

2015/16

Annual Report



**Center for
Science and the
Imagination**

**Arizona State
University**

CSI Publications 2015-16

Scholarly Publications

Bennett, M. & Richards, L. (2015, October). Fluxing futures: A practitioner's guide to probable near-term developments in publicity rights law. *Vanderbilt Journal of Entertainment & Technology Law*.

Bennett, M., Bowman, D., Dijkstra, A. (2016). Foreword. In D.M. Bowman et al., *Responsibility and emerging technologies: Experiences, education and beyond*. IOS Press, 2016.

Finn, E., (2015, November). We can build the future. *Computer*, IEEE Computer Society 48 (11), 90-91.

Halpern, M. K., Sadowski, J., Eschrich, J., Finn, E., & Guston, D. H. (2016). Stitching together creativity and responsibility: Interpreting *Frankenstein* across disciplines. *Bulletin of Science, Technology & Society*, 36(1), 49-57.

Ludlow, K., Bowman, D. M., Gatof, J., & Bennett, M. G. (2015). Regulating emerging and future technologies in the present. *NanoEthics*, 9(2), 151-163.

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 26(2), 582-599.

Books

Finn, E., & Zachary, G. P. (Eds.) (2015, October). *Journeys through time and space: A Tomorrow Project anthology*. Intel Corporation. <http://https://goo.gl/XWpG5r>

Speitz, M. & Eschrich, J. (Eds) (2016, April). *Slow catastrophes, uncertain revivals*. <http://goo.gl/xpPpDo>

Posters and Presentations

Bennett, M. (2015, October). Complex dwelling: Navigating Detroit's 0% interest home repair loan program. Invited Performance-Seminar, *Mike Kelley Homestead*/Museum of Contemporary Art Detroit.

Bennett, M. (2015, December). Afrofuturism: Imagining the future of a black identity. Future Tense, New America, New York, NY. (panelist)

Bennett, M. (2015, November). Some impacts of technological flux on the publicity rights of marginal sports celebrities. Southern University Law Center, Baton Rouge, LA.

Bennett, M. (2015, November). Objective clientele. Society for Social Studies of Science (4S), Denver, CO.

Bennett, M. (2015, October). Better fundraising through science: How National Science Foundation grants can help you support your art. Signal Return, Detroit, MI.

Dalal, M., Wylie, R., & Walker, E. (2016, June). Using a systematic review for cross-theory comparisons. The International Conference of the Learning Sciences, Singapore.

Eschrich, J. (2015, November). Reinterpreting Mary Shelley's *Frankenstein*: The centrality of creativity and responsibility. Society for Social Studies of Science (4S). Denver, CO.

Finn, E. (2015, June) What is imagination? SciFoo Camp 2015. Menlo Park, CA.

Finn, E. (November 2015). Algorithmic culture and the politics of process. Society for Literature, Science, and the Arts (SLSA), Rice University, Houston, TX.

Finn, E. (December 10, 2015). The tyranny of algorithms. Future Tense, New America, Washington, D.C.

Finn, E. (March, 13, 2016). The black box of the present: Computational time in the age of the algorithm. The Contemporary, Princeton University, Princeton, NJ.

Finn, E. (2016, April). MegaCity: Stories and visions for a better future. Mad Scientist Conference, Arizona State University, Tempe, AZ.

Finn, E. (2016, April). Storytelling and climate change. Oxford Literary Festival, Worcester College, University of Oxford, Oxford, United Kingdom.

Finn, E. (2016, May). Monster collaborations: Approaching the *Frankenstein* bicentennial through the humanities and informal STEM learning. HASTAC Conference, Arizona State University, Tempe, AZ.

Finn, E., Wylie, R., & Nagy, P. (2016, May). Frankenstein and transmedia storytelling: Building engagement and efficacy in science, technology, and society. Fourth Annual Conference on Governance of Emerging Technologies: Law, Policy, and Ethics, Tempe, AZ.

Wang, S., Walker, E., & Wylie, R. (2016, June). Analyzing frequent sequential patterns of learning behaviors in concept mapping. 2016 Educational Data Mining Conference, Raleigh, NC.

Wylie, R. (2015, October). Better futures through better dreams: Using the power of collaboration to inspire innovation. Invited speaker. Foresight and Trends, Los Angeles, CA.

Popular Media

Bennett, M. (2015, October 7) ASU expert weighs in on the pros and cons of new trans-pacific partnership. *ASU News*. <https://www.law.asu.edu/content/asu-expert-weighs-pros-and-cons-new-trans-pacific-partnership>

Bennett, M. (2015, December 18) "Star Wars: The Force Awakens" casts diverse actors. *KJZZ 91.5* public radio. <http://kjzz.org/content/240003/star-wars-force-awakens-casts-diverse-actors>

Finn, E. (May 14, 2016) Facebook trending story: the wizard of oz algorithm. CNN. <http://www.cnn.com/2016/05/13/opinions/facebook-trending-humans-behind-the-algorithm-opinion-finn/>

Finn, E. (2015, September 21). The internet of slow things. *Slate*. http://www.slate.com/blogs/future_tense/2015/09/21/delayed_gratification_isn_t_a_bug_of_3_d_printing_it_s_a_feature.html

Wylie, R. (2015, October 22). "Star Wars," "The Martian" show science fiction's role in pop culture. *KJZZ 91.5* public radio. <http://kjzz.org/content/209647/star-wars-martian-show-science-fictions-role-pop-culture>

It has been four years since we launched the Center for Science and the Imagination, and this remains the most amazing and delightful job imaginable. The center continues to grow and mature with new projects and collaborators, and an increasing international profile for cutting-edge, transdisciplinary work.

A sign of this growth is our ability to serve as a host for visiting scholars, students, and practitioners. We were delighted to welcome Brian David Johnson as our futurist in residence for the spring of 2016. Brian is advancing a number of efforts in collaboration with colleagues here at Arizona State University, including the Future of the American Dream and 21st Century Robot projects. Thanks to Brian we also welcomed U.S. Air Force Academy Cadet Ryan Lee for a research project in summer 2015, and we look forward to more visitors in the year to come.

The past year also marked another milestone in terms of externally sponsored research. In the summer of 2015, we began work on a four-year project funded by the Advancing Informal STEM Learning program at the National Science Foundation (Award #1516684). The project is founded on the incredibly successful transmedia myth that is *Frankenstein* (even if you haven't read Mary Shelley's novel, you have worn the costume, seen the movie, or eaten the breakfast cereal). We will use the upcoming bicentennial of *Frankenstein* to engage diverse public audiences around questions of scientific creativity and responsibility as they manifest in contemporary research, from stem cells and bioengineering to artificial intelligence and robotics.

That transmedia award has also made possible two new positions at CSI: we welcomed Bob Beard as our communication and public engagement strategist in October 2015, and Peter Nagy joined the NSF project

team as a postdoctoral fellow in March 2016. In addition to his NSF role, Bob also works to engage the center's communities of attention on the Hieroglyph and CSI sites, as well as at a range of public venues like Phoenix Comicon.

Acclaimed science fiction author Paolo Bacigalupi visited campus this fall as our second Imagination and Climate Futures Lecturer, and his visit prompted conversations that seeded another new initiative: Future Tense Fiction. Several times a year we will publish a piece of original science fiction by a leading author, paired with a response essay from a researcher in a relevant field. Paolo led off the series with a story, "Mika Model," that confronted the challenging moral and legal questions of thinking machines, and the reaction from legal scholar Ryan Calo articulated exactly how science fiction can be beneficial in illuminating a field, even for researchers working within it. The second story in the series will be written by Arthur C. Clarke Award winner and National Book Award nominee Emily St. John Mandel.

These are just a few of the exciting things that happened in the past year. Looking ahead, there are new projects brewing, new books arriving, and new collaborations at every scale of operation. Beginning in July 2016, CSI is formally joining the Institute for the Future of Innovation in Society, and we look forward to working with our new colleagues as well as deepening ties across the university and our far-flung network of imagination.

To the future!

A handwritten signature in black ink, appearing to read 'Ed Finn', with a stylized flourish at the end.

Ed Finn
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Center for Science and the Imagination Annual Report 2015/16

Future of Learning 06

Designing tools to fathom a complex world.

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New platforms for storytelling and conversation.

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Creating visceral experiences of tomorrow.

How can we use shared texts and collective myths to light the spark of imagination and create new opportunities for collaborative, creative learning?



**“The world was to me a secret
which I desired to divine.”**

” Mary Shelley, *Frankenstein*

Frankenstein 200

Mary Shelley's *Frankenstein* is a modern myth: a 200-year-old science fiction story with themes of human creativity, social responsibility, and scientific ethics. Two centuries later, these themes resonate in our technological age. As citizens with access to incredible tools for creation and transformation, we need not only to understand the fundamentals of science and technology, but to develop skills to actively participate in the discussions surrounding these fields. Arizona State University, with a grant from the National Science Foundation (Award #1516684), is taking on this challenge by exploring the implications of the Frankenstein narrative through digital and hands-on activities, inviting deeper conversations about scientific innovation and responsibility.

The project, titled “Increasing Learning and Efficacy about Emerging Technologies through Transmedia Engagement by the Public in Science-in-Society Activities,” will advance novel approaches to the design and development of STEM learning in informal environments, across both digital and physical platforms:

- The Digital Museum: A collection of Frankenstein-related objects from a range of museums, science centers, and archives that enable the public to create and share their own virtual exhibits.
- Frankenstein's Footlocker: A museum kit featuring creative and making activities that promote reflection on related social and ethical issues. Activities will explore emerging technologies such as artificial

intelligence, synthetic biology, robotics, and bioengineering.

- Frankenstein's Workbench: A set of at-home maker activities, online challenges, and competitions involving hands-on science and other creative activities.

Across these multiple engagements, the Transmedia Museum will prompt participants to consider the questions that emerged in Shelley's *Frankenstein* and that persist in contemporary society:

What is life?

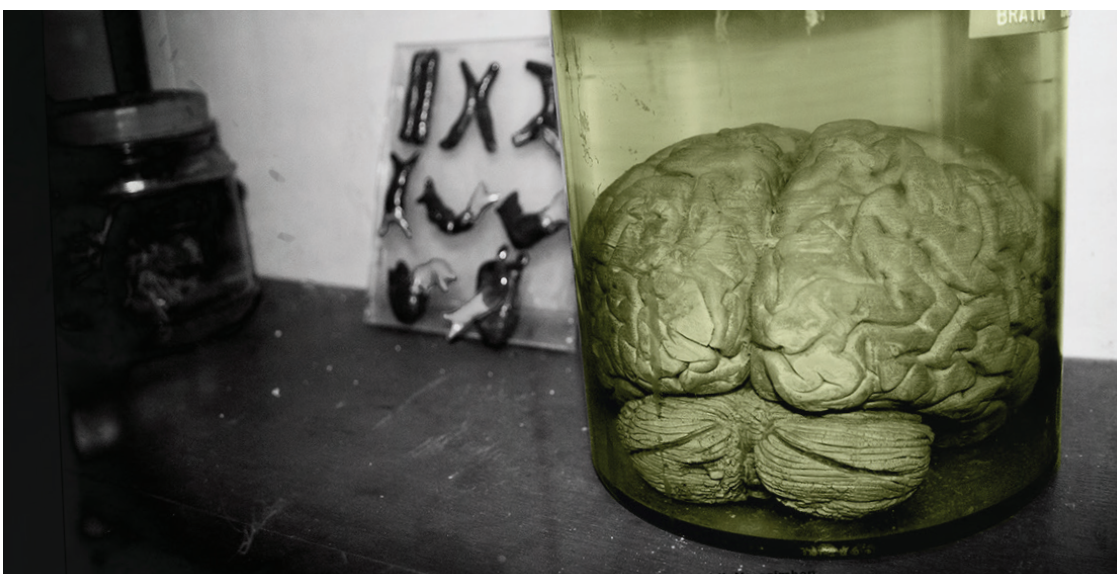
What does it mean to be human?

Why do we create?

In collaboration with an interdisciplinary team of researchers from ASU and advisors from around the nation, we continue to work through these elements, activities, and prototypes to create experiences befitting Shelley's masterpiece.

Partners:

- The Bakken Museum
- The Rosenbach Museum and Library
- Science Museum of Minnesota
- Arizona Science Center
- Mesa i.d.e.a. Museum
- Arizona State Library System
- Children's Museum of Houston
- Scottsdale Cultural Council
- Phoenix Comicon



The Dare

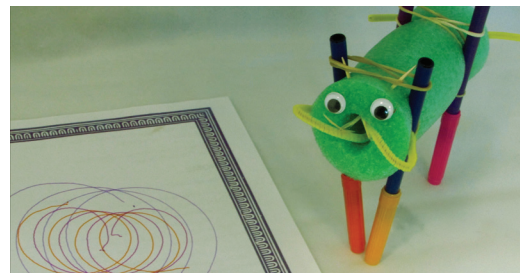
Two centuries ago, on a dare to tell the best scary story, 18-year-old Mary Shelley came up with an idea that became the basis for *Frankenstein*. Shelley's original concept evolved into the novel that helped to kick-start the genres of science fiction and Gothic horror. This idea also birthed an enduring myth that shapes how we grapple with creativity, science, technology, and their consequences.

Two hundred years later, inspired by that classic dare, CSI launched a pair of creative challenges to inspire amateur and professional writers to reflect on questions of science, ethics, creativity, and responsibility.

First, in partnership with National Novel Writing Month and the Chabot Space and Science Center, CSI launched #Frankenstein200, a short fiction contest about unexpected consequences and unintended monstrosities. We received more than 65 entries over a six-week period, which were read and shared by members of the Medium digital community.

Two randomly-selected winning authors received a curated selection of classic and contemporary science fiction books, plus personal feedback from Hugo and Sturgeon Award-winning author Elizabeth Bear.

Second, ASU and *Creative Nonfiction* magazine are hosting "Dangerous Creations," a long-form nonfiction competition that challenges authors to document true stories about the evolving relationships between humans and technology. Winners will be announced in 2017 and will have their work featured in an upcoming issue of *Creative Nonfiction*. Two runners-up will be awarded \$2,500 each, and the grand prize winner will receive \$10,000.



The Scribbler, a hands-on science and ethics activity, raises challenging questions about creativity and responsibility.



"Frankenstein at 200" exhibit at ASU's Hayden Library.

Frankenstein Critical Edition Advisory Board Workshop

On May 14-15, 2015, CSI convened a group of scholars, writers, and archivists to explore the potential of Mary Shelley's *Frankenstein* as the testbed for an innovative new publishing experiment. Over the course of two days, Imaginary College Fellow Corey Pressman and a small team of his colleagues from the media consultancy Neologic facilitated a workshop, which included representatives from ASU and several other institutions, including Torie Bosch of *Slate* magazine, Elizabeth Denlinger of the New York Public Library, and celebrated *Frankenstein* scholar Charles E. Robinson.

The goal of the workshop was to plan a new critical edition of *Frankenstein* designed to engage scientists and engineers in thinking

about the ethical and social dimensions of their work through the lens of Shelley's landmark novel. Through a series of design exercises, the group identified potential users and reading scenarios, with an emphasis on potential classroom and informal learning applications. The "blue-sky" design document that emerged from the process will serve as an important reference point as the critical edition project moves forward in both print and electronic media. The workshop was supported by a grant from the National Science Foundation (Award #1354287) as well as by CSI, the School for the Future of Innovation in Society, and the Lincoln Center for Applied Ethics.

Caring for the Future at the HASTAC Conference

We often imagine our technological future as a fixed point towards which we are hurtling uncontrollably. But the future is not a matter of destiny – instead, it's a spectrum of possibilities, shaped by countless decisions at scales ranging from grand public policy deliberations to momentary personal preferences.

Technology journalists and humanities scholars are increasingly orienting their work toward understanding our prospects for the future, treating the future as a space for inquiry, civic discourse, and principled intervention. Their journalistic and scholarly projects are not just efforts to interpret the future, but also to prepare citizens and learners to be active agents in shaping it.

In May 2016, CSI presented “Caring for the Future: Interventions at the Nexus of Technology and Society,” a panel at the 2016 HASTAC (Humanities, Arts, Science, and Technology Alliance and Collaboratory)

conference at ASU's Tempe campus. The panel explored what technology journalists and humanities scholars can learn from one another and how their work might mutually foster more inclusive and informed public conversations about technological change and its effects on societies and cultures.

Featured speakers included Torie Bosch, editor of the Future Tense channel at *Slate* magazine; Ron Broglio, associate professor of English and senior sustainability scholar at ASU; Ed Finn, director of CSI; and Will Oremus, senior technology writer at *Slate*.



"Caring for the Future" panel at the 2016 HASTAC conference.



Materials from a study to understand the different ways that students engage with learning materials.

Postdigital Textbook

In its final year, the Postdigital Textbook Project, funded through NSF's Cyberlearning Program (Award #1451431), made progress in developing a framework for designing the future of digital textbooks that incorporates: 1) student and teacher goals, 2) affordances of learning materials and technologies, and 3) theoretically productive student behaviors. Developing the framework integrated the work of three activities: synthesis of the literature, user-centered design, and prototype development.

Medha Dalal, a graduate student in the Mary Lou Fulton Teachers College, conducted a multitheoretical literature review to identify theoretically productive student behaviors. Drawing from eight perspectives (e.g., knowledge building,

inquiry learning, sociocultural), Dalal extracted student behaviors that correlated with increased learning and synthesized the results to develop a list of recommended behaviors for educational interventions. These behaviors include peer discussion, generating explanations, and developing concept maps. A poster describing the literature review process and preliminary results was presented at the International Conference of the Learning Sciences.

Josh Gigantino, a graduate student in the School of Arts, Media and Engineering, conducted user-centered design activities. The first was a two-week diary study with high school students to better understand where and when students do homework (e.g., at home, on the bus, with friends,



Wheels used to explore learner relationships with different modes of study.

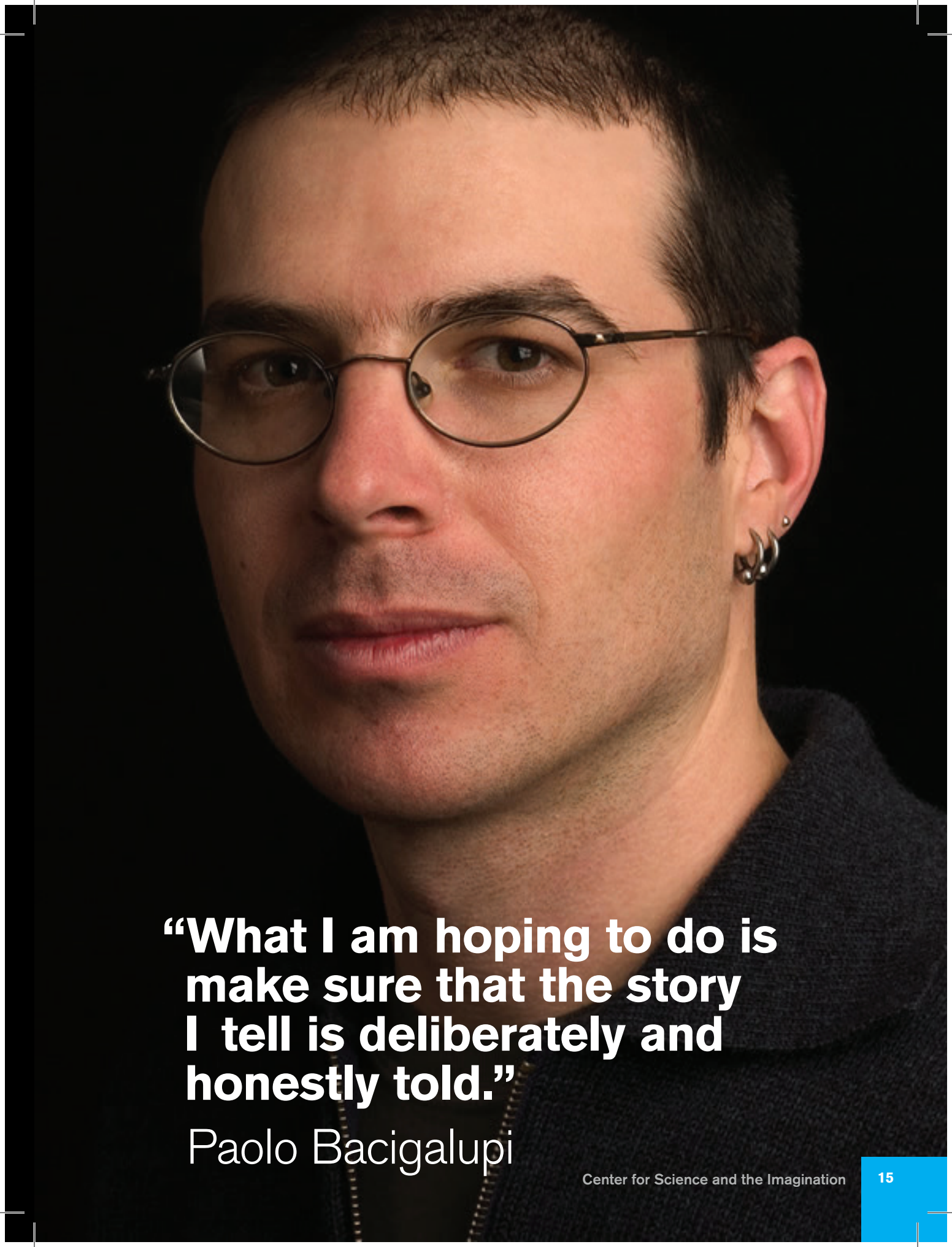
independently). Gigantino also ran design workshops to assess what students want from educational technologies. In one workshop, students wrote love letters and breakup letters to their favorite and least favorite learning materials. In another, students created collages to represent their experience with different learning materials. Results from these workshops led to the understanding that students desire systems that are easy to use and help them manage their time well. Students frequently expressed frustration about timed in-class activities and other assignments perceived as “busy work.”

Shang Wang, a graduate student in the School of Computing, Informatics, and Decision Systems Engineering, integrated results from the literature synthesis and

user-centered design activities to create two features for our postdigital textbook prototype. The first allows concept-mapping activities to be integrated into textbook content through the addition of hyperlinks and improved navigation. The second adds collaborative Q&A to the student experience. We are using results from a weeklong study at a local high school to iteratively refine the features and prototype.

By combining learning theories, student needs, and prototype development, we are advancing the project goals of developing a framework that explores how technological affordances interact with student and teacher goals in complex classroom environments.

How can we harness imagination as a resource for confronting our biggest problems? How can we tell new stories that inspire hope, agency, and ambition?

A close-up portrait of Paolo Bacigalupi, a man with short dark hair, wearing round glasses and a dark jacket. He has a small hoop earring in his left ear. The background is dark.

**“What I am hoping to do is
make sure that the story
I tell is deliberately and
honestly told.”**

Paolo Bacigalupi



Illustration for Neal Stephenson's "Atmosphaera Incognita," by Haylee Bolinger. Originally appeared in *Hieroglyph: Stories and Visions for a Better Future*.

Hieroglyph

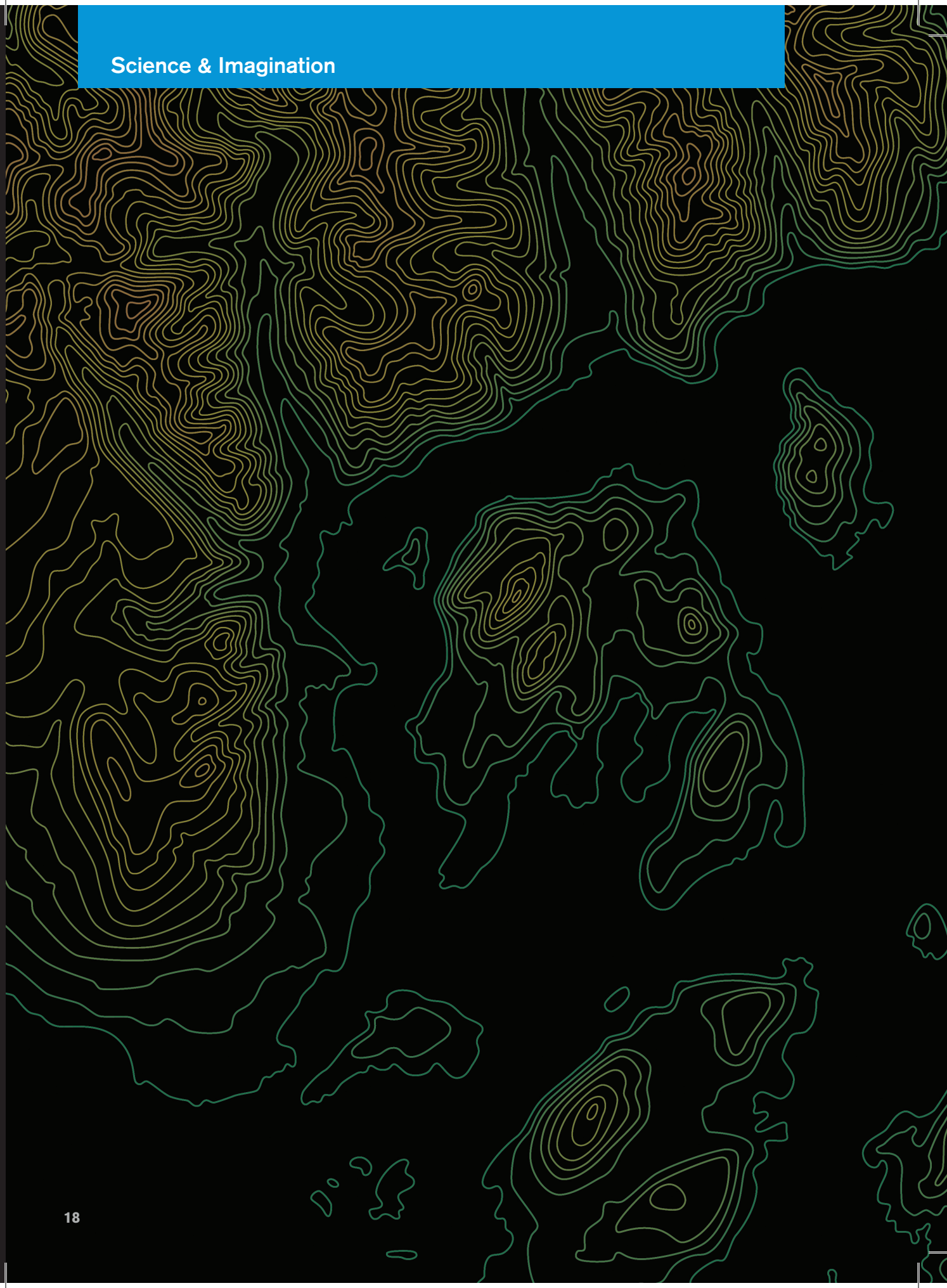
Project Hieroglyph remains the backbone of our work at the Center for Science and the Imagination. Neal Stephenson's original call for inclusive, plausible, and hopeful visions of the future is an intellectual foundation for all of our projects, and exciting new endeavors are just around the corner.

Over the past year, Hieroglyph has been recognized for its contributions to the public discussion around scientific literacy and innovation. The White House Office of Science and Technology Policy cited Hieroglyph as an example of how science fiction can inspire new scientific and technological breakthroughs. Our anthology, *Hieroglyph: Stories and Visions for a Better Future*, earned a "Most Significant Futures Work" award from the Society of Professional Futurists, who declared that the book demonstrated "an interesting blend of futures purposes with fiction...with potential for broad dissemination."

In 2016, Hieroglyph's influential method of bringing together top science fiction authors, scientists, engineers, and other experts to collaborate on research-based stories set in the near future was reflected in similar projects from Microsoft Research and the Electronic Frontier Foundation. Meanwhile, our own anthology has been adopted in classrooms in Arizona and nationwide.

One particularly exciting educational experiment with Hieroglyph is "Slow Catastrophes, Speculative Futures, Science & Imagination: Rewriting and Rethinking Sustainability," a course designed and taught by Dr. Michele Speitz at Furman University in South Carolina. During the semester, students read and discussed stories from the Hieroglyph anthology, along with scholarly readings on sustainability, ecocriticism, international development, and ecology. Based on these sources, students created their own speculative fiction tales. We published these stories in a new anthology titled *Slow Catastrophes, Uncertain Revivals*, and offered it for free under a Creative Commons license. This collection reinforces the original goal of Hieroglyph, addressing the challenges of a rapidly transforming world while imagining possibilities for humans to adapt and thrive within it.

Science fiction storytelling is a powerful engine for catalyzing the public's dreams and demonstrating that a better future is within reach. As people continue to engage with scientific topics and bring their own big ideas into the conversation, Hieroglyph will answer the call and provide a platform that amplifies and crystallizes those ideas.



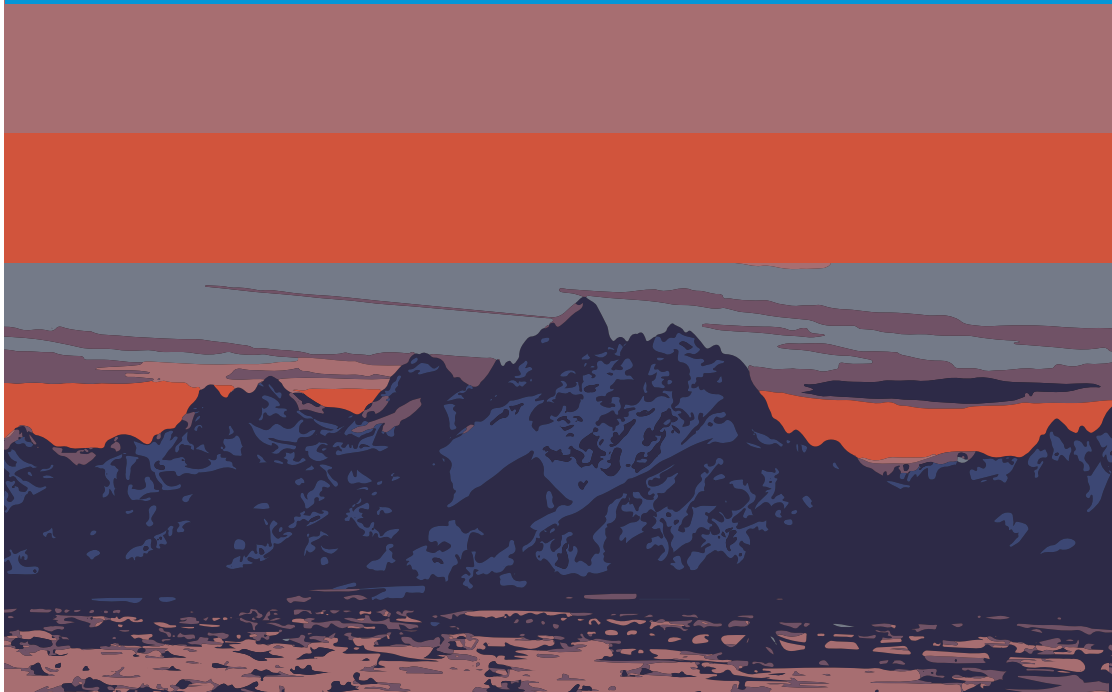


Matter's Climate Fiction Series

From H. G. Wells' *The Time Machine* to Toho's *Godzilla*, science fiction can herald a change in our collective understanding of the world. Time and again, the genre has provided us guideposts as well as cautions to help navigate the path forward. Climate fiction is beginning to fulfill this dual role of helpful guide and early warning signal. Climate fiction, like the Victorian and Atomic Age analogs mentioned above, asks readers to imagine and react to a future shaped by forces on a global scale—in this case, the disruption of ecological and social systems through climate change and other forms of environmental degradation.

In summer 2015, we were proud to work with science fiction luminary Margaret Atwood and the digital magazine *Matter* on a series of short stories and essays designed to communicate the dangers of climate change while helping readers think through issues and look for solutions. The collection featured new work by Atwood and a number of talented authors, scientists, and reporters, including frequent CSI collaborators Bruce Sterling and Charlie Jane Anders as well as CSI director Ed Finn, who wrote an essay titled "Imagining Climate."

Artwork for the 2016 Climate Fiction Short Story Contest, by Matt Phan.



Artwork for the 2016 Climate Fiction Short Story Contest, by Ariel Shamas.

Climate Fiction Short Story Contest

The challenge of climate change is that it's gradual: a pervasive, creeping calamity that can be difficult for people to accept or comprehend. But what if people could understand it better by escaping their everyday realities?

Speculative fiction stories have the power to take policy debates and obscure jargon and turn them into gripping, visceral tales. The emerging subgenre of climate fiction helps us to imagine futures shaped by climate change in human terms.

In September 2015, ASU's Imagination and Climate Futures Initiative partnered with the College of Liberal Arts and Sciences Dean's Council to invite writers to submit short stories that explore climate change, science, and human futures for its first Climate Fiction Short Story Contest. Successful entries envisioned futures for Earth and humanity transformed by

climate change, and reflected current scientific knowledge about climate change and its consequences for human societies and the environment. We were particularly interested in stories that illuminated political, ethical, and technological challenges that individuals and communities must confront in the face of climate change.

The contest received over 740 entries from 67 countries, and a majority of states in the U.S. were represented in the submissions. Our interdisciplinary panel of judges, led by science fiction legend Kim Stanley Robinson, will select 12 stories to be collected in a free digital anthology to be released in fall 2016. One grand prize winner will be awarded \$1000, with runners-up receiving book bundles signed by award-winning climate fiction author and Imagination and Climate Futures lecturer Paolo Bacigalupi.

Ocean Trash Write-Away

Every sea on Earth is plagued by massive amounts of trash. Refuse in the ocean kills hundreds of thousands of birds and marine mammals each year, and hazardous heavy metals bind to plastic particles and enter our food chain. According to a study published in the journal *Science* in 2015, between 4.8 and 12.7 million metric tons of plastic entered the world's oceans in 2010 alone.

The Ocean Trash Write-Away contest, presented in partnership with Sapiens Plurum and Ocean Conservancy, challenged writers ages 25 and under to imagine solutions to this global challenge and write inspiring short stories about futures where we've turned the tide on

ocean trash. Submissions were due on September 19, 2015, which just happened to be both International Coastal Cleanup Day and International Talk Like a Pirate Day.

The winner of the contest was Hannah Krieger, an emerging writer and editor from Kentucky. Hannah's story "And the Predator Is..." imagines how artificial intelligence might play a crucial role in combating ocean pollution. As part of Hannah's prize, she visited CSI as a special guest in April 2016; during her visit, she attended the Emerge festival, participated in ASU classes on poetry and sustainability, and met with creative writing professionals and educators.



Trash and debris washed up on the coast of Northern California.



Paolo Bacigalupi: Imagination and Climate Futures Lecture 2015

In Paolo Bacigalupi's most recent science fiction novel, *The Water Knife*, Phoenix is dried up and California and Nevada are not too far behind. The millions of people who rely on the Colorado River to survive are not only thirsty, but fighting for their lives. It's a compelling story that captures a not-so-distant future. Will Phoenix eventually collapse? Will the river run dry?

Bacigalupi visited ASU in September 2015 as the annual lecturer for the Imagination and Climate Futures Initiative to share the inspiration and research behind *The Water Knife*, and to discuss how he uses creative writing to imagine the future of the U.S. Southwest. Bacigalupi was the second annual lecturer for the initiative, following renowned author and activist Margaret Atwood.

Bacigalupi's lecture was titled "The Imagination Drought: Speculative Fiction as a Tool of Warning and Empowerment." During his visit, he also spoke with students and faculty at the Virginia G. Piper Center for Creative Writing and participated in a workshop, titled, "Art, Science, and Imagination—Developing Transdisciplinary Research and Teaching to Shape the Future." Bacigalupi also sat down with CSI's Ed Finn for a video interview to explore the details of his craft as a climate fiction storyteller. The conversation ranged from the power of specialized language and how to evoke an emotional response in readers, to fiction's special ability to change our thinking about complex global issues like climate change.

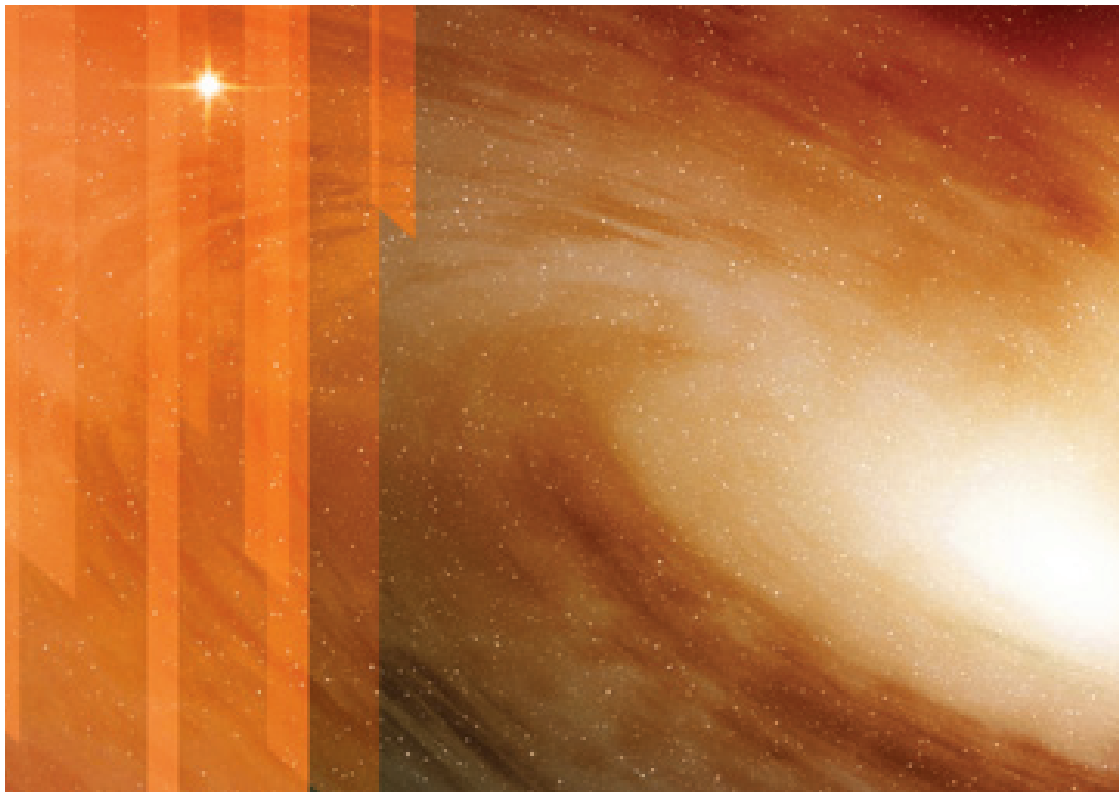
Tomorrow Project USA

Tomorrow Project USA is a collaboration with Intel and the Society for Science & the Public that ignites creative, productive, science-based conversations about the future. The project publishes anthologies featuring original stories, essays, and artwork created by K-12 and college students, distributed for free online and in print. CSI coordinates an editorial board of leading researchers, journalists, and scholars, and each anthology is co-edited by director Ed Finn and Imaginary College member G. Pascal Zachary.

In 2014-2015, we published three anthologies: *The Future: Powered by Fiction*; *Dark Futures*; and *Living Tomorrow*. This year we published the fourth and final anthology, *Journeys through Time and Space*, featuring stories drawn from a

pool of 274 submissions to our “The Future: Powered by Fiction” competition. The competition was truly global in scope: we received submissions from 15 countries and 36 U.S. states.

Journeys through Time and Space was released in October 2015, during the United Nations' World Space Week. Its 11 stories explore futures shaped by daring excursions through space and time, and into the labyrinthine caverns of the human mind. The anthology also features an essay by planetary scientist Jim Bell, a professor in ASU's School of Earth and Space Exploration, director of the NewSpace Initiative, and president of The Planetary Society, the world's largest public space advocacy organization.



Cover art for Tomorrow Project USA's *Journeys through Time and Space*.



Illustration of a robot comforting a human, by Ariel Shamas in collaboration with Corey Pressman.

Poetry for Robots

“Metaphor is not, and never has been, a mere literary term. It is an event.”

— Mary Reufle

We understand the world through metaphor. Our minds seek and spin patterns and connections, likenesses, and equations. Biologist and anthropologist Gregory Bateson observed that metaphor is “how the whole fabric of mental interconnections holds together. Metaphor is right at the bottom of being alive.”

The most effective and explicit specimens of metaphor are found in poetry. Weaving metaphors into poems is an age-old and far-flung human act: we see and search the world with a poetic mind.

Why, then, do we search online image banks with such literal terms? Because the robots haven’t been taught our poetry. They only know the technical EXIF metadata and whatever descriptive adjectives they’ve

been begrudgingly fed by underpaid (or unpaid) interns. But what if we wrote poetry for the robots? What if we used poetry and metaphor as metadata? Would a search for “eyes” return images of stars?

Poetry for Robots (poetry4robots.com) is a digital humanities experiment devised by Imaginary College member Corey Pressman at the creative agency and imagination lab Neologic and sponsored by CSI and WebVisions, a design and technology conference. The experiment has captured the imagination of the press and industry alike: Corey was invited to present the experiment at Google, and the project was covered in *The Guardian*, *Vice*, *The Huffington Post*, and other outlets.

Our aim is to continue the experiment, gather more poems, and find ways to apply what we learn to interactive contexts like search and shopping. Also, look for a special Frankenstein version of Poetry for Robots in 2018!

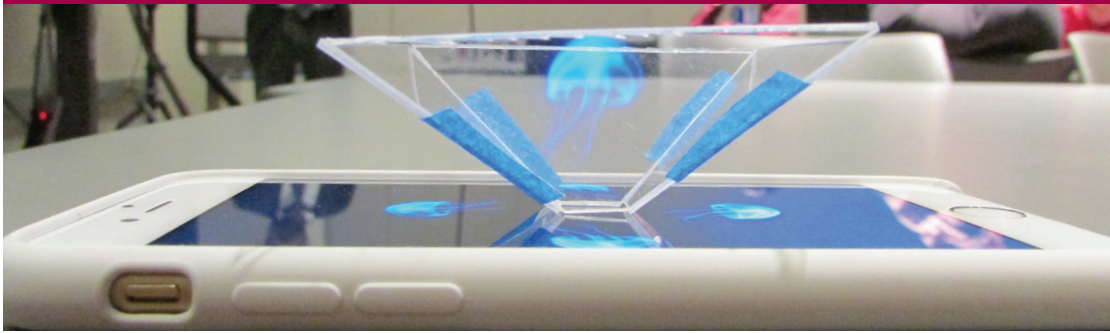
How can we teach imaginative thinking? What are the practices, the big ideas, and the learning experiences students need to become resilient thinkers and makers?

Students seated in a circle for group discussion in the Spring 2016 course "Science Fiction Studio."

**“Somewhere, something
incredible is waiting to
be known.”**

Carl Sagan





Students explore new types of technology, such as DIY 3D projection.

Science Fiction Studio

“A good science fiction story should be able to predict not the automobile but the traffic jam.”

– Frederik Pohl

Our Science Fiction Studio course teaches students how to prototype new technologies inspired by science fiction and share their own stories of the future through the things they create. The class was first offered during the spring 2016 semester.

In this initial offering, students drew inspiration from Neal Stephenson's science fiction classic *The Diamond Age: Or, A Young Lady's Illustrated Primer*. The course was directed by Imaginary College member Corey Pressman, and taught by CSI's Ed Finn and Ruth Wylie, with Erin Walker of ASU's School of Computing, Informatics and Decision Systems Engineering. The class contextualized the fictional world of *The Diamond Age* in terms of educational theory, recent developments in educational technology, and science fiction storytelling.

During the semester, Science Fiction Studio hosted several exciting guest

speakers, including MacArthur Fellow Liz Lerman of ASU's Herberger Institute for Design and the Arts, digital anthropologist Pamela Pavliscak of Change Sciences, and other guest speakers from the cutting edge of technology and prototyping, including representatives from Google and the Metropolitan Museum of Art's MediaLab.

Students worked in groups to prototype new technologies and described their utility and impact by writing their own short stories. Each three-week design cycle culminated in a friendly contest, judged by the instructors and guest speakers.

Prototypes produced by Science Fiction Studio students included HoloBuddy, a virtual reality AI-driven personal assistant; ARIES, a dance-recognition and interactive choreography tool; and careAsell, a global system of 3D printer kiosks that print on-demand necessities for travelers.

The course is currently being retooled for online delivery, so it can be deployed more broadly to train students and professionals in the powerful practice of science fiction prototyping.

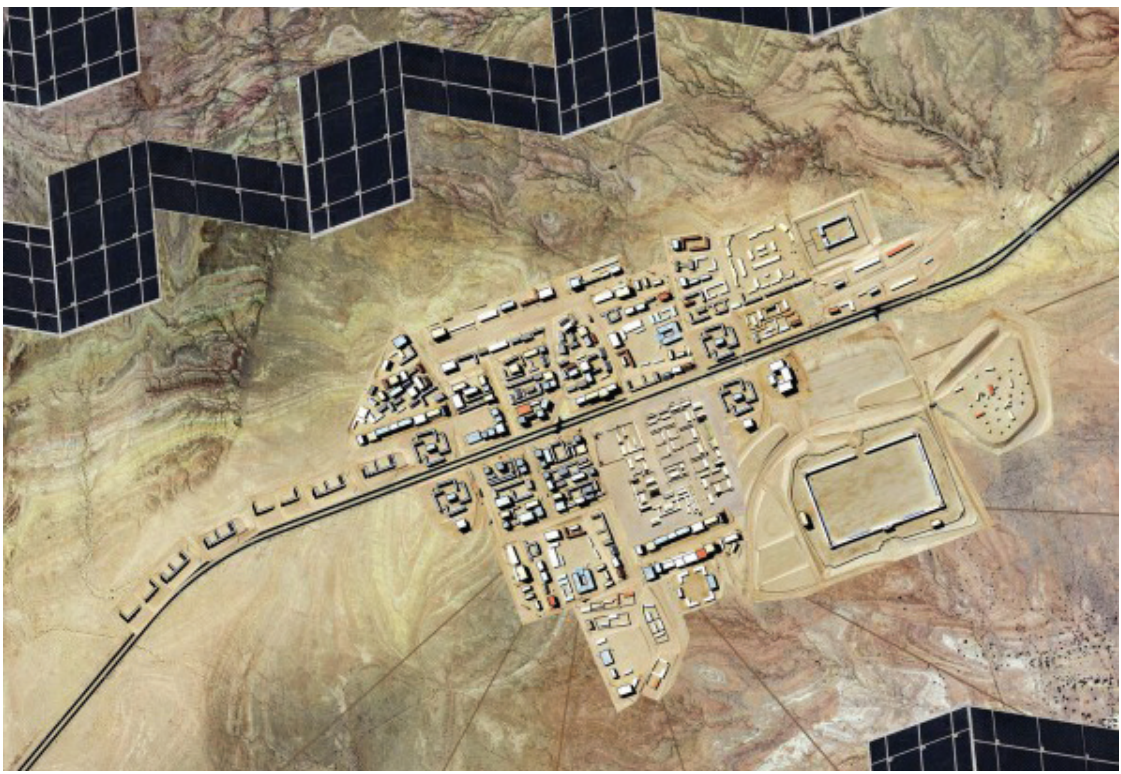


Illustration of an imagined desert city of the future, by Daniel Leivick. Originally appeared in *Hieroglyph: Stories and Visions for a Better Future*.

The History of the Future

Visions and predictions of the future are artifacts of particular times and places: they often tell us more about the hopes, values, anxieties, and prejudices of their creators than about how the future will actually turn out.

The History of the Future is an interdisciplinary course designed by Paul Hirt, professor of history and senior sustainability scholar, and CSI's Joey Eschrich. It was taught during the spring 2016 semester through ASU's School of Sustainability and Department of History. The course is a follow-up to "Arizona 2050," a spring 2015 graduate seminar that challenged students to create stories about the future of Arizona, grounded in actual research.

The History of the Future examined a diverse set of visions of the future – ranging from philosophical tomes and policy reports to science fiction novels

and Hollywood films – crafted by people from different times, places, and walks of life. The course considered the values, assumptions, and ideologies underlying these imagined futures. Students also applied critical perspectives on how societies—both past and present—envision the future, and wrote imaginative visions of their own. The course focused especially on issues of sustainability, the environment, and urban form, which pervade both historical and contemporary thinking about our collective prospects for the future.

Many students chose to focus their research and storytelling work for the class on the future of Arizona, including issues like immigration and migration; the nexus of water, energy, and food resources against the backdrop of drought-afflicted desert ecosystems; and the potentially devastating effects of climate change on communities and wildlife.

What is the Future of the American Dream?

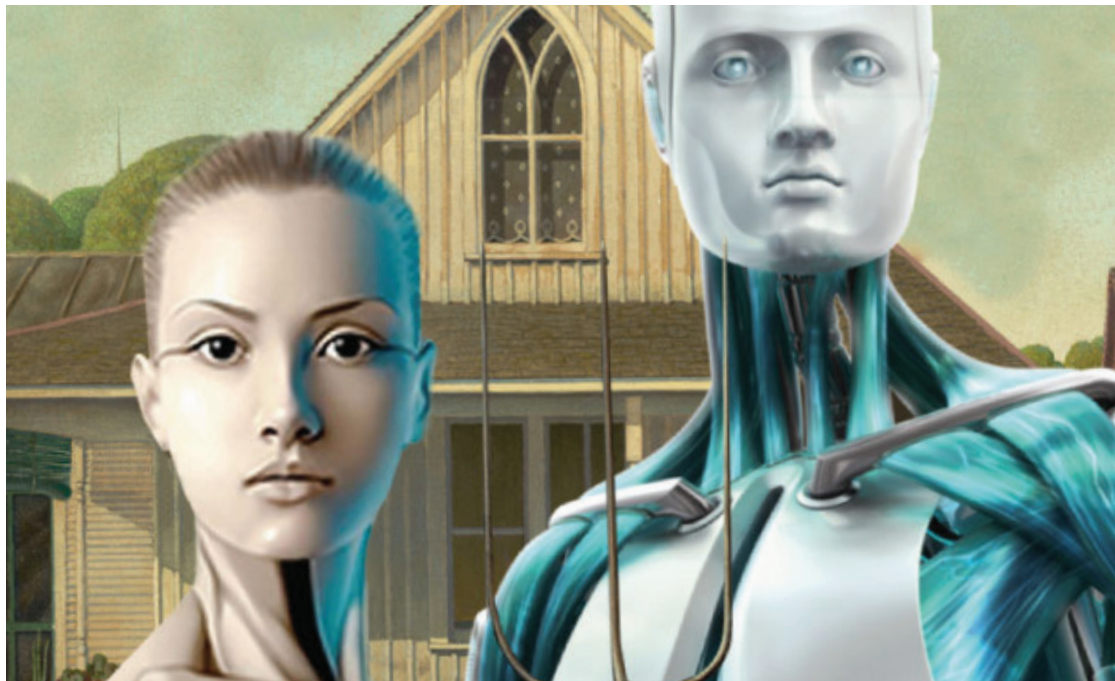
Stories are powerful tools for making sense of the world. This project explores one of the most powerful stories ever: The American Dream. But CSI is taking a different approach. We aren't only exploring the history of the American Dream and the present state of the nation—we're asking, "What's the future of the American Dream?"

Brian David Johnson, our futurist in residence, has learned that the way to change the future is to change the story people tell themselves about the future they will live in. When he started asking people about the future of the American Dream, it seemed that America was suffering from a lack of a dream, a deficit of imagination. He found a void where the American Dream used to be.

Throughout 2016, the Future of the American Dream team has traveled to

half of the fifty states to hold town halls. Some people told us that the American Dream was alive and well, a shining light on a hill to guide us. Others said that the American Dream was irrelevant and had lost its meaning. "What's the future of the American Dream?" has turned out to be a good launchpad for deeper conversations.

We've collected the stories on our website (futureoftheamericandream.com), we've captured our journey in a documentary series, and we're building a Town-Hall-in-a-Box app so everyone can participate in the conversation. Next we're partnering with the Smithsonian Institution on a four-city tour (with stops in Washington, D.C., Los Angeles, and Detroit) to hold larger town halls that will engage groups of people in inclusive civic conversations.





Media Literacies and Composition

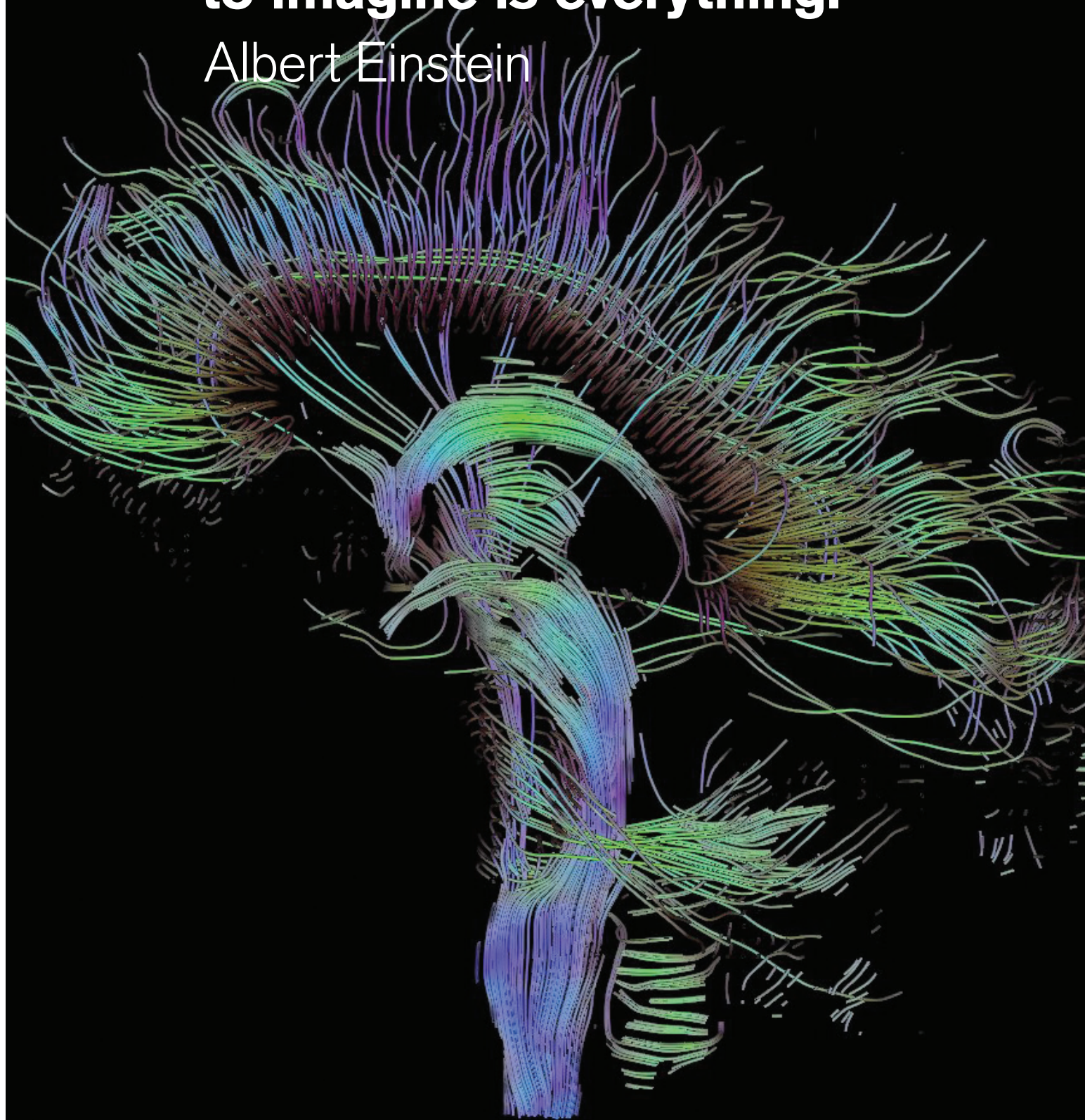
When we integrate computational systems into the core of our cultural and social practices, we reinvent how we tell stories. The roles of creators, critics, and audiences are blurring at the same time that digital tools allow us to infinitely reproduce and remix narratives, radically changing what we mean by the “work” or “text.” These new media platforms empower us to create, share, and respond to cultural narratives that defy traditional notions of how stories

operate, demanding new literacies. This is the topic explored by undergraduate Digital Culture students enrolled in Ed Finn’s Spring 2016 course, Media Literacies and Composition. Throughout the course, students individually and collectively created projects on the future of reading and creative experience in a range of media, culminating in the presentation of their own digital media narratives at the end of the semester.

How can we bring together the world's most imaginative and ambitious thinkers about the future? How do we invite everyone into those conversations?

**“To know is nothing at all;
to imagine is everything.”**

Albert Einstein



Fellows of the Imaginary College



Michael G. Bennett



Corey Pressman



Erin Walker



Phil Weaver-Stoesz



Manjana Milkoreit



Hannah Star Rogers



Jonathon Keats



Brenda Cooper



Megan Halpern



Dehlia Hannah

Imaginary College

The Imaginary College is a group of outstanding creative thinkers, researchers, practitioners, and mad geniuses that represents one of the core missions of the Center for Science and Imagination: to seek out intelligent life wherever it

resides in the universe, and to get it on our side. Through the Imaginary College, CSI partners with and celebrates the individuals and groups who are already advancing our mission of fresh, creative, and ambitious thinking about the future.

Philosophers



Margaret Atwood



Paolo Bacigalupi



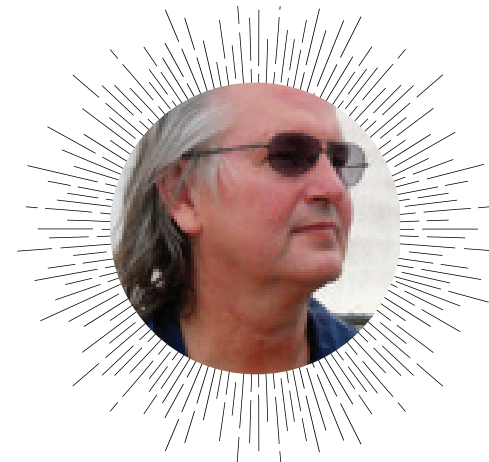
Kathryn Cramer



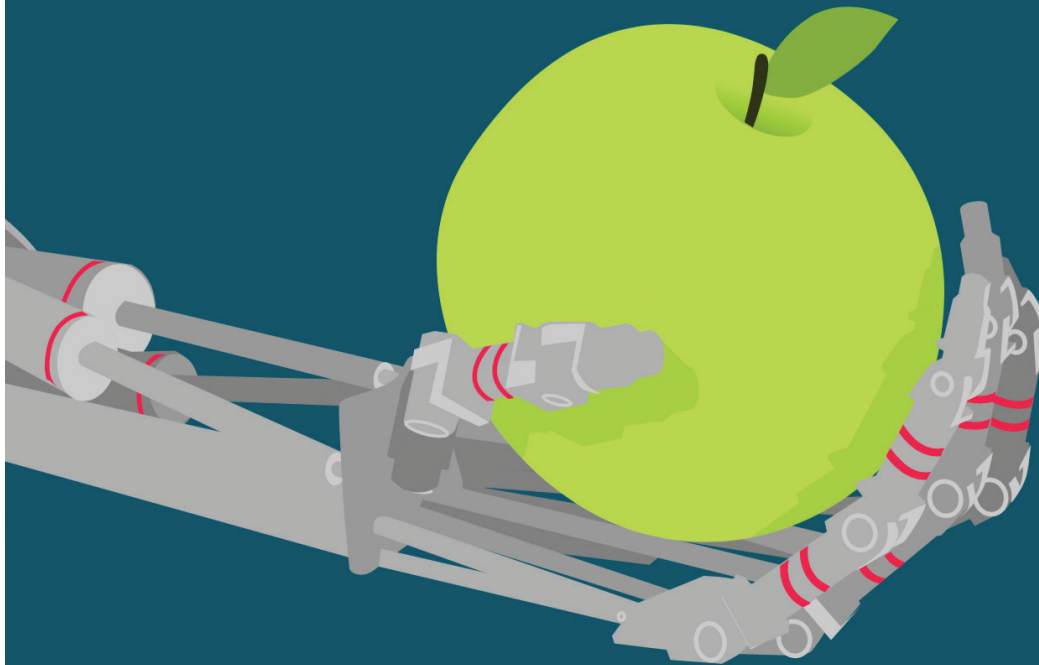
Don Marinelli



Neal Stephenson



Bruce Sterling



Future Tense

Future Tense is the citizen's guide to the future.

A partnership of *Slate*, New America, and Arizona State University, Future Tense explores how emerging technologies will change the way we live. The latest consumer gadgets are intriguing, but we focus on the longer-term transformative power of robotics, information and communication technologies, synthetic biology, augmented reality, space exploration, and other technologies.

Future Tense seeks to understand the latest technological and scientific breakthroughs and what they mean for our environment,

how we relate to one another, and what it means to be human. We also examine whether technology and its development can be governed democratically and ethically. We ask these questions in daily commentary published on *Slate* and through public events in Washington, D.C., New York, and other major cities featuring conversations with leading scientists, technologists, policymakers, and journalists.

CSI acts as a hub for Future Tense at ASU, working to involve more faculty, staff, and students in the partnership and exploring how to connect Future Tense more deeply to the university's research and outreach efforts.

Futurography

It's difficult to talk about the future. Many of the technologies and scientific breakthroughs that appear to be on the horizon never come to fruition, or will be markedly differently than we imagined. (Hoverboards, anyone?) And the conversations about any development with a science-fiction flavor tend to be polarized: A new technology will save the planet and make us all rich! No, it will doom the environment and give all our jobs to robots!

That's why Future Tense, a partnership between ASU, *Slate*, and New America, created Futurography. Future Tense aims to be the citizen's guide to the future, a place to explore emerging technologies and their implications for policy and society. But we decided it was time to get a little more fundamental. Futurography combines the storytelling techniques of journalism and the instructive capacity of a massive open online course (MOOC) in an effort

to educate readers about the technologies that will define tomorrow.

Each month-long installment of Futurography includes a bevy of articles from experts along with supplementary materials like quizzes, surveys, interactive elements, videos, and even the occasional science fiction story.

The Futurography packages for this, our inaugural year, were:

January 2016: Geoengineering

February 2016: Algorithms

March 2016: Cyberwar

April 2016: Artificial Intelligence

May 2016: Drones

June 2016: Self-Driving Cars







Illustrations by Lisa Larson-Walker for Paolo Bacigalupi's story "Mika Model."

Future Tense Fiction

In April 2016, CSI launched a new experiment with the Future Tense channel at *Slate*: a regular series featuring original science fiction stories by well-known authors. We launched Future Tense Fiction with a story by climate fiction author Paolo Bacigalupi, whose tightly scripted "Mika Model" imagines the moral and legal consequences of autonomous, intelligent robots run amok. Each Future Tense Fiction story will be paired with a response essay from a researcher or technical expert;

Bacigalupi's story was published alongside a short essay by robotics law scholar Ryan Calo. Calo's response essay beautifully (and without our prompting) described how "Mika Model" achieved one of science fiction's most powerful roles: giving him an insight into his own professional field that he might not otherwise have discovered. Future Tense Fiction stories will appear approximately once a quarter.



Generative artwork by Jared Tarbell created using a repetitive algorithm.

The Tyranny of Algorithms

Algorithms are learning more and more about us while we seem to understand them less and less. Somewhere in the past few years, we ceded some of our individual autonomy to ostensibly life-enriching algorithmic intelligence. Computational systems regularly tell us where to go, whom to date, what to be entertained by, and what to think about. With every click, every app, every terms of service agreement, we buy into the idea that big data, ubiquitous sensors, and various forms of machine learning can model and beneficially regulate our lives.

Algorithms drive the stock market, compose and curate our music, approve loans, drive cars, write news articles, and make hiring and firing decisions. Are they in charge?

On December 10, 2016, Future Tense hosted “The Tyranny of Algorithms” in Washington, D.C. At this public event, CSI director Ed Finn discussed the future of our increasingly algorithmic culture with journalists, scholars, engineers, science fiction authors, policy analysts, and legal experts.

Imaginary Papers

Imaginary Papers is CSI's newly-revitalized blog, hosted on the social writing platform Medium and co-edited by CSI's Joey Eschrich and Corey Pressman, a member of the center's Imaginary College.

Imaginary Papers imagines, negotiates, analyzes, and speculates playfully about the relationship between humans and our technology, with a particular focus on the future, especially the near future. We're interested in the way the past and present

inform our vision of the future. We want to explore our relationships with technology from the beginning of history to the end.

We publish essays, micro-fiction, meanderings and half-baked ideas, manifestos and screeds, art, photography, interviews with those who toil in the borderlands between technology and culture, and more.







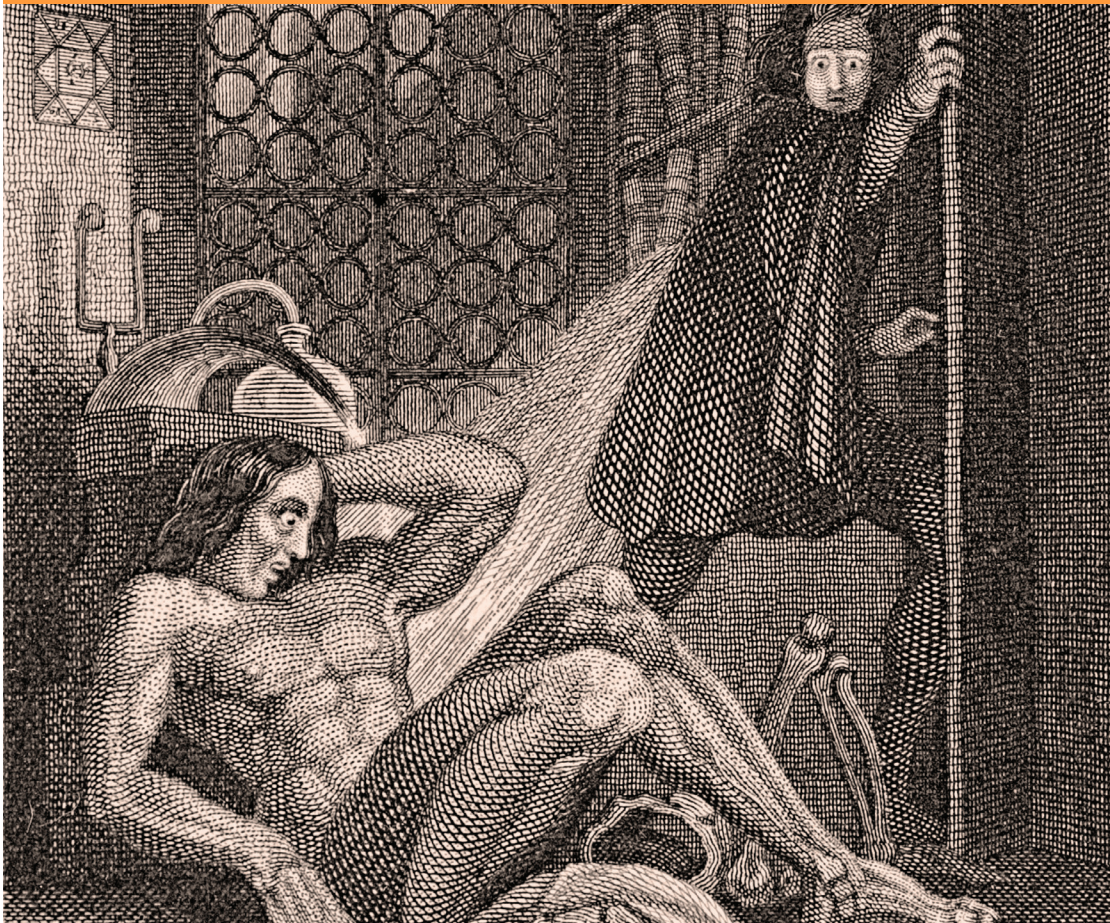
Brian David Johnson at ASU

Renowned futurist, technologist, and author Brian David Johnson, who left his position at the Intel Corporation in January 2016, joined ASU as futurist in residence at the Center for Science and the Imagination and as a professor of practice in the School for the Future of Innovation in Society. Johnson had worked at Intel and collaborated with a variety of private-sector partners since 2002, and was named the corporation's first futurist in 2009.

Johnson used his appointment at ASU in 2016 to lead two exciting projects of great public interest designed to ignite new conversations about the future we're building together: Future of the American Dream and 21st Century Robot.

Johnson's residency afforded faculty, students, and the public greater access to a working applied futurist through guest lectures, media outreach, publishing in IEEE's *Computer* magazine, *Detroit News*, and other venues, and public events including the Mackinac Policy Conference in Detroit.

Brian David Johnson talking with students about futurism and robotics at Mater Christi School in Burlington, Vermont.



Frontispiece from the 1831 edition of Mary Shelley's *Frankenstein*.

Journal Article: Stitching Together Creativity and Responsibility

In May 2016, the peer-reviewed journal *Bulletin of Science, Technology & Society* published “Stitching Together Creativity and Responsibility: Interpreting Frankenstein Across Disciplines,” an article co-authored by several researchers affiliated with ASU’s Frankenstein Bicentennial Project: Megan Halpern, a postdoctoral researcher at the Center for Nanotechnology in Society; Jathan Sadowski, a graduate research assistant at the Consortium for Science, Policy and Outcomes; Joey Eschrich, editor and program manager at CSI; Ed Finn, director of CSI; and David H. Guston, founding

director of the School for the Future of Innovation in Society.

The article provides three brief analyses of Shelley’s *Frankenstein* from different disciplinary perspectives: literature, science and technology studies, and feminist studies. The essay argues that the novel works as a “boundary object,” a shared point of reference that provides common ground for experts from a variety of disciplines to exchange insights and explore issues of scientific discovery, ethics, and social responsibility.



ASU's science delegation in Cuba.

Science Delegation to Cuba

In March 2016, CSI's Ruth Wylie traveled to Havana, Cuba as part of ASU's 12-person science delegation. The six-day trip began with a presentation by Sergio Pastrana, executive director and secretary of foreign affairs at the Academy of Sciences of Cuba. Throughout the week, the ASU delegation met with scientists, engineers, and artists to discuss possible collaborations and science diplomacy. During their visit to the Cuban

Neuroscience Center, Ruth gave a talk titled "Using Imagination as a Tool in the Development of Scientific Innovation." Other discussion topics included disaster risk reduction, resilience, renewable energy, biomedical sciences, medicine, and healthcare.



The Villa Diodati, where Mary Shelley came up with the story that became *Frankenstein* in 1816.

Frankenstein's Shadow

Two hundred years ago, on the shores of Lake Geneva in Switzerland, a group of writers, philosophers, poets, and intellectuals gathered to discuss the rapidly changing world around them, and endeavored to mark their place in it. Out of this came *Frankenstein*, Mary Shelley's enduring tale of creation and responsibility.

Two centuries later, on June 14 and 15, 2016 in Geneva, just steps from the historic villa where Mary first imagined her story, ASU, Duke University, and the University of Lausanne in association with the Fondation Brocher hosted "Frankenstein's Shadow," an international, multidisciplinary symposium commemorating the origin of *Frankenstein*. The symposium assessed

Frankenstein's resonance through different times and cultures, particularly in public policy debates about governing biotechnology and medicine.

Taking inspiration from Shelley's circle of intellectuals, CSI assembled a team of humanists, biologists, authors, and artists from around the world to participate in this once-in-a-lifetime event. The symposium was successful in expanding our network of people working at the intersection of art and science, extending the legacy of Shelley's novel, and breathing new life into the Frankenstein myth through a robust set of new perspectives and discoveries.



Participants share ideas with collaborators during the book sprint at the Society for Scholarly Publishing annual meeting in Vancouver.

Vancouver Book Sprint

A book sprint is an ambitious experiment to change the way we think, talk, and write about scholarly topics. At the Society for Scholarly Publishing (SSP) annual meeting in Vancouver, Canada, we brought together a team of science fiction authors, scholars, digital publishers, journalists, and technologists to write, edit, and publish a book in 72 hours.

Over the course of the three days, we pondered questions about the future of scholarly publishing such as: Should algorithms be co-authors? What new forms might books take to reach broader audiences and have greater impact? What is the role of scholarship in shaping the public square?

The book sprint consisted of six mini-sprints; during each session, our core sprinters joined conference attendees to tackle one of six big questions. Each sprint began with a facilitated conversation, followed by time for the writers to reflect and compose a piece of writing inspired by the discussion. Outputs ranged from traditional essays to a collection of memes and a letter written to taxpayers of the future.

Conferences like the SSP annual meeting and scholarly publications themselves are

often catalysts for spontaneous, inspiring, thought-provoking conversations among colleagues, but those conversations are rarely captured and shared. The book sprint process aims to absorb some of the kismet and energy of those initial conversations, right at the start of the big idea, and make it part of a more lasting product.

Our four core sprinters who participated in every session were Madeline Ashby, a science fiction author and strategic foresight consultant; Annalee Newitz, tech culture editor at *Ars Technica* and a science fiction author and critic; Roopika Risam, a digital humanities scholar and assistant professor of English and secondary education at Salem State University; and Ido Roll, an educational technologist at the University of British Columbia's Centre for Teaching, Learning, and Technology. In addition to these four core authors, many SSP members made valuable contributions to individual sprints and shared their expertise.

The 2016 SSP Annual Meeting Book Sprint was sponsored by Cengage Publisher Services, Overleaf, JSTOR, Research Square, and the Society for Scholarly Publishing.



Illustration for the *Small Wonder* Science Fiction TV Dinner event, by Nina Miller.

Science Fiction TV Dinners

The Science Fiction TV Dinner series is a launch pad for imaginative, engaging conversations about science, technology, and society. The series uses science fiction as an inclusive meeting ground where people from diverse professional and intellectual backgrounds – from artists, writers, and historians to scientists, engineers, and fan scholars – can bring their expertise and knowledge to the conversation.

Since 2012, Science Fiction TV Dinners have developed an enthusiastic following on and off campus, providing the opportunity for people of all ages and backgrounds to come together, learn, and explore visions of the future in an entertaining, informal setting.

At each event, we serve dinner, screen an episode of a classic or contemporary science fiction television show, and have a conversation about key themes, debates, and ethical quandaries. Science Fiction TV Dinners bring science, art, and storytelling into dialog and provide a platform for collectively exploring a diverse array of future visions.

Our TV Dinner events this year:

September 2015: *Small Wonder*

Speakers: Futurist Brian David Johnson and digital humanities scholar Jacqueline Wernimont

October 2015: *Star Trek: The Original Series*

Speakers: Former NASA astronaut and ASU University Explorer Scott Parazynski and retired Air Force colonel and aerospace expert Marcy Steinke

November 2015: *Looney Tunes (in Space)*

Speakers: Planetary scientist Lindy Elkins-Tanton and media industry scholar Kevin Sandler

January 2016: *The Starlost*

Speakers: Science, technology, and society scholar David Guston and environmental ethicist Ben Minter

February 2016: *Lost in Space*

Speakers: Environmental historian Paul Hirt and human-computer interaction scholar Ruth Wylie

April 2016: *In the Flesh*

Speakers: Strategic communications scholar Scott Ruston and media scholar Andrea Wood

The History of the Future

Inspired by CSI's popular Science Fiction TV Dinner series, we partnered with FilmBar, a local, independent movie house in downtown Phoenix, to create a summer film series. Titled "History of the Future," the series explored gripping, cinematic visions of the future across the past four decades.

History of the Future started from the premise that science fiction films of the past are less about predicting "the future" and more about addressing the values and anxieties of the time in which they were made. The film series facilitated conversations between the public and a roster of scholars across multiple disciplines to examine how films of the past dealt with technologies that we're actually grappling with today. From ethical protocols for artificial intelligence, to off-world governance, to pervasive surveillance and new, burgeoning forms of reality, this film series expanded CSI's reach to a new, diverse, and curious audience.

History of the Future events:

May 2016: *Westworld*

Speaker: Film and popular culture scholar
Jason David Scott

June 2016: *Outland*

Speaker: Theoretical astrophysicist
Steve Desch

July 2016: *The Lawnmower Man*

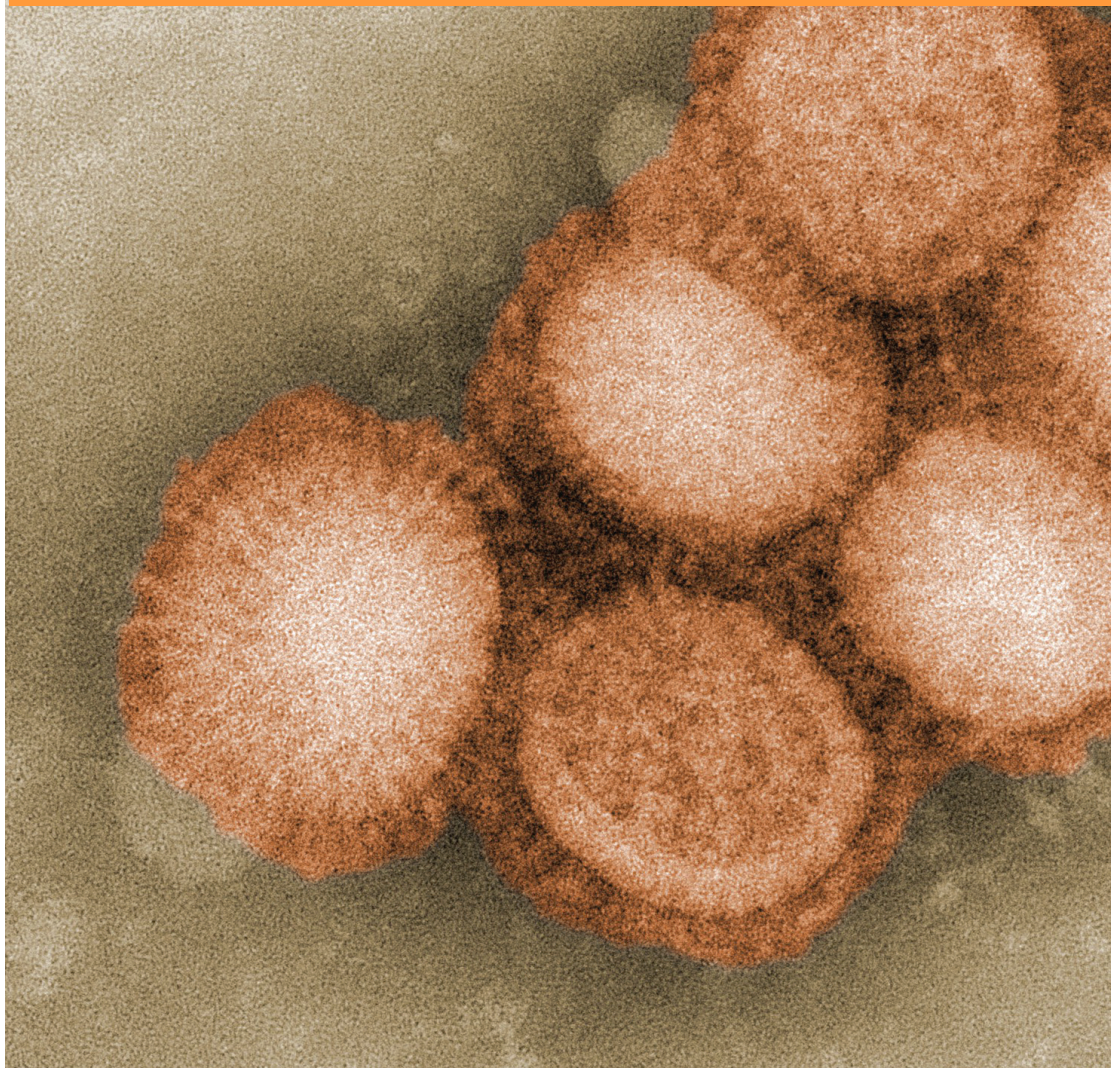
Speakers: Digital communication scholar
Alex Halavais and futurist Corey Pressman

August 2016: *Equilibrium*

Speakers: Digital humanities scholar
Jacqueline Wernimont



Promotional artwork for the History of the Future film series.



A transmission electron micrograph of the swine flu virus.

Health Innovation at the Movies

The 2011 thriller *Contagion* turns public health, medical ethics, and emergency care into gripping adventure. Praised by scientists and critics alike, the film features Matt Damon, Jude Law, Gwyneth Paltrow, Kate Winslet, and other stars confronting an emerging pandemic virus wreaking havoc across the globe.

In March 2016, CSI teamed up with ASU's College of Nursing and Health Innovation to present "Health Innovation at the Movies: *Contagion*," a public screening of the film

at the AMC Arizona Center 24 theaters and a discussion and Q&A with medical researchers and practitioners Kim Day, Aliria Muñoz, and Therese Speer. The panelists discussed how narrative visions of the future help healthcare professionals prepare for global challenges and underscore the importance of social and cultural factors in responding effectively to public health crises.

Imaginary Friends Happy Hours

In support of the Center's goal of fostering radical collaboration, we launched the Imaginary Friends Happy Hour series in spring 2015. This social event provides a space for forging new connections and collaborations between ASU's talented faculty and artists, makers, and innovative business leaders from the community. Each month, CSI hosts a gathering for

people from diverse backgrounds to exchange ideas about the future together in a casual setting.

Through the Imaginary Friends Happy Hours, we have expanded our network and created connections with engaged and enthusiastic partners across many fields.



How can we create visceral,
immersive experiences of the future?
How can we think critically and push
the bounds of the possible through
making and doing?

The 2016 Emerge festival explored the theme
"The Future of Sport 2040."

A high-angle, wide shot of a crowded event at night. A large white tent covers the area, with people walking around and interacting. In the foreground, a group of people is gathered around a table with computer monitors. To the left, a white sofa is visible. The scene is illuminated by various lights, including a bright blue light source on the right. The overall atmosphere is one of a busy, interactive public event.

“The best way to predict the future is to create it.”

Peter Drucker



Station for Emerge participants to submit their cheers to the Cheering Artificial Intelligence Leader (CAIL).

Emergence: Artists and Scientists Redesign the Future

Emergence is an annual art-science event and research project that gathers artists, designers, scientists, engineers, and audiences to imagine a vast array of possible futures. The event invites participants to step into tangible, vibrant experiences that demonstrate how we might live and thrive in the decades to come.

The 2016 event, "The Future of Sport 2040", was held on April 29, 2016 at

ASU's Wells Fargo Arena. The space, which typically hosts NCAA sports, was transformed into a crossroads of ideas, demonstrations, and collaborative art-science installations.

CSI invited the public to consider the future of sport through three interactive experiences: a prototype of a Cheering Artificial Intelligence Leader (CAIL), The Games that Got Us Through, and Post-sporting: Biogame Feedback.

AI Cheerleader

The Cheering Artificial Intelligence Leader (CAIL) performs cheers in a future where a distributed network AI replaces cheerleaders as we know them. Before the Emerge event, elementary school students, MFA poetry students, and professional authors submitted cheers to our interactive interface. At the website, users could hear

CAIL perform their cheers from the future and add to the system's cheer database. At Emerge, visitors were invited to hear all of the submitted cheers performed live by CAIL, and were able to add cheers of their own. Following the event, Four Chambers, a Phoenix-based literary press, published a compilation of the cheers.



A close-up of part of the CAIL apparatus at Emerge.



Emerge participants play Cistern, a thriving sport in the world of 2040.

The Games That Got Us Through: Climate Change Sports

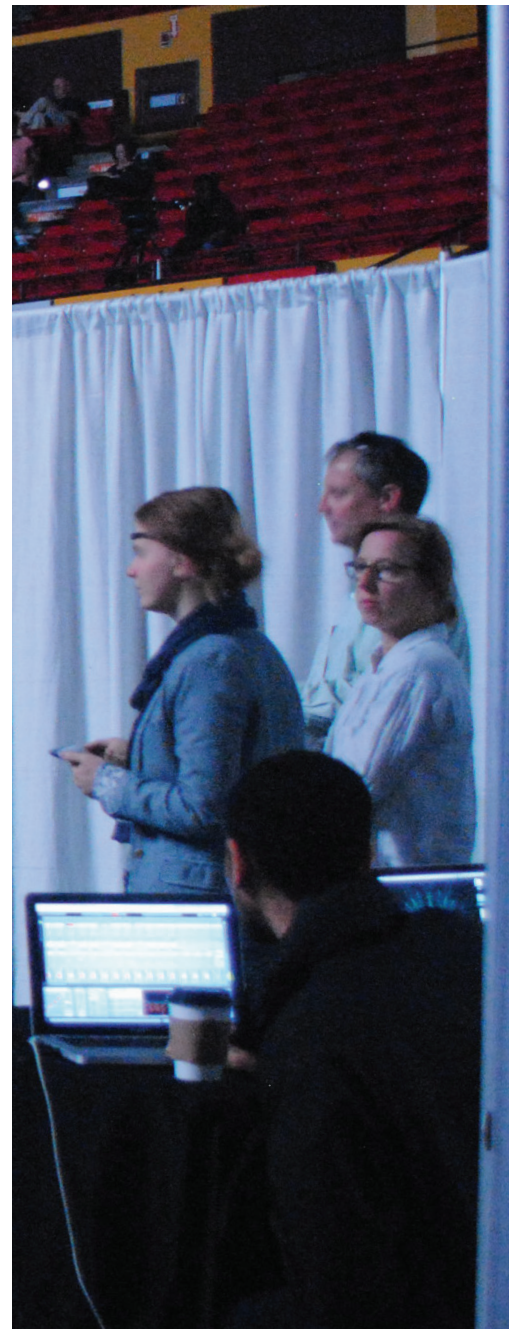
How do you run out of water? According to *The Applied History Institute*, really slowly, and then all at once. Institute co-founders Bryce Hidysmith, Andrew Hudson, and Adam Flynn, a former Princeton University football player, artist, and environmental activist, created *Cistern*, an imagined sport popular in 2040 in the aftermath of

massive climate change. Bryce, Andrew, and Adam created a rulebook as well as *The Games That Got Us Through*, an accompanying collection of climate fiction stories. At Emerge, visitors could choose to play *Cistern* or enjoy the game from the sidelines.

Post-Sporting: Biogame Feedback

Dr. Paula Gardner and her research team from McMaster University demonstrated their multiplayer, interactive digital game to Emerge visitors. The game's "Body Editing" Platform integrates a gesture and motion tracking system powered by the Microsoft

Kinect, an EEG brainwave monitor, and an EKG heart rhythm sensor, using Gardner's specially-designed software interface. These readings are displayed as audio and visual feedback in response to the participants' gestures and biodata.



Players interacting with Dr. Paula Gardner's biofeedback game at Emerge.

The 21st Century Robot Project: Burbank

We believe that anyone can design and engineer their own robot. Building on this belief, our 21st Century Robot project, directed by CSI futurist in residence Brian David Johnson, brings together conceptual tools, educational media, and engineering kits so that kids of all ages can explore their innovative technological ideas.

In spring 2016, 21st Century Robot collaborated with three middle schools in Burbank, California, working with robotics clubs to get students imagining, understanding, and building robots through a process that included design, engineering, programming, and science fiction writing.

The 10-hour 21st Century Robot program, designed by Johnson and Ruth Wylie, assistant director of CSI, guides students

through several phases of design, concluding with a build day where students meet each other's robots and show them off to their friends.

The program in Burbank will serve as a template to take to other schools and educational settings. This curriculum enables students to become advocates for robotics, bringing the process of tinkering and creation to the next generation of robot designers.

21st Century Robot is supported by by Warner Bros. Entertainment, SciFutures, Maker Faire, and the ASU Foundation for a New American University.



ASU futurist Brian David Johnson with his robot, Jimmy, at Maker Faire NYC 2014.



Kelly Richardson, *Mariner 9*, 2012. Panoramic video installation with sound; Courtesy of the artist and Birch Contemporary, Toronto, Canada. © Kelly Richardson. Photo: Colin Davison

Kelly Richardson, Tales on the Horizon

From September 2015 through January 2016, the Scottsdale Museum of Contemporary Art (SMoCA) displayed Canadian artist Kelly Richardson's exhibition *Tales on the Horizon*, which presents several mysterious meditations on possible futures, blending cues from 19th-century landscape painting, 20th-century cinema, and 21st-century planetary research. The exhibition includes the colossal video piece *Mariner 9*, which immerses visitors in a Martian landscape littered with the remains of past exploratory missions, and *Orion Tide*, which depicts ambiguous rocket-propelled objects launching into the night sky.

CSI supported *Tales on the Horizon* and Richardson's provocative art-science work by connecting the artist with subject

matter experts related to the themes of the exhibition, and on issues around the relationship between humans and our ecosystem that are central to upcoming projects.

We also hosted a double feature movie night at SMoCA where we screened both the 1990 and 2012 versions of the Martian action extravaganza *Total Recall*, accompanied by a panel conversation with three ASU experts on human futures in space: Jim Bell of the School of Earth and Space Exploration and NewSpace Initiative; Rhett Larson of the Sandra Day O'Connor College of Law and Kyl Center for Water Policy; and Sara Imari Walker of the School of Earth and Space Exploration and BEYOND Center for Fundamental Questions in Science.



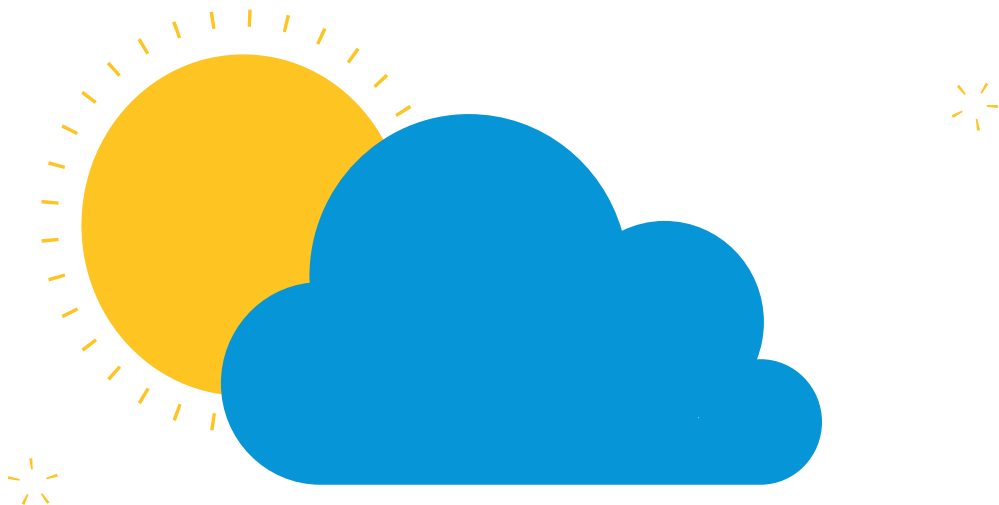


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 18—19 Matter's Cli-Fi "Everything Change" Cover Artwork by Matt Phan for The Center for Science and the Imagination
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 51 "Beer Actor" by Alan Levine under CC
 53 Emerge photograph by Ariel Shamas
 54—57 Emerge photographs by Ariel Shamas
 58 21st Century robot photo from ASU Magazine Online
 59 Kelly Richardson, Mariner 9, 2012. Panoramic video installation with sound; Originally commissioned by Tyneside Cinema, Newcastle upon Tyne, United Kingdom. Courtesy of the artist and Birch Contemporary, Toronto, Canada. © Kelly Richardson. Photo: Colin Davison

You can change the future!

Your decisions today shape the world your children and grandchildren will be living in, so consider making an investment in their name for their future.

Become a Futurist! We need your enthusiasm and your ideas. Join our mailing list, attend an event, or contact us directly and join a community dedicated to building a future that is for everyone.



**Center for Science
and the Imagination**
Arizona State University

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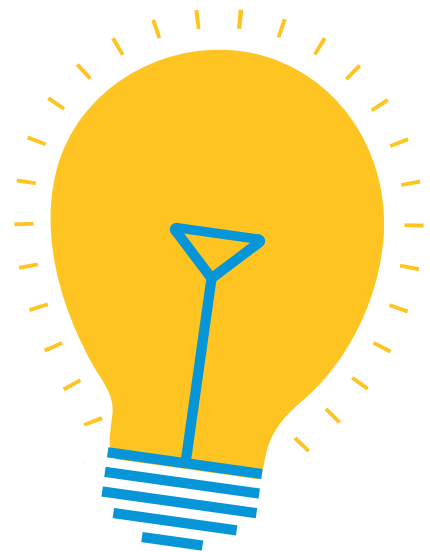


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