organizations in

we're working on will bring community members together to create a vision for their future, and also put them in contact with other communities across the country and even the world," Ostman said. "There are many possible futures, and everyone can participate in thinking about and shaping the kind of world we want to live in."



Current projects include:



Earth & Space: This project is connecting learners to Earth and space science experts through

hands-on activity toolkits, exhibitions and professional development opportunities. This partnership of the NISE Network and NASA is active in over 350 U.S. communities.

3.75 million people participated in **NISE Network Earth & Space** activities in 2017–18. This figure will continue to grow in the future, as 52 exhibits are installed in museums across the country, including the Arizona Science Center in Phoenix.

86% of partners offered **Earth & Space** programming for underserved and underrepresented groups in 2017–18.



ChemAttitudes links research with practice on informal learning through shared educational kits designed to stimulate interest, sense of relevance and feelings of self-efficacy about chemistry among public audiences. This national partnership of the NISE Network and the American Chemical Society brings educators, chemists and learners together to improve chemistry education.



Frankenstein: This celebration explores creativity and responsible innovation in a transmedia environment.

The ASU-led project celebrates the 200th anniversary of the publication of Mary Shelley's novel with hands-on activities and an immersive online game.



Climate: This project is exploring climate resilience and social justice. ASU's participation in the international

Humanities Action Lab coalition provides a local lens on a global issue.

Institute grew research base with the launch of new centers

The Institute for the Future of Innovation in Society launched a set of new centers that are pioneering transdisciplinary research.

Center for Innovation in Informal STEM Learning

The Center for Innovation in Informal STEM Learning investigates how people learn about science, technology, engineering, and math (STEM) across their lifetimes. Working with museums, libraries, and other informal learning organizations throughout the country, the Center makes opportunities for all people to create new visions for STEM and society. Research Professional Paul Martin and Associate Research Professor Rae Ostman co-direct the Center and lead activities to develop innovative approaches to informal learning, connect diverse people and explore emerging technologies, cutting-edge research in science and engineering and multiple visions for the future. The Center facilitates experiments in public engagement and builds dynamic spaces where the next generation of educators and science communicators participate in research, development, and evaluation.

Center for Innovation and Development in Society

The Center for Innovation and Development in Society is responding to challenges in global development, especially for poor and marginalized communities. To address these challenges, the Center focuses research on scientific, technological, institutional and policy innovations designed to improve the quality of human life. Associate Professor Netra Chhetri directs this transdisciplinary and applied research center, which is reimagining goals and pathways of development. Using concepts of shared governance, community participation and alternative imaginations, the Center works to improve human well-being through innovation and ensure benefits are equitably distributed across society. Working closely with the new PhD program, Innovation in Global Development, it uses an engagement model focused on translating ideas into actions to deliver measurable results in the real world, particularly in low and middle-income countries.

Center for Smart Cities and Regions

The mission of the Center for Smart Cities and Regions is to advance urban and regional innovation to make more inclusive, vibrant, resilient and sustainable communities. Co-directors Associate Professor Diana Bowman, who is also an associate dean for international engagement in the Sandra Day O'Connor College of Law, Assistant Professor Thad Miller and Associate Professor Erik Johnston lead the Center's collaboration



with researchers, policymakers, planners, entrepreneurs, industry and the public to enhance the ability of cities and regions to use emerging high-tech infrastructures and improve quality of life responsibly. Among the Center's first partners are the Institute for Digital Progress and the Greater Phoenix Economic Council which announced the Greater Phoenix Smart Region initiative at the Smart Cities Connect conference in Kansas City. Leveraging resources from across ASU, the Center bridges the gap between innovation in data and technologies and urban

governance to develop anticipatory capacities and responsible innovation processes to create positive futures for cities, regions and their diverse communities. The Center for Smart Cities and Regions generates ideas, methods, scenarios, networks and spaces for collaboration, engagement, educational programs and other research products to enable partners to leverage technological innovation to create the urban and regional futures they want.

Center for Energy and Society

Today's energy transitions are bringing about the most extensive transformation of global industrial systems in over a century. With Professor Clark Miller, who is also Associate Director for Faculty, as director, the Center's goal is to help communities and organizations understand and manage the human complexity of these changes through research into the social, political, and economic drivers, dynamics and outcomes of energy innovation. Center faculty and students work with grassroots partners and communities to develop innovative approaches to energy design that provide for integrative socio-technical solutions that ensure future energy systems will advance diverse societal goals and just human futures.

Center for the Study of Futures

The Center for the Study of Futures offers futures research, experimental practice, and innovative foresight training for diverse audiences. It builds a cross-disciplinary capacity to imagine a rich variety of plausible futures, reflect on what those futures demand from us, and design pathways toward positive outcomes. By investigating and inventing new theories and methods for creating better futures, the Center aims to nurture and amplify future-oriented scholarship and practice. Associate Professor Cynthia Selin leads the Center, and participating faculty member include Visiting Assistant Professor Lauren Withycombe Keeler and Associate Research Professor Michael Bennett.

Making his own way: ASU student receives NSF grant for research on maker education



I f you could start any project right now, what would it be? Would you create something functional like a piece of furniture or finally tackle that home improvement project you've been putting off? Would you develop a revolutionary invention to solve one of the world's biggest problems? Or would you spring for creating something wilder, say ... a 20-foot tall, fire-breathing dragon with moving wings?

According to Steven Weiner, a doctoral student in the Human and Social Dimensions of Science and Technology (HSD) program, all of these ideas are conducive to learning important skills that can help us thrive in the real world. Weiner, who examines innovative learning frameworks in hopes of creating better STEM learning environments, received a National Science Foundation Graduate Research Fellowship to fund his education and research.

The maker movement is a broad term that encompasses a passion for independent creation and development shared by engineers, scientists, inventors, designers, artists and others. Weiner first learned of the maker movement while listening to a podcast on his commute to his job as a high school physics teacher.

"It was like a lightning bolt moment," he said. "They were talking about encouraging students to have authentic, meaningful interactions with hands-on activities. And not just things like pushing buttons or turning levers like many science centers do, but actually making things and breaking things and getting to understand how things work on a very visceral level."

For Weiner, the news couldn't have come at a better time. Teaching had become frustrating, as he felt he was pushing students to learn things they didn't want to learn — or at least, that they thought they didn't want to learn due to the rigid nature of the education

model in schools. But in discovering the maker movement, he realized that his real passion is inspiring learning through creativity and innovation.

So when he learned that the Arizona Science Center was planning to install a makerspace in the former Phoenix Museum of History building, he jumped at the opportunity to get involved.

"When I came in, it was just an idea, but I had a very clear vision of what it could be. I wanted a community space where people young and old could come in and learn how to make things."

—Steven Weiner

Steven Weiner left teaching science in traditional ways behind when he discovered learning through makerspaces. The space was revolutionary in that it wasn't an exhibit or permanent display of ideas, but a place where people could come and use machines like laser cutters, 3D printers and woodcutting tools to design and create almost anything they could imagine.

"It was overwhelming having all of this responsibility and creative freedom, but also very exciting. I went from being a high school teacher working with these young kids, which I loved, to going on to having this very high-stakes role with \$1.5 million on the line and working with architects and deadlines," Weiner said with a chuckle.

Weiner's vision helped shape what is known today as the CREATE Makerspace at the Arizona Science

Center. And his plans for expanding the maker education platform didn't stop there. He decided he wanted to go back to school to get his PhD, so he could fully immerse himself in maker research. His goal is to find out what makes makerspaces successful, and how that could translate to formal learning environments.

"It occurs to me more and more that the communities are the most important thing," Weiner said. "It's not just about these technologies. It's about the people who are interested in sharing their ideas, working with others, collaborating, iterating, failing together and ultimately getting each other excited about learning."

To fuel this dream, he applied for the National Science Foundation Graduate Research Fellowship, which provides an annual stipend of \$34,000 as well as \$12,000 in tuition coverage. Two of his mentors, Assistant Professor Micah Lande and Associate Professor Shawn Jordan — faculty at The Polytechnic School in ASU's Ira A. Fulton Schools of Engineering — described Steven as "a young researcher who

brings intellectual excellence and curiosity, an experienced perspective grounded in student-centered learning and the practice of teaching STEM and making, and a passion for impacting the future of STEM education."

Weiner is excited to dive headfirst into this opportunity.

"I plan to look at bringing maker education into institutions like schools and even museums and libraries and examining how these things are being affected or are affecting school or organization cultures," he said. However, Weiner noted that before that can happen, institutions need to change how they install maker education and makerspaces.

"There's a fear that the maker movement is just a fad, that there's no cultural buy-in, so these makerspaces aren't lasting long," he said, "It's exhilarating to come in and look at the technology, but those things are not enough to sustain the culture that we see in authentic grassroots maker communities. I want to look at these successful communities and find out what makes them sustainable and bring that into schools."



SPOTLIGHT STUDENT FEATURE

Kayla Kutter **Master of Science and** **Technology Policy (MSTP)** **student Kayla Kutter has been** **named an Energy Scholar** **by Net Impact, 3Degrees and** **OneEnergy Renewables.**

With a focus on energy security, energy equity, and environmental stability — the "energy trilemma" — Kutter concentrates on the complex links that sometimes work at cross purposes in delivering energy services in an equitable, efficient and environmentally sound way. Her work examines the interactions among public and private actors, governments and regulators, economic and social factors, national resources, environmental concerns and individual behaviors.

In the MSTP program, Kutter learned there is more to fostering change than merely developing new technologies. "It's about the people you affect and how change is implemented. Policy and understanding the social impacts of the technology are equally important to the development of clean energy technologies" she said. While in the program, Kutter looks forward to expanding her knowledge of policy development, history of technological development, and social impacts. With backgrounds in math and physics, Kutter is also enrolled in the Master of Sustainability Solutions program in the School of Sustainability.



From left: Faculty members Micah Lande and Shawn Jordan join Steven Weiner in a panel discussion at the 2016 World Maker Faire in New York.

ASU student named a finalist for Red Hat's 'Women in Open Source' award

When a teenaged Nikki Stevens built their first website, they did not foresee the barriers they would encounter in pursuit of their newfound passion. Now a doctoral candidate with SFIS, Stevens has founded two organizations, works a lucrative career as a technical architect and freelance software engineer, and was selected as a finalist for Red Hat's "Women in Open Source Award."

Stevens, whose preferred pronoun is "they," has accomplishments that speak to a tenacious grit, which has buoyed their talent, and a resolute determination to succeed as a non-binary software engineer in the primarily male-dominated tech space. Stevens grew to realize that extra time, effort and creative techniques were required to get work beyond those demanded of male counterparts.

Award," which was created in response to the low percentage of women in the open source community — only 11 percent of contributors to be exact, according to Red Hat's website. The award seeks to recognize exceptional women in tech with the hope that it can show young women and girls who have an interest in the field they don't have to be intimidated and they can achieve success despite the prevailing impression that open source is a man's world.

"Representation matters. We want to elevate women," Stevens said. "Queer women, women of color, nonbinary and genderqueer people too, we want to elevate everyone who is doing good work. We want those who want to enter the field to look and see people who look like them."

Stevens also strives to make the open-source community more inclusive. Stevens was inspired to take action after attending tech conventions and realizing that they were consistently staring out into crowds of white male faces. Stevens decided to do a small presentation titled "Calling All White Men."

They were not expecting what came next.

"It was a little too 'nail on the head' for some people. I got a really aggressive reaction, and that was really powerful," they said. "I got a ton of harassment for it. So then I thought, 'Okay, we really need to talk about this if just suggesting that we have a problem is creating such a strong backlash.'"

Following DrupalCon in New Orleans (an annual technology conference), Stevens formed the Drupal Diversity and Inclusion

Group (DD&I) to help combat negative sentiments and increase the programming community's diversity. The group will come under new leadership this year, and Stevens is excited to see the group grow.

Stevens also created the Open Demographics Initiative, which is focused on improving language used in surveying people about gender, race, ethnicity, sexual orientation and other information.

"They ask these questions in ways that are really exclusionary," Stevens said. "So I was like, 'Well, why isn't there a W3C for these questions? And why aren't the people who are being questioned involved in the questioning?'"

Stevens came up with a recommended set of questions that anyone can use to ask community members about their demographics while minimizing potentially offensive outcomes. They are seeking more contributors to make the project as collaborative as possible.

Stevens' advice for women, non-binary, and gender nonconforming individuals trying to break into the field is to be grounded in a social dimension as opposed to technical training.

"I think the first thing is to find other people and find a support community," they said. "I had a lot of really powerful female mentors, and the value of those types of mentors cannot be overstated. I had so many powerful women, both guiding me with advice and providing material support whether it be buying me lunches or work clothes when I couldn't afford them, introducing me to people, taking me to conferences with them. It's so important."



"I created my own website when I was 15," they said. "But I had to pretend to be older, and I had to pretend to be male most of the time online because I realized pretty fast that if I was going to be paid to do work, I had to kind of suck it up."

—Nikki Stevens

Stevens' experience is not far off from accounts of other women, non-binary and genderqueer people who struggle to prove themselves amongst their predominantly white male peers.

"I can say I've spent time working longer hours, doing more work and doing better work than my peers, in order to get roughly the same treatment," Stevens said. "And I'm not sure that my time doing that is over, in academia as well as in tech."

Enter the "Women in Open Source

Encouraging the public to take the wheel in autonomous vehicles debate

Participatory Technology Assessment technique builds public engagement in policy making



Autonomous vehicles represent the convergence of rapid innovation in artificial intelligence, technology platforms and transportation. The influence and governance of this technology is the focus of multiple activities within SFIS and IFIS.

Public engagement on issues surrounding emerging technologies is the hallmark of research called participatory technology assessment (pTA). The technique, used by the Consortium for Science, Policy & Outcomes, involves holding forums across the country with hundreds of people representing multiple demographic groups discussing current social issues related to science and technology. Topics have ranged from asteroid detection to responding to climate change and, most recently, policies surrounding autonomous vehicles.

Through a project called Citizen Perspectives on Driverless Vehicles, funded by the Kettering Foundation, Professor Daniel Sarewitz and Clinical Associate Professor Mahmud Farooque used pTA to center democratic deliberation on shaping the course of the evolution of autonomous vehicles in our society. They have produced a set of guidelines designed for use by communities to bring their voices and values into the decision-making process. Sarewitz and Farooque are

focused on democratizing the creation of public policy by including public input — using public forums to counteract the exclusionary effects of decision making that happens behind closed doors.

An undergraduate class taught by Assistant Professor Thad Miller worked with the City of Tempe on ways the city can mitigate negative impacts of autonomous vehicles while leveraging their benefits.

The students presented their findings to the city, addressing such topics as: What should basic safety standards be? Which priorities should technology favor as it reacts to a growing variety of road hazards? What will happen to public transit? What will happen to parking structures? Will driverless cars lead to the renewal of urban sprawl? “These are things cities need to think about now and not 15 years down the road,” Miller said.

In March 2018, the first fatal accident involving an autonomous vehicle occurred in Tempe, Arizona. The incident prompted conversations around the world on a range of issues, including the technology that powers self-driving cars, the liability when there is no human driver at the wheel, and how to engage the public in policy decisions. As thought leaders in relevant areas, many SFIS faculty took part in the ensuing public discussion. Articles in Bloomberg, The Wall

Street Journal, The Guardian, The New York Times and other influential venues featured commentary by faculty including Professor Andrew Maynard, Professor Clark Miller, Assistant Professor Thad Miller, Associate Research Professor Michael Bennett, Associate Professor Jameson Wetmore and Clinical Associate Professor Ira Bennett.

“It’s critical that everyone has a seat at the table when discussing this technology’s development, use and regulation,” said Maynard, who elaborates this sentiment in a video he created that examines implementation issues around autonomous vehicle technology. The video is part of his Risk Bites series on YouTube focused on risks and benefits of new and emerging technologies.

In an article co-authored by Maynard, Wetmore, Thad Miller and Ira Bennett, the group noted, “We’ve learned that if innovators, scientists and policymakers engage early and often with people who understand responsible innovation, they can avoid unpleasant surprises down the pike. Engaging constructively with members of the public early on can help develop technologies and regulations that are better aligned with what people want and are willing to support.”

FUTURE OF

X

SFIS partnered with First Friday to engage the public in considering potential futures

Throughout the 2017–18 academic year, SFIS hosted Future of X events designed to promote conversation about the intersection of emerging innovations and the future. The interactive exhibits and activities were part of monthly First Friday community events held in Phoenix from September through May.

First Fridays are family friendly opportunities for arts and cultural displays in open venues in downtown Phoenix. SFIS established a monthly presence among the booths and galleries congregated near Roosevelt Row, one of the more popular areas for visitors. “The venue, which brings together monthly the biggest crowd in Phoenix outside of scheduled sporting events, gave a selection of SFIS professors the opportunity to express novel ideas and practices to diverse audiences in a thriving urban setting, near the downtown campus,” said Professor of Practice Gregg Zachary, who conceived the event series. “The encounters with both visitors and residents of Phoenix also provided new forms of feedback and a heightened sense of social embeddedness for our new school as a whole.”

Future of X took varied forms ranging from a theatrical and dance performance to games, to recording visitors’ unscripted commentary. Each of the monthly themes was designed to portray aspects of research happening at SFIS in ways that are accessible to the community, invite public participation and promote thoughtful inquiry. (Videos of presentations are available on SFIS’ YouTube channel.)

Future of X at First Friday in Phoenix hosted these events

SEPTEMBER

American Dream Tarot and AudaCITY, a game for developing ways of thinking about sustainability

American Dream Tarot is a future visioning game created by Visiting Assistant Professor Lauren Withycombe Keeler and Associate Research Professor Michael Bennett that combines contemporary scenario planning and forecasting methods to engage participants with old and new ways of imagining futures.

AudaCITY is a sustainability visioning and strategy game created by Keeler. It is designed to help decision-makers set sustainability goals, understand the transformations that need to take place within the community to achieve sustainability, build resilience and develop strategies capable of making the goals into reality.

OCTOBER



Finding Frankenstein, an excerpt of the Frankenstein Bicentennial Project

This activity was part of the celebration of the bicentennial of the publication of Mary Shelley’s “Frankenstein, or The Modern Prometheus,” an enduring tale of creation and responsibility.

Frankenstein continues to influence the way we confront emerging technologies, conceptualize the process of scientific research, imagine the motivations and ethical struggles of scientists, and weigh the benefits of innovation with its unforeseen pitfalls. The Frankenstein Bicentennial Project spanned from 2013 to 2018, marking the anniversary of the legendary “dare” among Shelley, her husband Percy, Lord Byron and John William Polidori on the shores of Lake Geneva that ignited Shelley’s imagination, as well as the novel’s eventual publication in 1818. At Future of X, actors gave dramatic storytelling performances complemented by a live version of Frankenstein’s monster that engaged with the audience. In addition, attendees made a variety of batteries, that brought figures made of dough “to life electronically.” The electricity-themed interactive displays prompted conversation and reflection in the audience about responsible innovation concerns raised in the novel.

NOVEMBER



Sea Turtle Conservation and Science Dance

Work to save sea turtles was on display in different performance styles educating and fascinating viewers. Postdoctoral researcher Jesse Senko engaged audience members in explaining threats faced by sea turtles and his work with local fisheries in Mexico. He described a novel method to mitigate bycatch of air-breathing animals in fishing nets using solar powered lights to help them avoid the danger of getting entangled and drowning. Senko's presentations alternated with those of Associate Professor Kiki Jenkins, who performed with students her original choreography depicting hazards for turtles in the open sea. The audience and student volunteers discussed their perceptions of the performances and what they learned about the conservation of ocean species.

DECEMBER

Science and Religion

In partnership with SFIS, Think Write Publish (TWP) held an outdoor participatory event in which people were asked: "Do you think that there could be a scientific basis for spiritual experiences?" More than 100 people responded to the question on camera, and even more shared written responses that were archived. This event was inspired by the narrative "The Vale" by TWP Fellow Jonathan Mosedale.

JANUARY

Solar Phoenix 2050. What is the future of solar energy in Phoenix?

Solar energy is one of the most significant sources of power on the planet, and Phoenix is one of the best places to find it though the city currently takes relatively little advantage of it. We asked participants if solar energy can do more to power homes and businesses in the region and encouraged discussion about what it would mean to power the city with solar energy. Games and activities for kids helped build an understanding of solar technologies and their strengths and limitations as energy technologies. Adults had opportunities to explore artistic and creative ideas for making solar energy a beautiful and meaningful contributor to the city's architectural landscapes, to discuss what's happening in solar energy hotspots around the world and to share their ideas and visions about the future of solar energy in Phoenix.

FEBRUARY

Future of Technology

Is your Xbox more critical than your iPhone? Your coffee machine more important than GPS? We weave technology into the fabric of what we do every day. A bracket game helped participants think about this concept by pitting one type of technology against another, just like in a sports tournament. Attendees played to determine which technology would advance through the brackets to win while discussing the qualities of winning and losing technologies and how they help create better societies.

MARCH

Preview of Emerge

– Who will you be in Luna City, 2175?

The Emerge team treated attendees to an intriguing preview of the event later that month. "Luna City, 2175," in which dozens of actors, set designers, students and faculty created an immersive environment at the annual event that reflected visions of a city on the Moon in 2175 and explored the social

and cultural challenges of long-term lunar habitation. Actors in their roles from Luna City engaged the audience as they replicated communication and governance techniques such as "conflict circles" envisioned for the city. Visual displays prompted discussions with visitors encouraging them to reflect on who they would be if they were residents of Luna City.

APRIL

Engineering and Border Walls: When mental walls lead to physical walls

Engineers have helped design and build the world we all live in. Engineers and engineering are behind our phones, our homes, and our ability to navigate life. Using the current debate around border walls between the U.S. and Mexico, this interactive public art installation created a conversation highlighting the role of engineers and companies in building objects and structures that have significant long-term social, political, economic, and environmental implications. The event asked the public to consider – and share their answers to – important questions like, "What is the social responsibility of engineers in society?" and, "Who do, and who should engineers work for?"

MAY

Fake News

New digital technologies make it easier, cheaper and quicker to spread lies and untruths. This event focused on how people adapt, "catch up" and, if necessary, redesign the powerful digital technologies that have replaced an old information ecology that protected and defended accuracy. Participants discussed the benefits and costs of relying on popular platforms such as Facebook and Google for our knowledge of the world.

Solar fishing lights: the future of fishing

One biologist's bright idea cuts down plastic trash in the ocean while saving money and wildlife

When trawlers head out to sea to fish for halibut, tuna and swordfish, fishermen spend hours attaching glow sticks near hooks so fish can see the bait.

They'll go through hundreds and thousands of glow sticks, tossing them overboard when they haul in the catch. It's a cost of doing business, like fuel or bait, and it adds to the tremendous amount of plastic trash in the world's oceans.

Now imagine something different: miniaturized solar-powered lights on longlines and nets that charge on the deck, cut back on labor, save money and don't end up contributing to marine pollution. They'll also save bycatch of endangered sea turtles and sharks in gillnet fisheries.

"This is the future of fisheries," said Postdoctoral Researcher Jesse Senko, a biologist new to SFIS in 2018. "Around the world, they are going to be fishing with solar-powered nets and solar-powered longlines. With a solar-powered light, you don't do anything. You're out on the ocean — you have a ton of sunlight, and it's free."

It would also contribute toward the marketability of catch. Buyers from coastal restaurants to mega-chains like Target, McDonald's and Whole Foods tout "sustainably caught" seafood because consumers want it. Fishing gear that doesn't add to marine trash and helps prevent endangered bycatch helps earn that label.

"They're doing it because they can make money off of it," Senko said. "People want it. ... There is more demand than there is supply. Seafood is becoming such a luxury item right now. People are willing to pay a premium for it. They're willing to pay for it if they know it's sustainably sourced, it's fresh and it's local."

Moreover, it's not more government oversight over fishermen.

"The great thing about this is it doesn't require regulations," said Senko. "It's a total

bottom-up approach. It's not the government saying you have to do this or you have to do that. It's: 'how can we create solutions they want to use?' ... They're only using the light sticks because it's the cheapest option."

Senko came up with the idea while working on his PhD in Baja California, Mexico. He put battery-powered lights on gillnets to reduce sea turtle bycatch. (The turtles can see the net and avoid it.) What he found was there was a 50% reduction in turtle bycatch and a 90% reduction in shark bycatch. He has seen turtles swim up to nets and turn around.

"What I found was fishermen would not use the lights because of the batteries," Senko said. "They only lasted a week." They were also expensive to fishermen who went out in boats the size of a conference table and used handheld GPS units. Replacing them on a wet deck was another problem. "Fishing is a tough industry," Senko said. "People don't realize it."

Senko's father first took him fishing when he was three. He surf-cast for snapper blues, ate winter flounder for breakfast as a kid, and still keeps a boat on the water in Bridgeport. He majored in fisheries and wildlife sciences

"This is the future of fishing."

—Jesse Senko

at the University of Connecticut, received his master's in wildlife ecology and conservation from the University of Florida and earned his PhD in biology from ASU.

"That's what helps with my research," he said. "I've been fishing since I was in diapers. I grew up on the water. I grew up on Long Island Sound." Senko considers himself a blue-collar PhD. "To me, it's a source of pride. I'm not an academic who stays in his ivory tower and

lectures about how bad fishermen are and how the world is ending," he said. "I like the fact I can roll up my sleeves and go work with these guys."

He helped develop a technology that didn't exist. Since the goal was to get something solar-powered that works, Senko partnered with ASU's Solar Power Laboratory and NOAA Fisheries to develop it.

He received a Disney Conservation Fund grant of \$50,000 in 2017 to begin working on it, as well as \$45,000 over three years from the World Wildlife Fund. He also worked on larger-scale proposals for the National Science Foundation and the National Fish and Wildlife Federation.

The solar panels have to emit enough energy to light up gear for 12 hours, with potentially minutes of charging time. Solar-panel engineers believed the concept was workable.

"Jesse provided us with a new challenge as saltwater is hard on electronics, and we also need to be able to survive the pounding of the ocean," said Stuart Bowden of ASU's Solar Power Lab. **"I'm motivated by the environmental benefits of solar. But solar-powered lights to warn turtles? Now that's a motivator!"** It's especially cool that Jesse has the data to show the number of turtles saved. Normally we think about how to provide terawatts of power for the whole planet. This is at the other end of the scale with only milliwatts needed. However, it came at just the right time as we'd just come up with a new cell design that is ideal for small power applications."

Senko sees his mission as solving several problems while simultaneously increasing opportunity for fishermen. "You're reducing global plastic pollution," he said. "You're increasing (renewable) energy use. You're saving endangered species, primarily turtles and sharks. It's a cleaner fishery. And you're helping fishermen, who are always blamed. They're always the bad guys that governments around the world are always cracking down on. It's not only that. We can then help them market their seafood as sustainably caught. We can help them get into a premium market because they're using this technology."

Adapted from an ASU Now article by Scott Seckel



Growing resources in



SolarSPELL digital libraries expand service to new locations lacking internet

With over half of the world's population lacking internet connectivity, Associate Professor Laura Hosman saw a need in education and health services delivery, and she turned her attention to alleviating the problem. SolarSPELL began as a challenge to her students to create a solar-powered library that would fit into a backpack evolved into something with incredible impact.

"I had no idea the impact this initiative would have," said Hosman. "We have scaled this library-in-a-box to eight countries, and have affected tens of thousands of people!"

SolarSPELL is a compact, solar-powered digital library that can be accessed using Wi-Fi even where there is no internet connection. Content tailored to specific audiences, such as educational curriculum or healthcare information, is pre-loaded and can be accessed in the field through smartphones, tablets or any Wi-Fi-enabled device in a way that simulates accessing the internet. SolarSPELL's ruggedized build, mobility and independent power source have made it ideal for use in remote areas without access to the internet or reliable electricity.

"Our goal is to provide relevant, localized educational content to resource-constrained locations around the world," Hosman explained. Since the success of the initial trials of SolarSPELL in Micronesia in 2015, demand has increased,

and Hosman's team has worked to scale up production and distribution. The group of university students and staff, librarians, and faculty works with Peace Corps, which has a presence in over 60 countries, plus education ministries and local organizations to provide libraries with appropriate content, training and support in the use of SolarSPELL.

Since 2015, the team has sustained its support in prior implementation sites by returning to train the incoming cohort of Peace Corps volunteers and their local counterparts, and carrying out impact evaluation in each location. During the past year, SolarSPELL was also able to expand to four additional countries: Comoros, Fiji, South Sudan and Rwanda. In 2019, plans are to continue its current presence in the Pacific Islands and East Africa, expand to refugee settlements

digital deserts



in Uganda and Kenya and introduce it here in Arizona. While continually improving upon its model of using SolarSPELL in schools, the team is also exploring including an agricultural library to meet the needs of smallholder farmers in multiple locations.

Not just a research and outreach project, SolarSPELL's involvement of students is core to the mission. An average of 50 students each semester have been part of the project, from building units and applying for grants to training Peace Corps volunteers and teachers in the field and evaluating results. Through this service-learning experience, students develop professional and cultural competencies that are crucial for 21st-century workforce skills and global citizenship.

SolarSPELL in Rwanda

The principal mission of the SolarSPELL project for Rwanda was to expand the scope of educational resources available to primary and secondary school-aged students. In 2007, the Rwandan government began the One Laptop per Child (OLPC) program which provided 267,000 laptops. Since nearly all schools lacked internet connectivity, use of the laptops has been severely limited. However, with SolarSPELL, students can connect to a wealth of high-quality educational resources across all subject areas, empowering them to become more active digital learners.

Arizona implementation

SolarSPELL has developed a library of Arizona Natural Resources to launch with Tonto Creek Camp in 2019. Tonto Creek is a STEM-focused camp near Payson, Arizona committed to serving local youth and providing outdoor educational opportunities. Although Tonto Creek Camp lacks internet connectivity, SolarSPELL can provide technology to enable campers and instructors to access educational materials throughout the campground, enhancing the lessons through a hybrid of outdoor activities and interactive digital content. An identical version is available online complementing the offline SolarSPELL library, and further empowering youth to continue exploring topics that piqued their interest at camp upon returning home.



Life on the Moon: Luna City 2175

Emerge — A Festival of Futures took audiences to a future community grappling with the evolution of their society.

“Luna City: 2175,” the seventh annual ASU Emerge, combined art, theater, technology and museum experience to imagine what an extra-planetary colony would be like 157 years from now. The immersive experience explored the social and cultural challenges of long-term habitation on the moon.

The audience interacted with Luna City residents, played by actors, and participated in events such as a “conflict circle” and a funeral. They saw what a house would look like, how the residents would feed themselves and what they would do for fun. There were artifacts, dancing and music.

“While we don’t know what the future holds, imagination provides a powerful way to reflect on longer swaths of time and enhance our ability to make change for the better,” said Associate Professor Cynthia Selin, co-director of Emerge.

“Emerge strives to promote a culture of collaborative innovation and foster transdisciplinarity, inspire public discussion about the role of science and technology in shaping society, playfully engage with contemporary issues and grand challenges, think differently about the future, and create a platform of intellectual and cultural exchange within and beyond ASU.”

About 180 people worked for nine months to create “Luna City: 2175,” sponsored by SFIS, the Herberger Institute for Design and the Arts, the Center for Science and the Imagination, the Ira A. Fulton Schools of Engineering, the Interplanetary Initiative, the College of Liberal Arts and Sciences and the School of Earth and Space Exploration. The vision of science fiction author Kim Stanley Robinson, who presented at the event, inspired the project.

Interdisciplinary strategy

Nine months before the event, dozens of experts — including planetary geologists, launch system engineers, architects, sociologists, political scientists, economists and artists — gathered to develop a “story bible,” an outline of the self-contained Luna City. According to the story bible, Luna City started as a mining and research facility and, after years of struggle, had become a spaceport and artists’ colony.

“We’re not just building the physical environment. It’s also about the story and how we think a human civilization will evolve,” said Jake Pinholster, co-director of the event and associate dean for policy and initiatives in the Herberger Institute for Design and the Arts and head of graduate programs in interdisciplinary digital media and performance design.

The Luna City story was about how people govern themselves in a place where they are forced to be

interdependent in the face of a hostile natural environment. “Right now, no one has ever been to space who didn’t go there specifically to go to space. So once people just start being people in space, what does it mean?” he said.

Building a new world

The 3,500-square-foot Emerge universe that transformed the Galvin Playhouse on the Tempe campus for two days was designed and constructed by student workers, staff, faculty and community members and artists.

Even during their spring break, students were busy cutting, hammering and painting the physical world of Luna City, which looked different than what the audience might expect.

“I think when people envision the future of space travel, we base it off of ‘Star Trek’ and ‘Star Wars’ — everything is metal and plastic,” he said. But in Luna City, metal and plastic couldn’t be manufactured on the moon and were expensive to transport, while bamboo thrived in the poor soil, could purify water and air, and provided food, textiles and building materials. In real life, bamboo is expensive, so the students used a five-step process to paint boards to look like bamboo.



Top: Fara Shippee, a sophomore majoring in mechanical engineering, cuts a metal tube while building an aquaponic system. Shippee and her classmates in the Engineering Projects in Community Service program, known as EPICS, are working on the project.

Right: Undergraduates Miquella Young and Meredith Matsen perform “Anicca,” an original Buddhism-inspired dance performance about permanence-impermanence.

Pinholster said that some students earned credit for working on Emerge, such as those in the Engineering Projects in Community Service program, known as EPICS, who were building an aquaponics system that would house both trout and tomatoes to provide food for Luna City. The project incorporated other student technology projects, including the AZLoop pod, a high-speed transportation device developed by ASU students for the SpaceX Hyperloop competition the year before.

Suspending disbelief

Audiences could choose how they wanted to experience Luna City, according to Kenneth Eklund, an artist in residence with SFIS who helped create this year’s Emerge. Some quietly observed the action and displays while others became fully immersed in the “lunar” environment by interacting with the actors and objects. Eklund creates games to engage people in topics such as climate change, and he taught a class during the spring semester called “Play the Future: Engaging the Public with Serious Games.”

“The audience came in at whatever level they were at,” he said. “We needed to be inclusive, and I wanted to make sure that everyone was comfortable.” However, he was eager to accommodate people who wanted to become immersed in a created world. “People don’t always get this opportunity. They want to suspend disbelief and be in your fiction,” said Eklund.

Adapted from an ASU Now article by Mary Beth Faller



SPOTLIGHT STUDENT FEATURE

Jamie Winterton

Jamie Winterton, a PhD student in the Human and Social Dimensions of Science and Technology and director of strategic research Initiatives in ASU’s Global Security Initiative, traveled to Washington, D.C. in October 2017 to testify before the U.S. Senate Subcommittee on Privacy, Technology and the Law. The hearing, entitled “Equifax: Continuing to Monitor Data-Broker Cybersecurity,” examined cybersecurity measures and industry standard practices in place at data brokers like Equifax, Experian and TransUnion. Two of those brokers — Experian and Equifax — experienced significant data breaches since 2015.

Winterton said threats are evolving more quickly than defenses, and companies collect and store vast amounts of personal data yet cannot adequately protect them. “One reason why we can’t sufficiently secure online systems is that we fail to understand their complexity — from a computer science perspective, a social science perspective or a legal perspective, much less the overlap of the three,” Winterton said at the hearing.

“We must begin building systems that recognize an attack and defend against it, minimizing the damage of each intrusion — much like a healthy immune system isolates and destroys an intruding virus,” Winterton said. She added that the next generation of cybersecurity experts would come through universities, and it’s important to give them real-world, hands-on research experiences. “Getting those research experiences in college means they are already contributing to solving problems,” Winterton said. “Universities have a culture of exploration; we embrace tough challenges and have the freedom to take risks.”

Excerpted from an ASU Now article by Marshall Terrill

Inaugural undergraduate class eager to make their mark on the world

The graduating classes of the 2017–2018 school year will forever hold a place in SFIS history. “This year is special because it’s the first graduation of our undergraduate students receiving a bachelor’s degree in Innovation in Society,” said the director of SFIS, Professor Dave Guston. “We are incredibly excited about the future of these students, and for the other future graduates in the program.”

SFIS proudly congratulated two graduates receiving bachelor’s degrees in Fall 2017, and twelve in Spring 2018. During the Spring 2018 Convocation ceremony, undergraduate

student Monique Hasbun gave a moving speech and performed an original song that she wrote based on the school’s tagline, “The Future is for Everyone.”

“Being a part of this inaugural program has pushed our intellectual capabilities and flexibility to immerse our minds into complex subjects,” she said in her speech. “We all have a longing to make this world a better place, and at SFIS we have been given the tools we need to solve problems and make this world more habitable for all living things through innovation, alternative ways of thinking and inclusivity of all people.”

Along with the first graduating

class came the first undergraduate Outstanding Students, who were chosen based on their exceptional academic achievements, community engagement and service, and leadership and participation in ASU organizations. The Fall 2017 award went to Arizona Baskin, and J.P. Nelson received the Spring 2018 award.

Arizona Baskin graduated in Fall 2017, and thus had the honor of being named as SFIS’ first undergraduate Outstanding Student and Moeur Award recipient. Like many other students, Arizona came to SFIS in search of something different. He



New graduates, including Marcus Goodwin, center, sing the Arizona State Alma Mater at the conclusion of the spring 2018 convocation.

Outstanding Graduate Students

was feeling that his original pursuit of an engineering degree was not targeting the true nature of his interests. Finding SFIS' new undergraduate program provided the right fit for him at just the right time. He described how the undergraduate program changed his perspective, "When I was in electrical engineering, the emphasis was on the technology more than the people, and that just wasn't for me. At SFIS, they're asking questions that no one else is asking, and focusing on taking a more humanist approach." Baskin found he was intrigued by a career in policy making in the realm of science and technology and is considering law school for the future.

Another convert from a purely technical track of scholarship was Spring 2018 Outstanding Student **J.P. Nelson**. Nelson is no stranger to going the distance — in academics and on the track field. As a National Merit Scholar, a distance runner for ASU and recipient of a 2018 Moeur Award recognizing his 4.0 GPA, he kept busy throughout his four years as an undergraduate. In SFIS' Innovation in Society bachelor's degree program, he was thrilled to discover a field of study that he not only excelled in academically but was genuinely excited about. He said, "It's very liberating to feel that I can make a difference and hopefully accomplish good doing something that I really do enjoy."

Captivated by the education he received at SFIS as an undergrad, Nelson has enrolled in the Human and Social Dimensions of Science and Technology doctoral program and, as a research assistant, is delving into a project focused on public engagement around the governance of geoenvironmental research.



Lenora Ott

MS, Global Technology and Development, 2017

It started with a dance. A belly dancing class — Raqs Sharqui, to be exact — where Lenora Ott first learned about the Global Technology and Development master's program.

After hearing a close friend in the class talk so enthusiastically about it, she decided to look into it herself.

But what do global technology, development and dance have in common? Ott, who earned her master's degree in December of 2017, would tell you that they have many similarities and have the potential to work hand-in-hand to make a difference in the way we communicate. She believes that dance can be used as a tool to help assist development, connecting people in ways that go beyond the verbal or written word to come to a deeper understanding of one another through the movement of dance.

"My undergraduate degree is in anthropology, so having this global perspective, this desire to understand more about the world was not unusual to me. Having this technology aspect and this idea of development, of improving people's lives and making the places that they live a better place, that kind of drew me to the program."

Ott currently works as the Senior Education Programs Coordinator for ASU's Center for Evolution and Medicine Education Programs.



Elizabeth Garbee

PhD, Human and Social Dimensions of Science and Technology, 2018

It wasn't until a disaster struck her hometown that Elizabeth Garbee realized she no longer wanted to pursue her original plan of achieving a PhD in astrophysics.

The forest fire that tore through her town upset her world in more ways than one because it wasn't just an act of nature she could scientifically analyze from the comfort of a lab. To Garbee, things had become personal. Seeing firsthand that these kinds of events are more than just science projects, she realized the importance of the voices of human beings whose lives are affected every day.

The transition was not easy. Few resources were available to point Garbee in the right direction, and instead of inspiration and encouragement, she received warnings not to "waste" her physics degree by pursuing another track. But Garbee knew she was destined for something different, something she couldn't quite identify. That's when she stumbled across SFIS' Human and Social Dimensions of Science and Technology program.

Garbee fell in love with the kindness, charisma and passion of the people within this unique academic community as well as the academic rigor. She described what drew her in, "If I had to pick one idea that sort of changed everything, it would be that people do science, science doesn't do itself. It's like breaking everything you've known down into little pieces and having to rebuild it slowly and in a new way. I had to take those pieces and build a new lens with which to see the world, a lens that is more intellectually honest and serves me better."

Students use futures thinking to tackle challenges in Nepal, Greece and Ecuador.



Carlo Altamirano-Allende in Ecuador

Students learned about themselves and other cultures during SFIS-sponsored journeys to Nepal, Greece and Ecuador. Beyond the excitement of visiting a different country, the study abroad experiences provided invaluable opportunities to apply key concepts from the classroom to real-life environments.

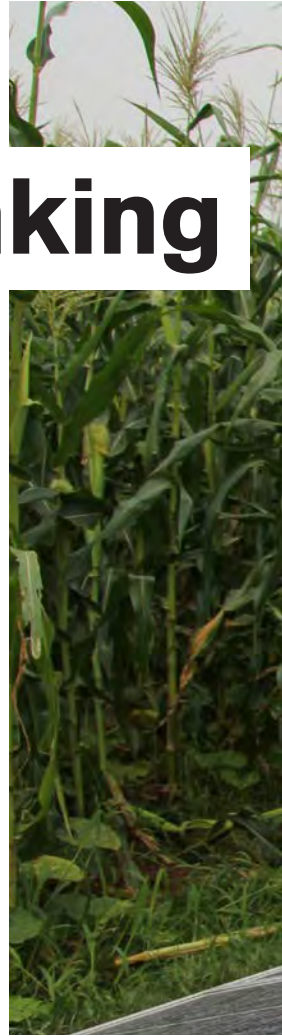
Challenges in sustainable development were the focus of a Study Abroad trip to Greece led by Mary Jane Parmentier, a clinical associate professor researching the role of technology in global development. “Students looked at the complexity involved in social, economic, environmental, cultural and political contexts as they visited archaeological sites and participated in community service projects,” she said.

Parmentier also led an excursion to Ecuador where students explored new ways of thinking about these issues while visiting indigenous communities and examining their assumptions and cognitive screens.

Monique Hasbun, a senior in the Innovation in Society program, explained how she was able to apply techniques she had studied while

in the field during her study abroad experience. “We used the concept of futures thinking to analyze emerging trends in a society and possible futures a community might encounter in certain circumstances. For example, how the region of Mani in Greece might function with an influx of immigrants or how the community will react to sustainable tourism happening in their village.”

Students who traveled to Nepal with the group led by Associate Professor Netra Chhetri and accompanied by Nalini Chhetri, a clinical associate professor and assistant director of the School, learned how communities are integrating local resources with technology to solve challenges. They helped install solar panels to power irrigation in two local farming communities, and they participated in a biochar project that processes invasive





Tharu community celebrating the hand-over of student-installed solar powered irrigation system in rural Nepal.

weeds in the area into charcoal. The group also conducted STEM learning activities with fifth through 10th-grade students to gauge interest in energy and education innovations in community middle and high schools.

“We challenged our students to view issues that communities are facing through a lens of local culture and economic conditions. It was eye-opening for many as they came to understand not just the limitations villages struggle with, but also the incredible capacities and resilience these local communities bring to the table,” said Nalini Chhetri. “For the fourth time, the Nepal program has focused on students from interdisciplinary backgrounds including engineering and environmental science graduate students from Tribhuvan University (TU), Nepal’s oldest and largest university. This type of peer

learning has been considered the highlight of the program by students of both universities.”

Justin Haley, a graduate student in the Global Technology and Development master’s program, commented, “I have learned things that no textbook could ever teach me, like the value of empowerment as a transformative tool (and also how to use a squatty potty without falling into the abyss) and forged meaningful relationships with people whose humanity and compassion have offered a renewed faith in the future.” Heather Otten, an undergraduate student on the trip, said, “I am so grateful not only for this experiential learning opportunity but also for the passion and life it brought back to me.”



Monique Hasbun in Greece

Eradicating poverty through energy innovation

Conference sparks discussions about energy accessibility and justice



Access to energy is at the nexus of many social problems. Improving the ability of people to gain access to affordable, reliable power can help mitigate the effects of poverty and a host of related challenges, such as access to clean water, food, healthcare, adequate housing and clean environments.

As governments worldwide grapple with advancing economic development while moving toward cleaner energy usage, 1.2 billion people still have minimal or no access to energy (according to the International Energy Agency).

The Eradicating Poverty through Energy Innovation (EPEI) conference, hosted by ASU in February 2018, sought to involve participants from around the world in addressing this issue and generating positive outcomes.

“This is an issue of justice... It is absolutely fundamental to establishing the basic foundation of a standard of living,” said Simon Trace, a principal consultant on natural resources and energy at Oxford Policy Management with extensive experience in NGOs. “This is not just the unfortunate consequence of a technical process. There are choices that are being made here.”

Trace was a keynote speaker at the EPEI conference, which had a goal of exploring ideas for how investments in sustainable energy can also be used to address other social needs, and ultimately eliminate poverty.

As the conference host, SFIS assembled participants with diverse expertise from 11 countries and five continents to share research and experiences and to deliberate on strategies for creating pathways to full energy access in areas that don't currently have electricity.

One key idea motivated the conference, noted co-organizer Professor Clark Miller, director of SFIS's Center for Energy and Society: “Energy innovation can help end poverty in remote and rural communities if projects can deliver high levels of social and economic value for energy users.”

Jim Rogers, a former CEO of Duke Energy and co-founder of the Global BrightLight Foundation, observed that energy is one of the most significant contributors to human inequality. As a result, he argued, access to electricity should be viewed as a fundamental human right.

Doctoral student Saurabh Biswas of the School of Sustainability helped organize the conference. “One theme moved to the forefront across three days, and that is the ambition of the agenda of eradicating energy poverty,” he said. “There was an explicit opinion shared among 100-plus participants that the approach has been minimally ambitious so far, and it is high time that we redefine the values and principles of the global energy access initiative to be based on ideas of justice and equity.”

So what's next after a successful conference?

“Having invested several years in building relationships with institutions in Asia, it was pleasing to hear academics representing India and Nepal offer to host the next iteration of the conference,” said SFIS faculty member and co-organizer Nalini Chhetri. “Their reason is that focusing on the social value of energy was both timely and relevant for them. So holding such an event in these nations will create a critical mass of stakeholders who can rethink and reimagine how to address energy poverty.”

Carnegie Fellowship awarded to SFIS' Diana Bowman

Examining legal and ethical issues around reproductive technology



The Carnegie Corporation of New York named Professor Diana Bowman as one of 31 recipients of the 2018 Andrew Carnegie fellowships.

Selected from a field of roughly 300 finalists, Bowman proposed a groundbreaking study on the ethical and legal issues presented by a new type of reproductive technology called mitochondrial donation, which results in “three-parent families,” as the baby contains DNA from three individuals.

Each year, the Carnegie program seeks nominations from more than 600 leaders representing a range of universities, think tanks, publishers, independent scholars and nonprofit organizations nationwide. Jurors are asked to consider the merits of each proposal based on its originality, promise and potential impact on a particular field of scholarship.

Bowman said she felt honored just to be chosen as ASU's nominee for the fellowship, and she was stunned to be selected by the Carnegie Corporation.

“I think I'm still in a state of shock,” she said. “I never thought that I had a realistic chance at actually winning one of the fellowships. So I was overwhelmed and delighted. I was excited more so for everybody who's helped me get to where I am today. I see this award as a team honor, not

an individual honor. I've had some of the most amazing mentors and teachers in my career, so I felt as much about recognition of all their work and support rather than just my own.”

Bowman explained mitochondrial donation as a new frontier in assistive reproductive technology.

“We've had test-tube babies now for nearly 40 years, so it's just an advance of that technology,” she said. “What's really exciting about mitochondrial donation is that it, for the first time, provides clinicians with a way of creating healthy babies for women who otherwise would pass a mitochondrial disease on to their biological child.”

“Mitochondrial diseases pass through the female line, and there is no cure for them,” Bowman said. “Children who are born with mitochondrial diseases will have varying degrees of health challenges, with mitochondrial diseases coming in many forms. The diseases can be treated but not cured. The symptoms of the diseases are often painful, and they're challenging — economically, emotionally, and socially — for the family. Mitochondrial donation allows you to remove the 'defective' mitochondria from the female, which is then replaced with 'healthy' mitochondria from a female donor. In doing so, you create an embryo that has the DNA from three people. And that's where it gets challenging.”

Each recipient of the Carnegie

fellowship receives up to \$200,000 to devote to their research. Bowman's project, a two-year study, will examine the ethical, legal and social implications of mitochondrial donation. She will talk to officials, focus groups, members of the public and affected families in the United Kingdom (where the technology is legal), the United States (where it is not) and elsewhere, trying to get an accurate sense of people's hopes and concerns.

Bowman wears several hats at ASU, serving as a tenured associate professor and associate director for students at SFIS, and co-director of the Center for Smart Cities and Regions, and the associate dean for international engagement at the Sandra Day O'Connor College of Law.

“Professor Bowman has had an incredibly productive — and still young — career, focused on understanding, analyzing and explaining the ethical, legal and social implications of new and emerging technologies,” said Professor Dave Guston, founding director of SFIS. “With this opportunity to devote concentrated effort to the study of mitochondrial donation and the creation of so-called 'three-parent families,' she will no doubt produce a thoughtful, creative and compelling assessment that will make scholars and policymakers alike take notice.”

Bowman will continue to teach at ASU, and she says there's no better way to teach than by involving students in research programs. She plans to have several students assisting with the study.

“This fellowship is a tremendous honor and validation of the brilliant work that Professor Bowman has done throughout her career,” said Douglas Sylvester, dean of the Sandra Day O'Connor College of Law. “There's nobody better suited to examine the complex issues — legal, political and ethical — surrounding mitochondrial donation.”

Adapted from ASU Now article by Karen Sung

Science and Religion: Conflicting opposites or harmonic experiences?

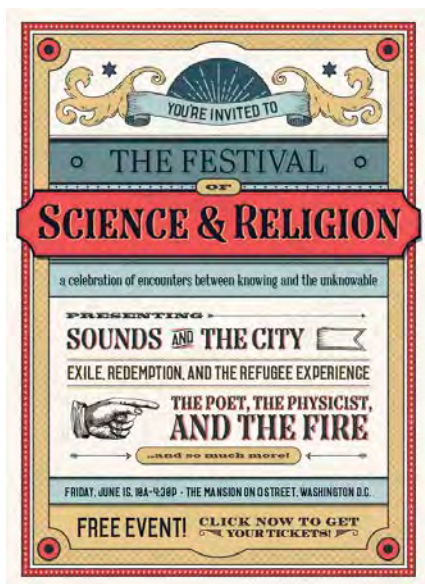
Using the power of story to enhance understanding

People have historically thought of science and religion as conflicting opposites, but Think, Write, Publish: Science & Religion proposed that the two can reinforce each other to allow a more nuanced, profound, and rewarding experience of our world and our place in it. TWP: Science & Religion was made possible through the Consortium for Science, Policy and Outcomes and the School for the Future of Innovation in Society, and implemented in collaboration with two publications: Creative Nonfiction and Issues in Science and Technology. The project, led by Professors Lee Gutkind and Dan Sarewitz, who is co-director of the Consortium for Science, Policy & Outcomes, was funded by a grant from the John Templeton Foundation.

The writing competition and fellowship helped participants develop dynamic interconnections between science and religion. Under the tutelage of Lee Gutkind, writers explored themes of space, nature, mindfulness, medicine and spirituality. The project worked with partners from five leading science museums to build programs that attracted nearly 30,000 visitors at nine events across six US cities inspired by those narratives. Also, the team created a course designed to help students explore their individual stories as

a way to fit grand, macro-scale perspectives on science and religion into personal narratives that focus on specific events, settings and experiences.

"The twenty or so authors in this TWP project each wrote a compelling narrative about how science and religion often work together to enrich the human experience," said Gutkind. "In a time of social divisiveness, our project helps bring people together across what is often a cultural fault-line, using the power of story to enhance understanding."



001

Writing Competition:

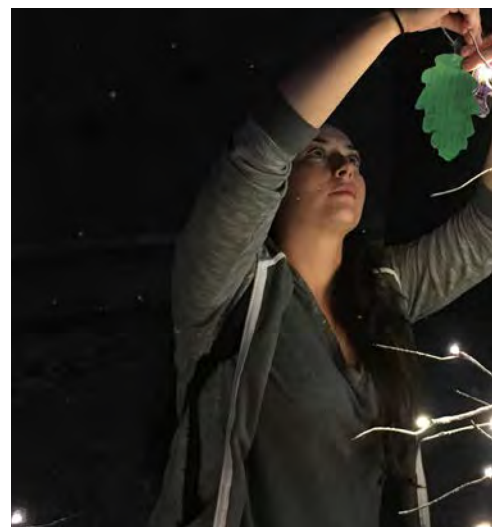
Jan. – Aug. 2017

In August 2017, TWP announced the winners for the Science & Religion Writing Competition. Rachel Wilkinson won best essay, receiving the \$10,000 grand prize for her narrative, "Search History." The runner-up, with her essay "Shuddering Before the Beautiful," was Jamie Zvirzdin, who took home a \$5,000 prize. Both essays were published in Creative Nonfiction's 65th issue and Issues in Science and Technology 34.

002

Special Fall Issues Launch at The National Academies of Sciences:
Oct. 13, 2017

Exploring the Harmonies: A Media Perspective drew in over 190 guests and featured a panel discussion among writers and editors from The Atlantic, The Washington Post, and The Weekly Standard. The event also included readings, conversations, and the launch of "Science and Religion: Exploring the Harmonies," the special fall issues of Creative Nonfiction and Issues in Science and Technology magazines.



A member of the public attaches her response to the interactive thought tree at the Future of X event in downtown Phoenix.

003

Kepler's Carol at the Science Museum of Minnesota: Sept. 2017 – June 2018

This play was inspired by a narrative from TWP Fellow Sarah J. Reynolds called "A Harmony of Views: Dreaming with Kepler about Life on Earth and Beyond." Using the familiar structure of Dickens' Christmas Carol, "Kepler's Carol" examines how Johannes Kepler, the 17th-century German mathematician, astronomer and astrologer, balanced his scientific work with his religious devotion. At the top of the show, the audience learns that Kepler is considering giving up scientific pursuits. Throughout the play, the ghosts convince him to continue his work.

004

Medicine and Religion at the Museum of Life + Science & The Monti: Nov. 3, 2017

Born out of the narrative "Faith in Nursing" by TWP Fellow Sarah Christiansen was an evening of storytelling that reflected on the intricate relationship between medicine and religion through the lens of personal narratives. Guests explored how our understanding of science and medicine inform our faith. The storytellers in this event used their unique perspectives to dive into their past experiences and reflect on what they've found.



005

Future of X at Downtown Phoenix, AZ: Dec. 1, 2017

At Downtown Phoenix's monthly art walk, TWP and SFIS collaborated in an initiative inspired by the narrative "The Vale" by TWP Fellow Jonathan Mosedale. Over 100 participants responded in writing or on camera to the question: "Do you think that there could be a scientific basis for spiritual experiences?" The question stumped some, but it promoted deep thought and reflection from all participants, and resulted in answers such as:

"Just because we can't understand it with what we can perceive, doesn't mean that it doesn't have an understanding based in science."

"Science is based on fact; it's something that you can prove. Spirituality is based on emotion and what you feel, where you know there is a higher power even though you cannot see or touch it, it's something that you know."

"Science underlies everything, and as for the whole concept of science and religion being different, I think they are more alike than they are different."

TWP then compiled the clips into a video titled "The Future of X: Science and Spirituality," which can be viewed on YouTube.

006

Multi-Sensory Mindfulness at Children's Creativity Museum in San Francisco: Dec. 9, 2017

Children and families got the opportunity to explore this multi-sensory, interactive installation that demonstrated the connections between neuroscience and mindfulness. The event engaged more than 60 participants in facilitated activities that connected ideas of emerging neurosciences to religious practice framed around notions of mindfulness. The narrative "Sounding the Sacred in New York City" by TWP Fellow Catherine Fletcher was the backbone of the installation.

007

Worldwide Online Course at ThinkWritePublish.org: Sept. 30 – Dec. 31, 2017

This free, online, self-paced course was designed to inspire insights into the process of writing a personal narrative. It focused specifically on true stories that explore harmonies between science and religion. The program attracted a diverse group of 137 students from around the world, and the website will soon feature the course material and lesson plans available to the public under a creative commons license at no cost.

008

Festival of Science and Religion in D.C. — June 15, 2018

The Festival of Science & Religion was a day-long celebration of the ways that science and religion interact and harmonize to create more meaning, understanding and purpose in our complicated world.

Set in Washington's magical Mansion on O St., the June 15th event offered our nearly 500 registered guests an opportunity to explore compelling new stories, and thought-provoking ideas presented by writers, thinkers, skeptics, and believers from various disciplines and denominations in a series of 19 events that challenged and inspired our ways of knowing and understanding.

From death cafés to events on soundscapes connecting religious rituals to advances in neuroscience, the festival furthered the broader goals of the TWP: Science & Religion project: to seek productive interaction between science and religion.

Invest in a future for everyone

Innovations in science and technology hold tremendous potential to help us confront and manage the complex challenges we face today, but success requires more than novel approaches. For innovations to be truly transformative, we must take into account the full range of social actors and conditions so that their benefits are distributed equitably.

The School for the Future of Innovation in Society is not just a school — it is also a catalyst for linking innovation to public value, driving meaningful responses to our most urgent challenges with a commitment to responsible innovation and social inclusiveness.

To sustain and extend our school's vision of a future for everyone, we need allies like you: individuals with the imagination, courage and dedication to securing a future for the great scope of humanity, not just the privileged few. As we expand current programs to a growing number of passionate students and professionals, your support will provide them the opportunity to engage beyond the classroom and inspire fresh thinking for better futures.



Your gifts will help to:

- **Make SFIS accessible to a greater number of students from all socioeconomic backgrounds.**
- **Ensure that the students who enroll will graduate and will thrive in their careers.**
- **Enable all students to move beyond the classroom to apply their learning to real situations.**
- **Create emergency funding for students in financial crisis.**
- **Provide leadership development opportunities.**
- **Fund professorships and endow chairs, attracting the best of the best.**
- **Create artist-in-residencies and visiting faculty programs.**
- **Advance research through interdisciplinary centers and active learning environments.**
- **Empower partnerships to advance national science policy, responsible innovation and imagine alternative futures.**

Thank You!

It is with deep gratitude that I acknowledge all who supported the School in 2017. Your investments provide students with enriching opportunities — the difference between a good and an excellent academic experience. Through your generosity, we are educating a new generation of scholars and practitioners, unbound by traditional disciplines, who will bring the necessary perspectives and skills to deploy empowering innovation across society. On behalf of our students who benefit from your support, thank you!



There are a variety of ways to get involved and champion SFIS students, research and academic programs. For more information on how you can make an impact through philanthropy, please contact Rebecca Pringle, Community Engagement and Development Coordinator, at (480) 965-4249 or Rebecca.Pringle@asu.edu.



Philanthropy Inspiring Students and New Traditions

Through the contributions of our community exclusively on Sun Devil Giving Day, ASU’s university-wide annual day of giving, the School established our first Charter Award Scholarships. The Charter Awards are granted annually

to twelve SFIS students who, through their academic achievements, extracurricular activities and leadership, demonstrate the values of access, excellence, and impact as outlined in the ASU Charter. Scholarship recipients include **first-generation**

college students, tribal community members and international students.

Furthermore, 75% of awardees were women. This new tradition is a school-wide celebration of our students’ achievements and the direct impact of philanthropy on student success.

Empowering Our Students



“Receiving the Charter Award enabled me to participate in a ten-day study abroad experience, where I could apply course concepts taught in the Global Technology and Development program, to real-world experiences in the field.”

—Kristen Linzy, GTD ‘18



“The HSD Charter Award was an unexpected and appreciated acknowledgment of my current work. I am grateful to be recognized for my international research collaborations. I want to expand these opportunities inside the program with my classmates and colleagues to highlight what it means to be an SFIS grad student in communities outside of Arizona.”

—Martin Perez Comisso, HSD PhD Student



“I feel pride and confidence knowing that SFIS appreciates my work and recognizes my potential as a scholar in Science and Technology Policy. This award has spurred me to reach out further to meet faculty and professionals who contribute to my ability to serve the communities around me through activism and science.”

—Jessica Givens, MSTP ‘19

School for the Future of Innovation in Society