2014 / 15
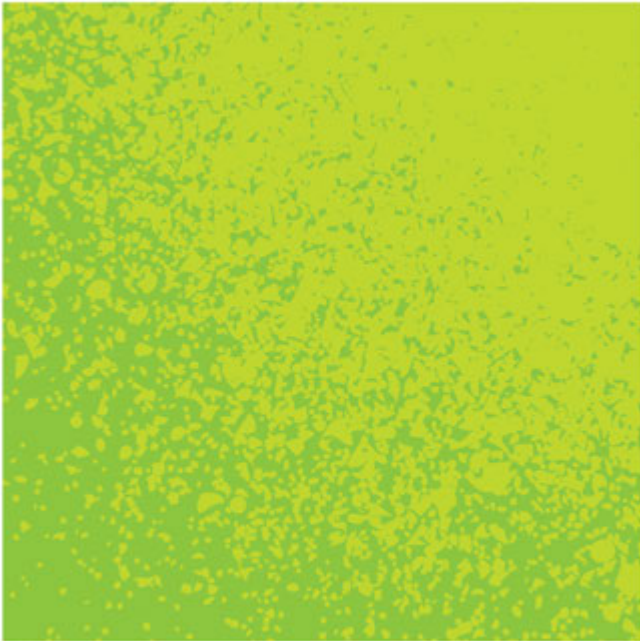
Annual Report

ASU® CENTER FOR
Science & THE
Imagination
ARIZONA STATE UNIVERSITY

Putting together the third Annual Report for the Center for Science and the Imagination has been an illuminating exercise, pushing us to catalog and synthesize a tremendous portfolio of projects, activities, events, and publications. In the past year we have hit a major milestone in terms of our presence and activities at Arizona State University, participating in major grant-funded research collaborations and defining an intellectual agenda around imaginative futures that is both playful and rigorous.

We are concentrating our efforts around several key areas, staying true to our core mission of catalyzing creative, ambitious thinking about the future.

The research areas that we defined in year two have begun to bear fruit:

- **Science & Imagination** saw the release of *Hieroglyph*, an award-winning anthology that marks the culmination of three years of collaborative work;

- **Tangible Futures** celebrated our most successful Emerge event to date, welcoming thousands of people to contemplate, reflect, and touch the future;

- **Networks of Imagination** continued to expand with new collaborative bridges to the Consortium for Science, Policy & Outcomes (CSPO), the Synthesis Center, and other emerging transdisciplinary programs at ASU;

- The **Future of the Book** initiative broke our own record by releasing three separate Tomorrow Project anthologies over the course of a year, celebrating thoughtful visions of the future from young creative writers around the world.

As we look forward to the coming academic year, we are thrilled to advance on the big ideas we have cultivated with our many collaborators: the Frankenstein Bicentennial Project, celebrating the 2016-2018 anniversary of Mary Shelley's epochal novel; the Imagination and Climate Futures Initiative, which brings some desperately needed creativity, optimism, and experimentalism to the climate crisis; and Arizona 2050, a series of experiments with socially embedded narratives about the future of water, energy, and food in the Southwest.

Most importantly, we are delighted to welcome new colleagues: Dr. Michael Bennett will be joining CSI in a joint appointment with CSPO, bringing expertise in the intersection of law, technology, and society. Cody Staats joins our staff as a Program Coordinator with a focus on business operations and grant administration. And we expect to announce more appointments this fall…an exciting year ahead!

As ever, please consider this an invitation: we look forward to collaborating with you on projects, events, little questions, big ideas, and everything in between.

Ed Finn
imagination@asu.edu
csi.asu.edu

Center for Science and the Imagination Annual Report 2014/15

CSI Total Media Hits 2014-15 = 303

Emerge
135 hits

Hieroglyph
123 hits

Other Projects
45 hits
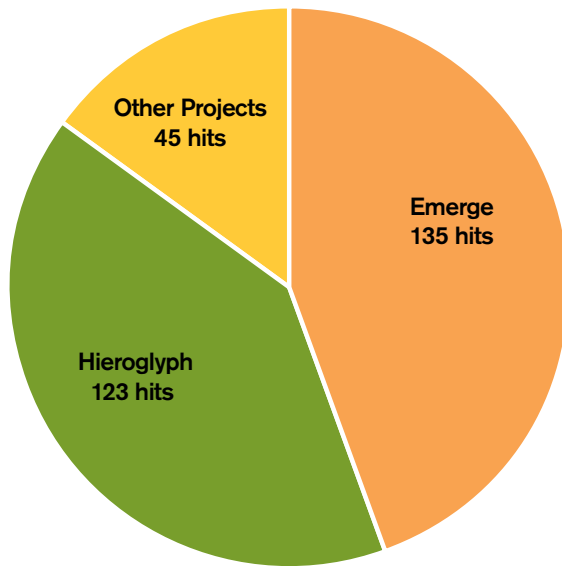
CSI Publications 2014-15

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219-243. doi:10.1080/00461520.2014.965823

Eschrich, J. (2014, September 12). Forget the tricorder: Why gadgets aren't the coolest part of science fiction." *Slate/Future Tense.* http://www.slate.com/articles/technology/future_tense/2014/09/project_hieroglyph_gadgets_aren_t_the_coolest_part_of_sci_fi.html

—. (2014, September 16). Project Hieroglyph: Science fiction for better futures. *Robohub.* http://robohub.org/project-hieroglyph-science-fiction-for-better-futures/

—. (2014, December 17). An illuminated manuscript about space exploration, science fiction, and physics. *Slate/Future Tense.* http://www.slate.com/blogs/future_tense/2014/12/17/interview_with_paul_davies_is_turned_into_an_illuminated_manuscript.html

—. (2015, March 5). Take a picture. It'll last longer: An experimental philosopher's project to document 100 or even 1,000 years of change with a single photograph. *Slate/Future Tense.* http://www.slate.com/articles/technology/future_tense/2015/03/experimental_philosopher_jonathon_keats_millennium_camera_experiment.html

Finn, E. (2014, September 16). The inspiration drought: Why our science fiction needs new dreams. *Slate/Future Tense.* http://www.slate.com/articles/technology/future_tense/2014/09/project_hieroglyph_why_our_science_fiction_needs_new_dreams.html

—. (2015, February 6). An interview with Margaret Atwood: The acclaimed author on hope, science, and writing about the future. *Slate/Future Tense.* http://www.slate.com/articles/technology/future_tense/2015/02/margaret_atwood_interview_the_author_speaks_on_hope_science_and_the_future.html

—. (2015, May 26). Apocalypse Moon: Neal Stephenson on his new novel, *Seveneves*, and the future of humanity. *Slate/Future Tense.* http://www.slate.com/articles/technology/future_tense/2015/05/neal_stephenson_discusses_his_new_novel_seveneves_and_the_role_of_science.html

Finn, E, & Cramer, K. (Eds.). (2014). *Hieroglyph: Stories and Visions for a Better Future*. New York: William Morrow/HarperCollins.

Finn, E., & Zachary, G.P. (Eds.). (2014*). The Future – Powered by Fiction: A Tomorrow Project Anthology*. Intel Corporation. http://tomorrow-projects.com/future-powered-fiction

—. (2015) *Dark Futures: A Tomorrow Project Anthology*. Intel Corporation. http://tomorrow-projects.com/dark-futures

—. (2015) *Living Tomorrow: A Tomorrow Project Anthology*. Intel Corporation. http://tomorrow-projects.com/living-tomorrow

Wang, S., Walker, E., Chaudhry, R., & Wylie, R. (2015, June). Personalized expert skeleton scaffolding in concept map construction. In C. Conati, N. Heffernan, A. Mitrovic, & M.F. Verdejo (Eds.), *Artificial Intelligence in Education* (pp. 808-811). Springer International Publishing. doi:10.1007/978-3-319-19773-9_121

Wylie, R., & Chi, M. T. (2014). The self-explanation principle in multimedia learning. In R.E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning* (2nd ed., pp. 413-432). Cambridge University Press.

A big leap

At CSI, our projects are designed to extend beyond traditional scholarly outcomes like peer-reviewed articles and conference presentations. We strive to produce work that generates broad public engagement, media coverage across the spectrum of popular outlets, and investment from external collaborators and funding organizations – alongside more conventionally rigorous intellectual products.

From publications and national and international media attention to external funding applications and in-person event attendance – **6,428 people** – 2014-2015 was an unprecedented success that we will continue to build upon.

$3,617,495

2014

$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000

2013   2014

2013   2014

2013   2014

CSI Recognized   Awards   Expenditures   Proposals
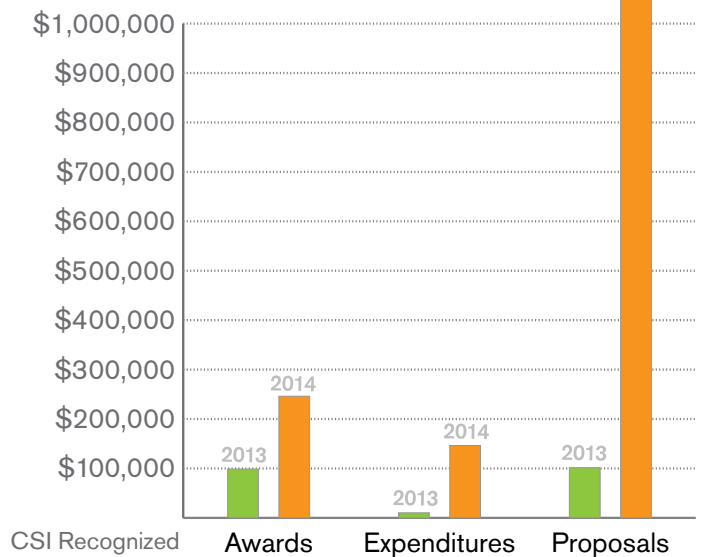
Project Hieroglyph

Founded by *New York Times* bestselling author Neal Stephenson, Hieroglyph aims to rekindle our grand ambitions for the future through the power of storytelling. Hieroglyph brings together top science fiction authors with scientists, engineers, and other experts to collaborate on ambitious, optimistic visions of the near future grounded in real emerging science and technology.
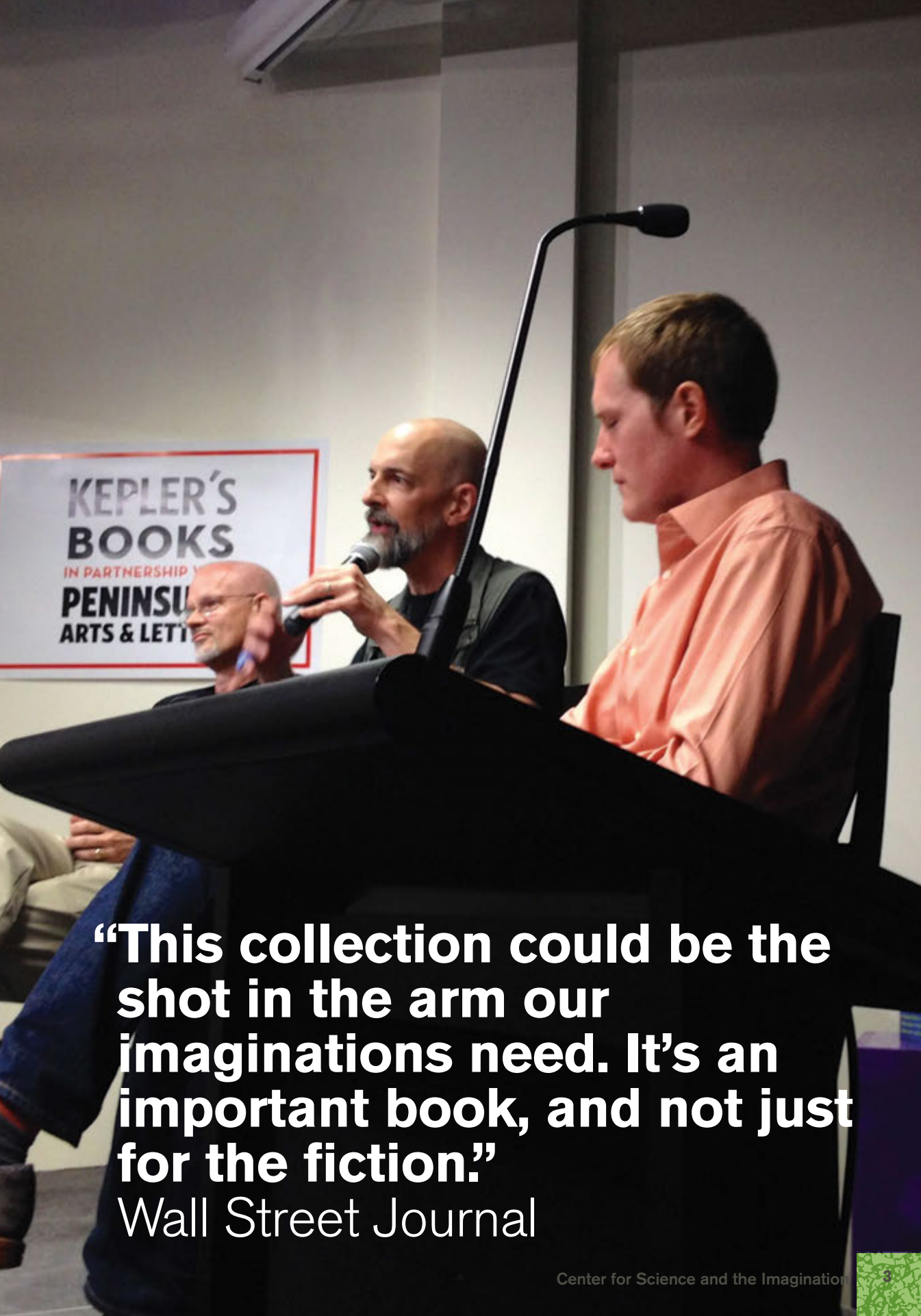
"This collection could be the shot in the arm our imaginations need. It's an important book, and not just for the fiction."
Wall Street Journal

Books for sale at a Hieroglyph launch event with Changing Hands Bookstore in Phoenix.

In his 2011 article "Innovation Starvation," Neal Stephenson argued that we—the society whose earlier scientists and engineers witnessed the airplane, the automobile, nuclear energy, the computer, and space exploration—must reignite our ambitions to think boldly and Do Big Stuff. He also advanced the Hieroglyph Theory, which illuminates the power of science fiction to inspire the imagination:

"Good SF supplies a plausible, fully thought-out picture of an alternate reality in which some sort of compelling innovation has taken place."

CSI serves as the headquarters for Project Hieroglyph, uniting writers and artists with scientists, engineers, and other researchers to cultivate and expand on audacious moonshot ideas to inspire people and catalyze real-world innovation.

We conduct research on the dynamics of radical collaboration and manage the project's digital community (hieroglyph. asu.edu), where more than 600 contributors participate in interdisciplinary collaborations, share resources, and create stories and projects that bridge science fiction and reality.

The first Project Hieroglyph anthology, *Hieroglyph: Stories and Visions for a Better Future*, was published by William Morrow / HarperCollins in September 2014. The book has sparked a national conversation in outlets including *The New York Times*, *The Wall Street Journal*, *BBC News*, *The Chronicle of Higher Education*, *The Huffington Post*, *Nature*, *The Guardian*, *Slate*, and the public radio programs *Science Friday*, *Studio 360*, and *To The Best of Our Knowledge*.

Launch events for the book were hosted by Google, Tumblr, the National Academy of Sciences, Town Hall Seattle, Zócalo Public Square, and leading independent bookstores like Changing Hands in Arizona, Kepler's in Silicon Valley, and Bakka Phoenix in Toronto.

Hieroglyph stories establish hopeful, compelling visions of the near future. We call this "science fiction of the present," because we now have all of the scientific knowledge and technological wizardry we need to make them a reality. What's missing is an inclusive, inspiring story about where we are and where we're headed. Hieroglyph is an effort to build those stories and start the hopeful, transdisciplinary conversations that will change the future.

These stories aren't just grounded in scientific and technical reality; they're designed to shape future research and

utilization in space exploration missions. The story, "The Man Who Sold the Moon," was awarded the prestigious Theodore Sturgeon Award for the best science fiction short story of 2014.

Lee Konstantinou's story about an alternative, surveillance-free Internet powered by flying drones dialogs with recently-launched projects from tech giants like Google and Facebook to provide Internet access to rural populations, and Brenda Cooper's story about drones protecting African elephants from poaching responds to a spate of recent efforts by governments, university researchers, and NGOs.

Authors featured in
Hieroglyph: Stories and Visions for a Better Future

Charlie Jane Anders
Madeline Ashby
Elizabeth Bear
Gregory Benford
David Brin
James L. Cambias
Brenda Cooper
Paul Davies
Cory Doctorow
Kathleen Ann Goonan
Lee Konstantinou
Lawrence M. Krauss
Geoffrey Landis
Annalee Newitz
Rudy Rucker
Karl Schroeder
Vandana Singh
Neal Stephenson
Bruce Sterling

innovation by inspiring young thinkers and doers and setting aspirational goals that they can actually accomplish during their careers.

Neal Stephenson's collaboration with ASU professor of structural engineering Keith Hjelmstad on an idea for a 20-kilometer steel tower has generated a host of new research questions about the structural mechanics of super-tall structures, especially with regard to the punishing winds of the jet stream and exotic upper-atmosphere weather phenomena.

Cory Doctorow's story about 3D printing with lunar regolith parallels ongoing work at NASA and the European Space Agency, as well as work at ASU's own School of Earth and Space Exploration on in-situ resource

Illustration for Lee Konstantinou's story "Johnny Appledrone vs. the FAA," 2013, Haylee Bolinger/ASU

hieroglyph.asu.edu

Arizona 2050

As a rapidly growing state in one of the world's hottest and driest regions, Arizona faces incredible sustainability challenges over the coming decades.

Arizona 2050 challenges students to use storytelling to create visions for the future of Arizona – with a special focus on the intersection of water, energy, and food systems – grounded in actual research in areas ranging from science and emerging technology to public policy, culture, education, and economics.

Arizona 2050's first project was a graduate seminar taught in the spring 2015 semester, co-designed by CSI's Joey Eschrich and Dr. Paul Hirt, a professor in ASU's School of Historical, Philosophical, and Religious Studies and a senior sustainability scholar at the Julie Ann Wrigley Global Institute of Sustainability. The course was cross-listed in ASU's School of Sustainability, Department of History, and Human and Social Dimensions of Science and Technology program.

In the course, students critically examine past and present attempts to understand the future of Arizona and explore a variety of methods for prototyping the future, including scenario planning and strategic foresight, statistical projections, and especially science fiction storytelling. They also work individually and in teams to conduct research on specific sets of issues (e.g., transportation infrastructure, solar energy, water conservation policy, wetlands management, urban architecture, immigration, religion, and so forth), and use that research as a launch pad for creating sets of narrative visions of the future, ranging across the spectrum from utopian to dystopian.

Along the way, students have the opportunity to hone their skills in various genres of public communication: expert interviews, magazine-style op-eds, essays and reports, oral presentations, and short stories. The course provides valuable experience with conducting interdisciplinary research, working in teams, and using new modes of public and scholarly communication to share complex ideas with policymakers, colleagues, and members of the public.

The Arizona 2050 graduate seminar will be taught every other spring semester, alternating with a new undergraduate course, "The History of the Future," designed and taught by Eschrich and Hirt and cross-listed in Sustainability, History, and English. The undergraduate course will retain major elements of the graduate seminar, including the research-based future of Arizona storytelling project, but will focus more on critical literacy with a broad range of future visions. Students will read, discuss, and analyze science fiction novels and short stories, policy reports, strategic plans from local and national government agencies, popular films, and strategic foresight briefs, interrogating their assumptions about the future, their social contexts, and their ideological objectives. Visions of the future emanate from specific groups at specific moments in history – they are political statements, and reveal as much about the moments of their creation as they do about the futures they aim to predict.

In both the graduate and undergraduate courses, critical reflexivity is a primary objective. Students not only analyze others' visions, hopes, and dreams for the future, but also examine their own assumptions, prejudices, and blind spots. Research briefs and reflective essays provide opportunities for students to present the intellectual and factual foundations for their stories, explicate their own creative choices as authors, and clearly articulate the assumptions about human nature, individual and group behavior, and economic, social, and technological changes that undergird their narratives.

Arizona 2050 students create compelling, research-based visions for the future of Arizona, centered on water, energy, and food systems.

Arizona 2050 draws on the research-based, plausible, near future storytelling model we have developed through Project Hieroglyph, but adapts it to a local context and aims it at a specific challenge: how to safeguard vibrant human communities in the increasingly arid U.S. Southwest, and make these communities more resilient in the long term. The Hieroglyph anthology served as a key grounding text for the graduate seminar, providing rich examples of stories that integrate actual scientific, technical, social, and cultural insights into compelling visions of the future. Hieroglyph authors also joined the students for virtual videoconference class visits, where they shared their experiences integrating research with narrative, crafting hopeful futures, and balancing technical detail with character development and psychological, cultural, and emotional complexity.

Ed Finn interviews Margaret Atwood on stage at the inaugural Imagination and Climate Futures Lecture in November 2014.

Imagination and Climate Futures Initiative

The Imagination and Climate Futures Initiative explores how imagination – or lack thereof – shapes humanity's response to climate change, and how imagination merged with science can create solutions to climate challenges. The initiative is a partnership among CSI, the Walton Sustainability Solutions Initiative, and the Virginia G. Piper Center for Creative Writing.

It was created in early 2014 and has quickly expanded its activities over the past year.

In November 2014, the ICF hosted internationally renowned novelist, critic, and activist Margaret Atwood for three days. Atwood's public lecture in downtown Phoenix attracted over 500 attendees, raising awareness and creating new conversations around climate change and

the role of art and storytelling in shaping our collective responses to it. CSI director Ed Finn's interview with Atwood was published on *Slate* magazine's Future Tense channel, and the ICF website features a number of short video excerpts from the interview at climateimagination.asu.edu/events.

Climate fiction novelist Paolo Bacigalupi will join us for a three-day visit as the second ICF featured lecturer in September 2015. Bacigalupi's newest novel, *The Water Knife*, is set in the U.S. Southwest, imagining a cataclysmic water war between Phoenix and Las Vegas.

In April 2015 the ICF organized its first scholarly panel event on ASU's Tempe campus: "Climate Fiction: Science, Stories or Seeds of Transformation." The event was moderated by ICF lead Manjana Milkoreit, and panelists included Joni Adamson, professor of English and environmental humanities; Clark Miller, associate director of the Consortium for Science, Policy and Outcomes and associate professor at the School of Politics and Global Studies; and Sydney Lines, program coordinator for ASU's Lightworks initiative and a graduate student in museum studies. As part of the panel event, CSI's Joey Eschrich facilitated a flash fiction exercise engaging attendees in imagining climate change futures for Arizona. The results have been published on the ICF website at climateimagination.asu.edu/flash-fiction. The event also led to an invitation to discuss climate fiction on on the Arizona PBS public affairs program *Arizona Horizon*, enabling us to reach a broader TV audience.

In June 2015, Milkoreit ran a second climate flash fiction exercise at the Institute for Advanced Sustainability Studies in

Potsdam, Germany. We are planning a larger flash fiction event on the sidelines of the international climate negotiations in Paris in December 2015 (the United Nations Framework Convention on Climate Change, Conference of the Parties 21, or UNFCCC COP21).

The power of speculative fiction is not to terrify us about the future, but to show us what it might look like to literally inhabit our ideas.

In addition to public events, the ICF has been actively involved in developing courses around climate futures and sustainability. In Spring 2015, Eschrich and environmental historian Paul Hirt designed and taught a graduate seminar titled "Arizona 2050: Sustainability and the Past, Present, and Possible Future of Arizona." An undergraduate version of the course, titled "The History of the Future," will be offered in Spring 2016, cross-listed in the School of Sustainability, Department of History, and Department of English. In addition, Milkoreit developed a graduate seminar that integrates concepts and ideas from sustainability, complex systems, and cognition in her "Sustainability Decision Lab" course, which will be offered in Fall 2015.

climateimagination.asu.edu

Emerge 2015: The Future of Choices and Values

Since its inception in 2012, Emerge has pushed the envelope of performance, technology, and critical thinking. Each year we explore this intersection by asking challenging questions about the future of our mediated lives by building, sharing, and experimenting with visceral experiences of the future.

Baxter the robot, star of Emerge 2015's *Ars Robotica* project, dances for his audience.

"**Get comfortable with the idea that you won't know what's good until it's already happened.**"

Jad Abumrad, *Radiolab*
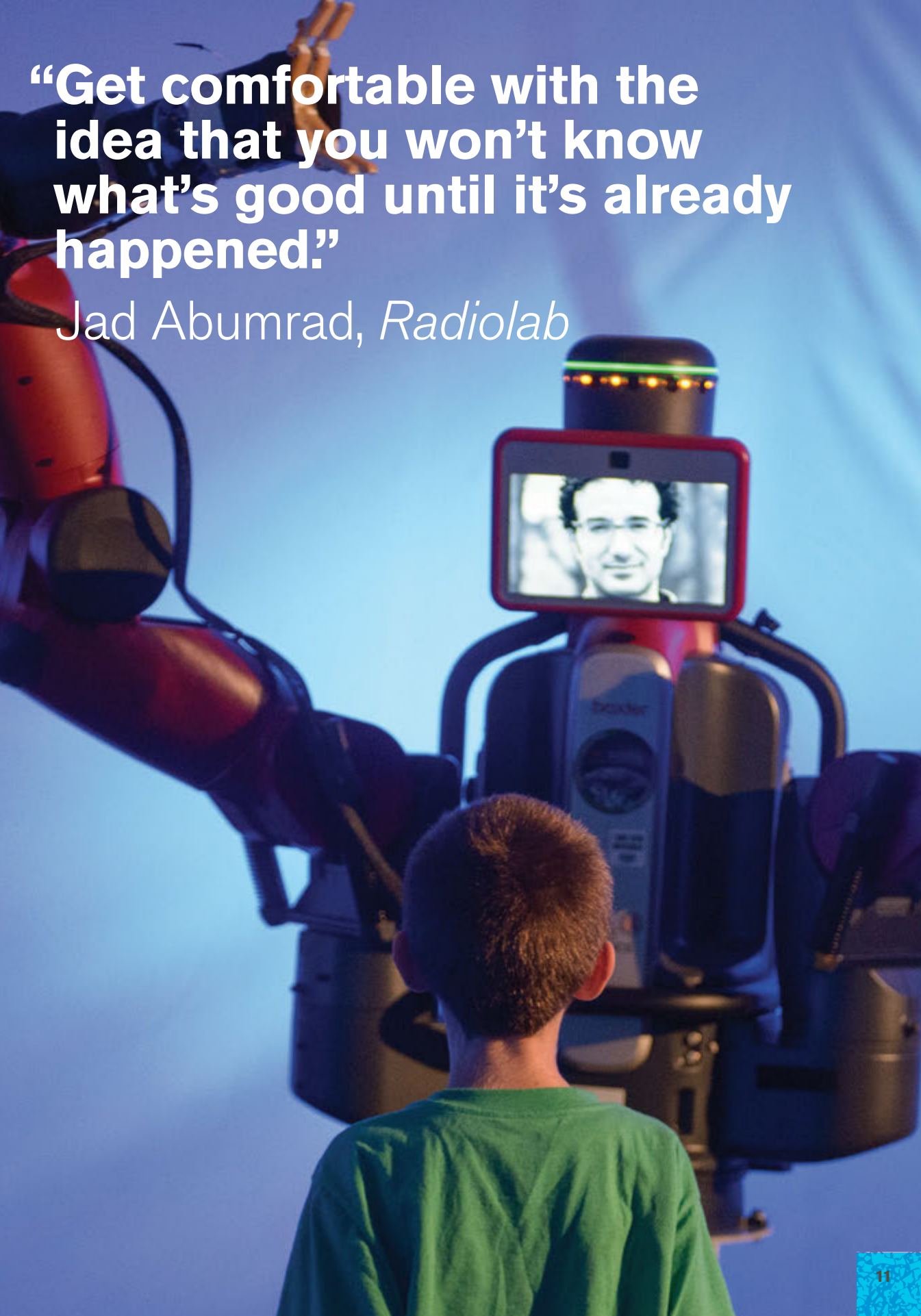
Over 2,000 people attended Emerge 2015 on Friday, March 6 at the SkySong Innovation Center in Scottsdale. Featured visionary Jad Abumrad, creator and host of *RadioLab* and winner of the MacArthur genius award, joined ten other visitations from the future, including theatrical performances, improvisation, games, and hands-on opportunities to design and build the future.

Experimental philosopher Jonathan Keats demonstrates how to create a 100-year camera.

The Deep Time Photo Lab, created by Jonathon Keats, invited visitors to build a pinhole camera with a 100-year exposure time to hide somewhere in the Phoenix area, invisibly monitoring changes in the urban landscape between now and 2115.

You Have Been Inventoried, created by Eric Kingsbury, explored a future where the smallest elements of your behavior can be digitally tracked, stored, and shared with people around you through an interactive exploration of RFID and data visualization technology.

Johnny Appledrone vs. the FAA, created by Donald Marinelli, explored issues of government surveillance, swarms of DIY drones, and an alternative Internet in a one-man show inspired by a story of the same name from ASU's science fiction anthology *Hieroglyph: Stories and Visions for a Better Future* (William Morrow/HarperCollins, 2014), written by Lee Konstantinou.

Lego Future Fairy Tales, created by Camilla Jensen and Tamara Christensen, asked visitors to create their own fairy tale from the future in an epic Lego build led by experts in the art and science of Lego Serious Play.

Abraxa, created by Rachel Bowditch of ASU's School of Film, Dance and Theatre, explored utopian experiments, dreams, and the concept of the ideal city through a roaming atmospheric performance.

Rachel Bowditch, *Abraxa*

The Happiness Project, created by Scott Cloutier of the Julie Ann Wrigley Global Institute for Sustainability, brought together sustainability researchers and community members to explore how we can work together to build happier neighborhoods through sustainability interventions.

Bodies for a Global Brain, created by Eben Portnoy, Zoe Sandoval, and Jeff Burke, integrated Google Glass wearable devices into a performative vision of a future in which humans connect their consciousness to global cloud computing networks, seeking connectedness and enlightenment.

Ars Robotica, created by Lance Gharavi, Sai Vemprala, Matt Ragan, and Stephen Christensen, asked the questions, "What if we could teach robots to dance? How would it change the relationship between humans and machines?" ASU roboticists and performance artists took on that challenge using the Baxter industrial robot.

Future Design Studio, created by Megan Halpern, encouraged visitors to create prototypes of artifacts from the future. From parking tickets to coffins, the Future Design Studio imagined what everyday objects might look like in the future, then invited guests to watch as improvisational performers from The Torch Theatre created a world in which those objects exist.

The Artwork Forge, created by Toby Fraley, tackled the theme of choices and values by positing that there are just too many choices in life. What if a robot could help simplify one by choosing art for your home? Co-commissioned by Emerge in collaboration with Scottsdale Public Art, *The Artwork Forge* was a demonstration of a coin-operated robotic art-dispensing machine that scans the Internet for

inspiration and creates customized paintings on 4" x 6" blocks of wood.

A performative exploration of the future, a lab for inspiring new ideas and prototypes, and an art-science research platform.

Emerge 2015 also served as a research platform: Megan Halpern, Emerge's director of research and collaboration, led a team of graduate student researchers who conducted interviews with Emerge visitors and visionaries. The interviews, along with ethnographic observations, are the basis for several journal articles that focus on why we imagine the kinds of futures explored at Emerge, and the relationship between collaborative event creators and audiences.

Toby Fraley's *Artwork Forge* in action.

Future Design Studio

Design fiction, the creation of fictional prototypes, is rapidly gaining attention in pockets of the design world. With roots in speculative design and science fiction, design fiction has thus far been the province of designers, scholars, and science fiction authors committed to thinking about the future in new and interesting ways. These projects have been created by experts, largely for experts. But we see an opportunity for such fictions to begin a broader public conversation about how we imagine our future. The Future Design Studio (FDS) brings the excitement of design fiction together with cutting edge research in science communication to create a way for people to play with ideas about technology in the future.

At Emerge 2015, we hosted the first Future Design Studio, inviting Emerge guests to build low-fidelity prototypes of artifacts from the future. Artifact building began when visitors chose a fortune cookie containing one of fifteen open-ended questions about the future. Questions included:

- What do we do with our dead in the future?

- What does it mean to be a fan in the future?
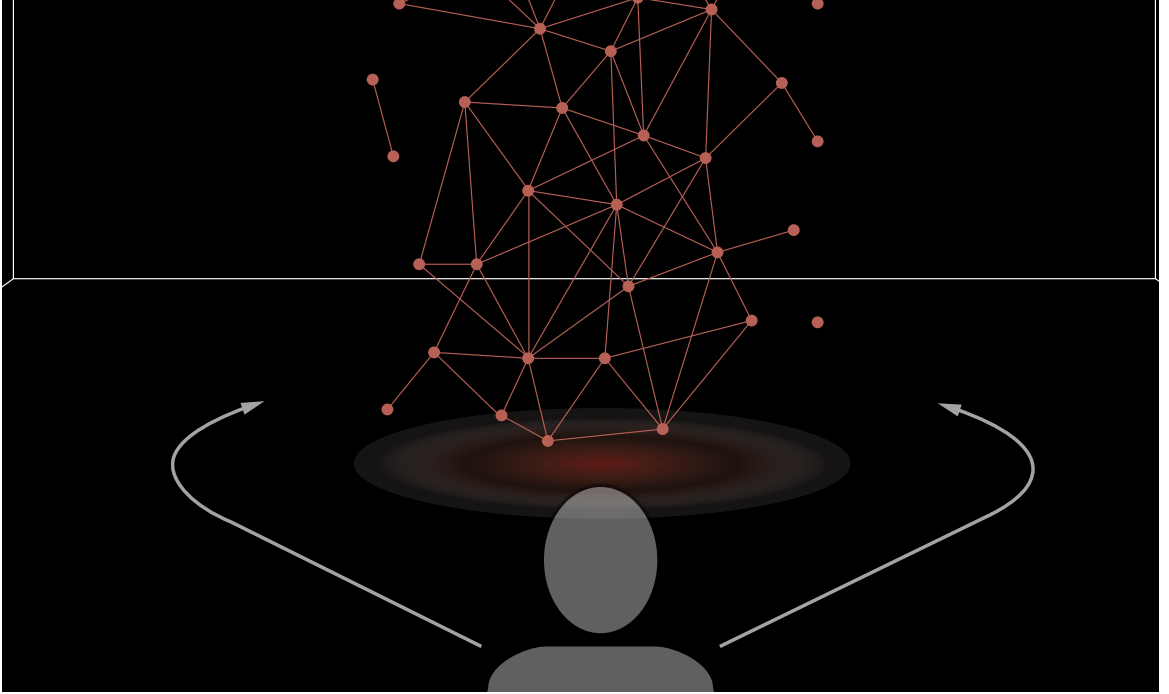
- How do you walk your dog in the future?

The Future Design Studio staff led the participants through the process, offering suggestions for how to design an artifact and develop a prototype. People often came in pairs or groups, and families came in together. Parents would often ask their children questions and help them design an artifact rather than make one for themselves. Over eighty artifacts were created by individuals, groups, and families whose time in the studio ranged from five minutes to well over an hour. To better understand the artifacts, we asked participants to fill out an "abridged user manual" that included a description of the artifact and instructions for use. To create a forum for continued deliberation about future innovation, a group of improvisational actors trained and rehearsed for a long form improvisational performance. The aim of the Future Design Players was to open up a deeper conversation about the assumptions and values embedded in participants' artifacts and user manuals.

Exploring design and performance to play with ideas about the future.

Analysis of the first event suggests that FDS has the potential to open new dimensions in conversations about our relationship with emerging technologies. Further, it invites a much broader range of participants to the table. Observations of the participation of individuals, couples, families, and small groups entering and working on designs together suggests that FDS is a social activity, and that these participants were discussing their choices. Participants' designs have the potential to reveal hopes and fears about new and emerging technologies.

Top image: A Future Design Studio participant assembles their prototype. Bottom image: The Future Design Studio Players present the audience with potential artifacts to be the subject of an improvisxed performance.

Thinking like Leonardo

In Spring 2015, we designed three activity stations that were integrated into the Phoenix Art Museum's "Leonardo da Vinci's Codex Leicester and the Power of Observation" exhibit, which was on view from January 24 through April 12. The exhibit's centerpiece was the Codex Leicester (1508-1510), the only Leonardo manuscript in the U.S. and the first original work by Leonardo to be displayed in Arizona.

The stations encouraged visitors to engage in critical and creative thinking and making, and the activities were designed to provide hands-on experiences for visitors to explore a key theme of the exhibit: thinking on paper.

The three interactive stations blend scientific discovery with creative expression:

- **Codex Word Play** provided an opportunity to explore the Codex Leicester and Leonardo's ideas about water through a mad libs-style.

- **Codex Middle Word** challenged visitors to synthesize ideas by imagining words that illuminate connections between them. This activity attempted to give participants a sense of Leonardo's unique, non-linear style of reasoning.

- **Create Your Own Codex** prompted visitors to create a codex featuring their own observations about the natural world around them.

The activities were designed by Max Evjen, a specialist in the field of informal science education, in collaboration with Kathryn Blake, The Gerry Grout education director at the Phoenix Art Museum, and Nina Miller, CSI's design strategist. Using a mixed methods approach, Evjen worked with CSI staff and students to collect timing and tracking data and behavioral observations, conduct pre- and post-exhibit interviews with museum visitors, and perform a content analysis on the *Create Your Own Codex* submissions.

Foresight

Arizona State University was selected for a competitive, five-year award of $20 million by the National Geospatial-Intelligence Agency (NGA) to launch a research partnership, effective June 1, to explore approaches for anticipating and mitigating national security risks associated with climate change.

Known as the Foresight Initiative, the cooperative agreement venture will explore how the effects of climate change on resources, such as water, food, and energy, could contribute to political unrest and instability, and gain insights to sustainability and resilience strategies for mitigating the effects.
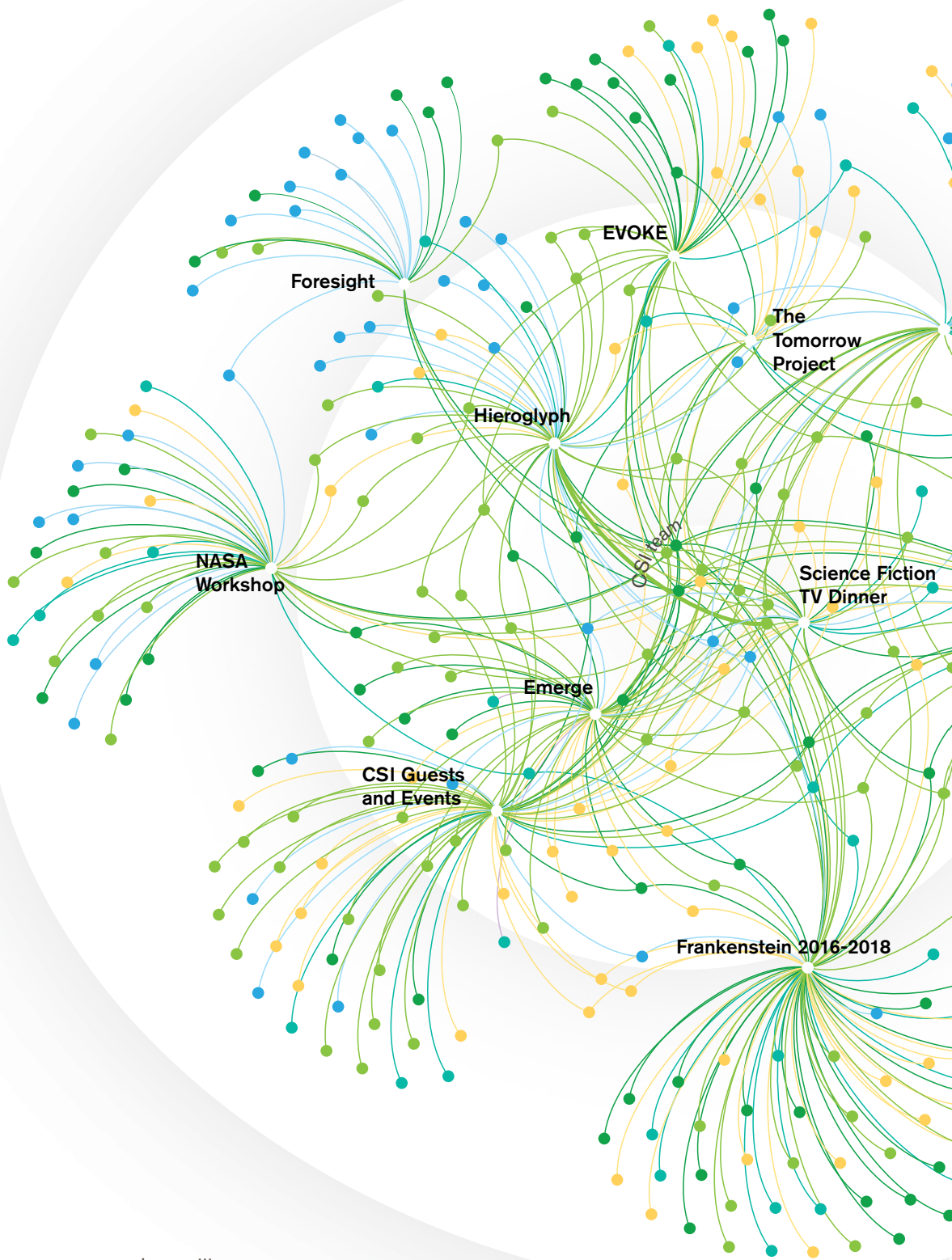
This initiative will play a key role in collaborative research efforts to accelerate the evolution of Activity-Based Intelligence addressing system level activities, dynamics, and interdependent network effects in the context of global climate risks to water security. This multi-year research partnership leverages ASU expertise and thought leadership in visual analytics, complex modeling, and transdisciplinary decision-making evolving from years of internal and external investments at ASU.

CSI is developing geo-narratives about the intersection of water and energy that combine geospatial intelligence with sustainability research, storytelling expertise, and cutting-edge digital tools to create new interactive and immersive experiences.

We aim to prototype an intuitive user interface not only for experiencing, but also authoring geo-narratives, by exploring how remote collaboration and decision-making can happen in a virtual or augmented reality environment.

Approved for public release under case number 15-407

EVOKE

Foresight

The
Tomorrow
Project

Hieroglyph

NASA
Workshop

CSI team

Science Fiction
TV Dinner

Emerge

CSI Guests
and Events

Frankenstein 2016-2018

science ● ● ● ● ● humanities

There are many ways to measure
the diversity of our collaborative
networks. This is just one view of
our complex and dynamic network.

Future Tense

Future of the Book

Frequent collaborators

Newer collaborators

A Growing Network

The Center for Science and the Imagination serves as a network hub for a diverse array of researchers, students, and practitioners.

We bring people together through events and public forums and a variety of collaborative, interdisciplinary projects, workshops, nontraditional publications, tangible design challenges, and freewheeling imaginative exercises.

We build new collaborations across disciplinary chasms and construct bridges among the worlds of academia, nonprofit organizations, government agencies, and private industry.

We believe that learning and research about imagination and the future is more robust, rigorous, and broadly relevant when it happens in a collaborative and interdisciplinary environment. These environments are not just places and times; they are platforms for generating new knowledge and insight, new stories for comprehending and intervening in the world.

One measure of our success is the degree to which we are able to bring people together and seed new conversations, relationships, and collaborations.

This chart represents the first stage in an iterative effort to map our network of collaborators and to better understand the imagination ecosystem we are building: the dense web of relationships that constitute our unique community of teachers, learners, poets, mad scientists, dreamers, and creators.
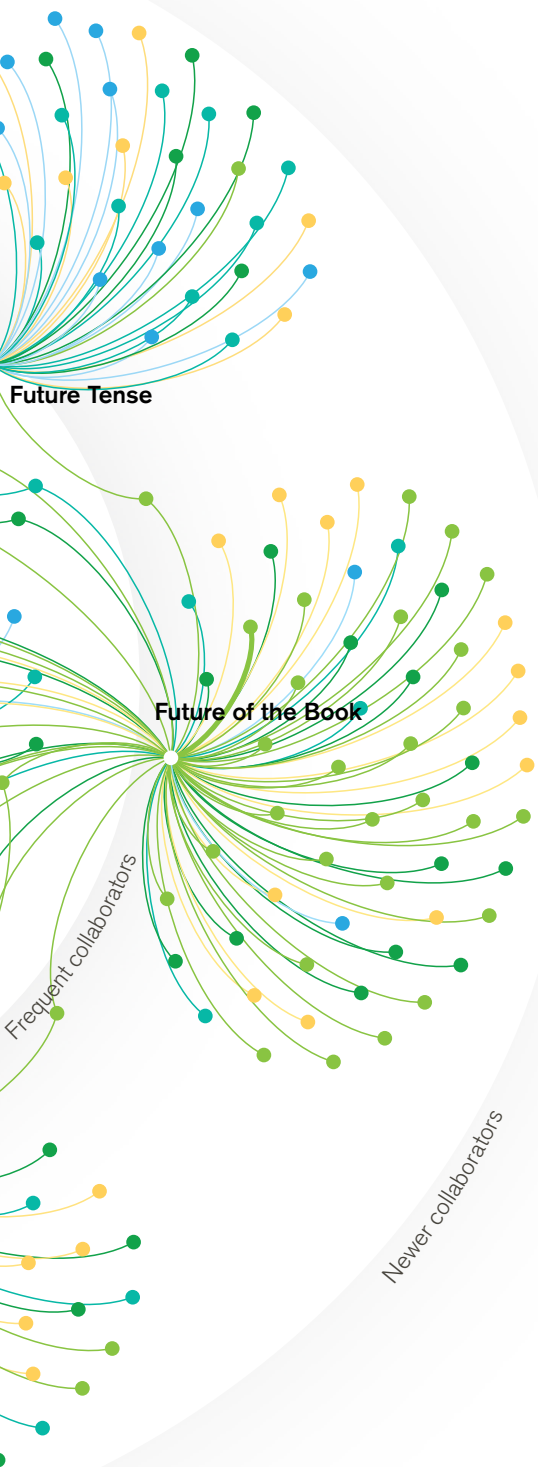
EVOKE Narrative Hackathon participants present their story and concept art.

EVOKE

We have begun collaborating with the World Bank on an exciting project designed to help young people in developing countries learn 21st century skills and tackle global challenges through a multi-player online educational game called EVOKE. "Agents" in the EVOKE network engage virtually and in the real world in social networks to complete missions that will change their community, their country, and their future.

On October 22-24, 2014, the World Bank and CSI hosted a Narrative Hackathon event at the TechShop in Chandler, AZ. The event united top science fiction writers, artists, futurists, and subject area experts on a range of pressing global issues to collaborate and build narratives in EVOKE's fictional universe. Participants worked in interdisciplinary teams throughout the event, with each team focusing on one of six global grand challenges: literacy, human trafficking, conservation, food and energy, nuclear security, and developing new economic models.

The Narrative Hackathon produced stories and art to expand and diversify the narrative universe that will be used to power future deployments of EVOKE all over the world. In 2015, we look forward to further developing these story ideas to integrate specific educational goals, and to begin developing the games themselves.

"Tapping into the vision and voices of some of the greatest storytellers in science fiction is a powerful way to inspire young people around the world..."

Bob Hawkins, World Bank
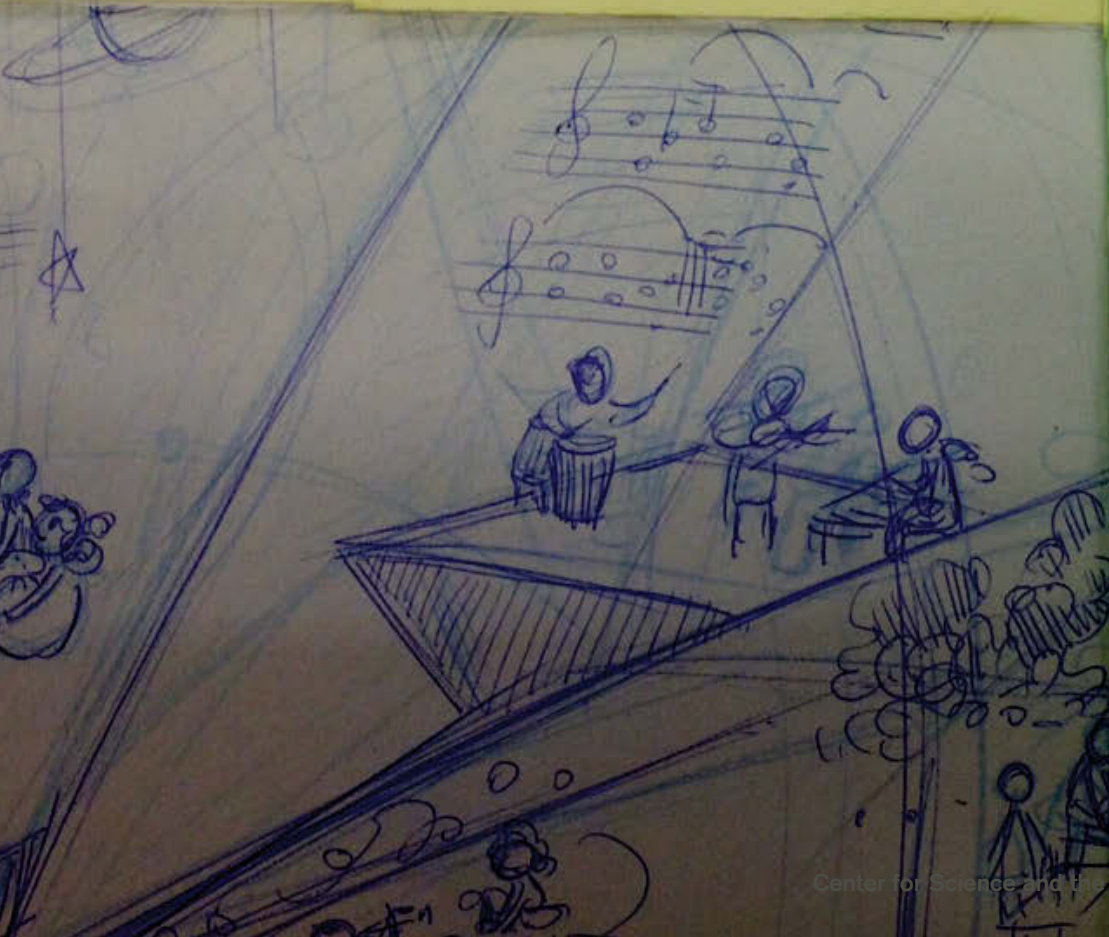
Mary Shelley, portrait by Richard Rothwell, 1840

Celebrating Frankenstein, 2016-2018

No work of literature has done more to shape the way we imagine science and ethics than *Frankenstein; or, The Modern Prometheus*, Mary Shelley's tale of creation and responsibility. *Frankenstein* continues to influence the way we confront emerging technologies, imagine the motivations and ethical struggles of scientists, and weigh the benefits of innovation with its unforeseen pitfalls.

CSI, in collaboration with the Consortium for Science, Policy and Outcomes, serves as the network hub for a global celebration of the writing and publication of *Frankenstein*. The celebration will encompass research projects, publications,

scientific demonstrations, competitions, and events exploring the novel's scientific, technological, artistic, cultural, and social legacies.

The Frankenstein Bicentennial Project will infuse science and engineering endeavors with ethical reflection.

It will use the power of storytelling and art to shape processes of innovation and empower public appraisal of techno-scientific research and creation. It will offer humanities scholars and artists a new set of concerns around research, public policy, and the ramifications of human creativity and invention. And it will bring forth new scientific and technological

advances inspired by Shelley's exploration of our inspiring and terrifying ability to bring new life into the world. As a network hub for the bicentennial, ASU will encourage and coordinate collaboration across institutions and among diverse groups worldwide.

Critical Edition Workshop

In May 2015, CSI hosted a workshop funded by the National Science Foundation to begin planning for a new critical edition of *Frankenstein* designed to encourage young and aspiring engineers, scientists, inventors, and makers to grapple with the ethical, social, environmental, and human dimensions of their work.

The critical edition will exist as both a physical book and an interactive digital space where readers can engage with multimedia content; share their own annotations, questions, and reactions to the novel; and engage in conversations with experts and fellow students about the ethical issues underlying scientific discovery, emerging technologies, and the promise and peril of human ingenuity.

Members of the advisory board for the critical edition include:

- Torie Bosch, Editor, Future Tense Channel, *Slate* magazine

- Elizabeth Denlinger, Curator, Carl H. Pforzheimer Collection of Shelley and His Circle, New York Public Library

- Karin Ellison, Associate Director, Center for Biology and Society, Arizona State University

- Ed Finn, Director, Center for Science and the Imagination, Arizona State University

- David H. Guston, Co-Director, Consortium for Science, Policy and Outcomes, Arizona State University

- Valerye Milleson, Postdoctoral Fellow, Lincoln Center for Applied Ethics, Arizona State University

- Corey Pressman, Director of Experience Strategy, Neologic

- Jason Robert, Director, Lincoln Center for Applied Ethics, Arizona State University

- Charles E. Robinson, Professor Emeritus, Department of English, University of Delaware

Film Weekend, Seattle

On January 23-25, 2015, the Frankenstein Bicentennial Project partnered with SIFF, producers of the world-renowned Seattle International Film Festival, to present a weekend of film screenings, public discussions, and panel conversations, titled "It's Alive!: Frankenstein on Film," in Seattle, Washington.

Presentations from ASU researchers included:

- Joey Eschrich, Center for Science and the Imagination, "*Splice* and Synthetic Biology's Monsters"

- David H. Guston, Consortium for Science, Policy and Outcomes, "From Frankenstein to Synthetic Biology: Responsible Innovation and the Insufficiency of 'Cool'"

- Peter Lehman, "Frankenstein: Imagining and Reimagining the Monster's Body"

Eschrich also hosted and introduced a screening of the Tim Burton animated film *Frankenweenie*, an adaptation of the Frankenstein mythos for a family audience, outlining the film's engagements with scientific ethics, its idiosyncratic production history, and its imaginative use of 3D filmmaking technology to underscore major themes, create dramatic tension, and flesh out the relationships among the film's characters.

Original illustrations for various TV Dinner events by CSI's Nina Miller.

Science Fiction TV Dinner Series

The Science Fiction TV Dinner series is a launch pad for imaginative, engaging conversations about science, technology, and society. Since 2012, the series has 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 and informal setting.

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.

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 2014: House, M.D.

Featured Speakers: Physician and personalized health scientist Kenneth S. Ramos and Cell and molecular biologist Catherine Seiler

October 2014: Buffy the Vampire Slayer

Featured Speakers: Technologists Astrid Atkinson and Bridget Kromhout and Social media scholar Dawn Gilpin
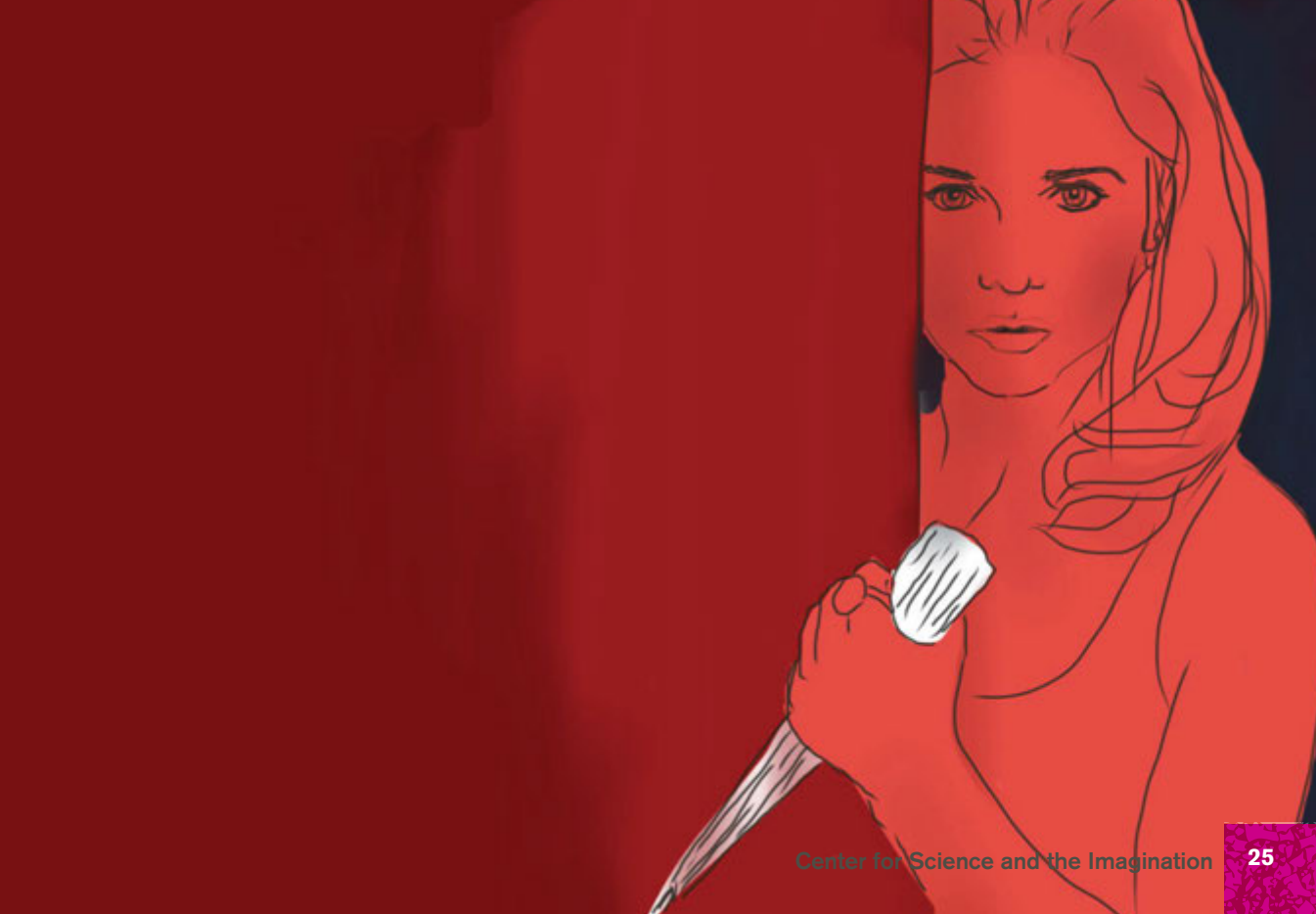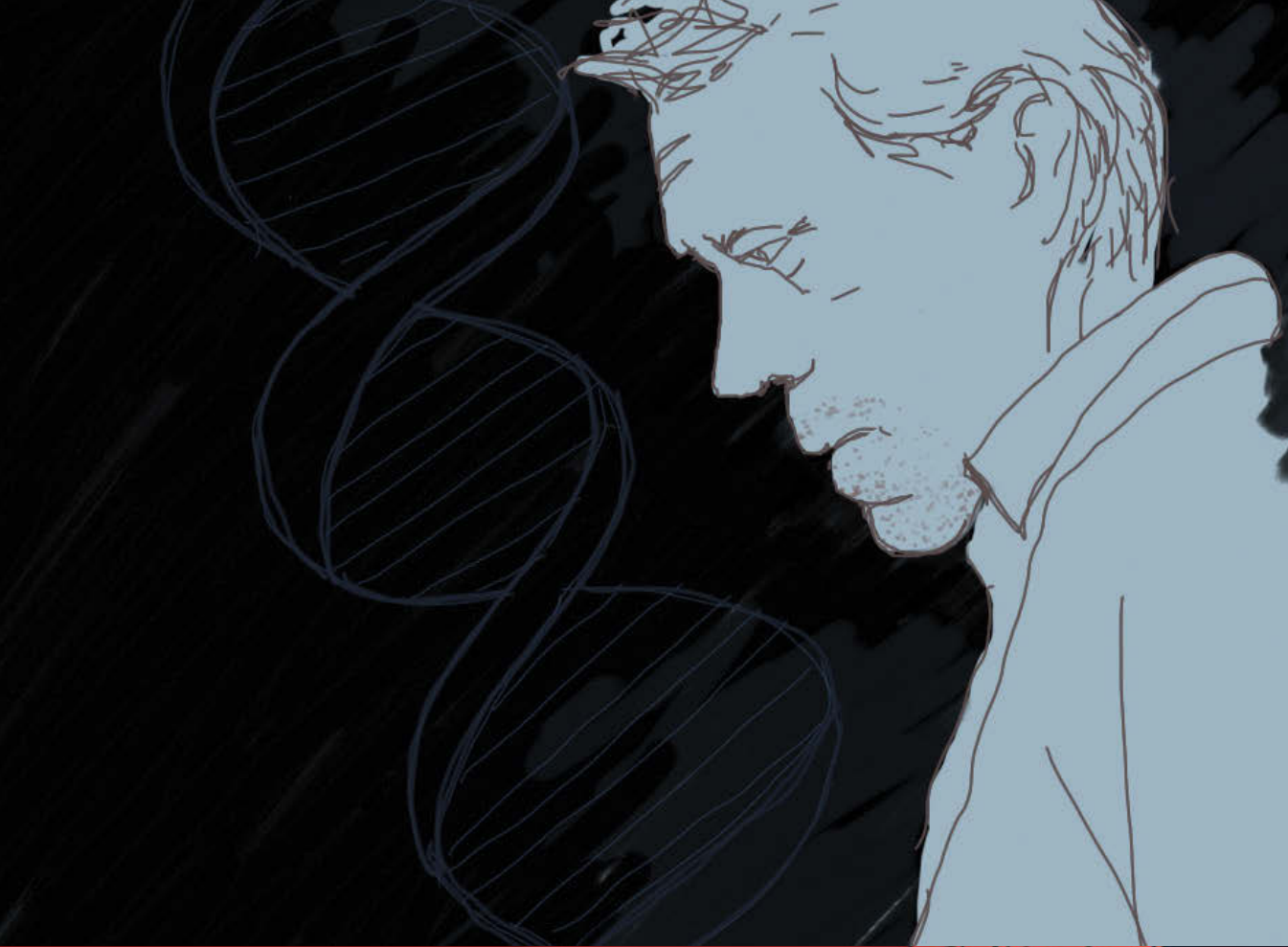
January 2015: Dollhouse

Featured Speakers: Neuropsychologist Mary Lu Bushnell and Actor Harry Lennix

February 2015: Looney Tunes in Space

Featured Speakers: Animation scholar Kevin Sandler and Planetary geologist David Williams

April 2015: Star Trek: Voyager

Featured Speakers: Media scholar Aviva Dove-Viebahn and Planetary geologist David Williams

Postdigital Textbook

Lead investigators: Erin Walker, Ruth Wylie, and Ed Finn

We fear that our digital technologies will isolate us, shutting down avenues for conversation and imprisoning us in a bubble of our own ideas and perspectives. But what if digital technologies could help build community, facilitating resource sharing, conversation, and collaboration?

The Postdigital Textbook Project is an NSF-funded Cyberlearning project (NSF Award 1451431) that aims to build a technologically enhanced book that adapts itself not only to the individual student but to the classroom as a whole. We don't want to simply digitize print books and replace static images with animations – we aspire to create a new tool for knowledge curation and collaboration.

Where traditional textbooks provide structured, static knowledge, the postdigital textbook facilitates curated knowledge, allowing students to make connections within the textbook and to secondary sources like online resources and other class materials. The postdigital textbook will serve as a collaborative resource, helping students and teachers build knowledge, be more aware of one another's activities, and have conversations and debates that enhance learning.

The postdigital textbook may bear little resemblance to an actual book, but we're using the term "textbook" to indicate that this new genre of technology will assume many of the roles textbooks currently play.

Our textbook will fuse advanced educational technologies, learning sciences theory, and insights from design research to reimagine the role that textbooks will play in classrooms. We will not only develop new tools, but also explore how the next generation of digital textbooks will work in practice, in the context of real classrooms. How can digital tools support community-building and encourage positive, constructive interactions among students, and between students and teachers?

At this stage of the project, we are drawing on learning sciences theory and participatory design exercises, working with teachers and students to determine what particular behaviors, relationships, and outcomes the postdigital textbook should facilitate to optimize learning. This grant represents the first stages of an ongoing collaboration that will eventually lead to the development of working prototypes of postdigital textbooks that can be tested in classroom environments.

We are developing intuitive digital learning tools for classrooms that prioritize collaboration, curation, and community – the social construction of knowledge.

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.

This year, we released three anthologies, 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.

The Future: Powered by Fiction was published in November 2014. It includes the top ten stories from our global competition, and addresses issues ranging from food systems and genetic engineering to international development, "designer babies," and artificial intelligence. It features an interview with Bryan Walsh, foreign editor for *Time* magazine, and an original piece of visual art from ASU master of fine arts student AJ Nafziger.

Dark Futures was published in January 2015. Its stories explore dystopian futures where technology and society have run amok. It features an essay from author and technologist Ramez Naam, an interview with legendary science fiction author Kim Stanley Robinson, and visual art from ASU master of fine arts students and graduates Haylee Bolinger, Bobby Zokaites, Eli McGlothern, and AJ Nafziger.

Living Tomorrow was published in April 2015. Its stories examine futures shaped by environmental and biological science and technology. It features an essay from technology theorist Alex Soojung-Kim Pang, plus interviews with Brenda Cooper, a science fiction and fantasy author, futurist, and chief technology officer for the city of Kirkland, Washington; and Vandana Singh, a speculative fiction author, professor of physics, and climate change researcher at Framingham State University in Massachusetts.

The fourth and final anthology in the series, *Journeys through Time and Space*, will be published in fall 2015.

Roomba Painting #1, by Bobby Zokaites, 2005.
Published in the *Dark Futures* anthology.

Process shot for *Pittsburgh 1957*, by Bobby Zokaites, 2005.
Final work published in the *Dark Futures* anthology.

Looking
Ahead

We're excited to continue growing and exploring in 2015 and beyond.

For the future of Hieroglyph, we hope to continue building out the promise we made from the beginning: creating a global ecosystem for big ideas. The project now has a vibrant online community full of creative, diversely talented people who are keen to make a difference. We are considering a number of "Hieroglyph 2.0" projects that range from new anthologies to interactive games, expansions of existing stories, and deeper dives into curriculum development and teaching.

The immediate future will hold a series of contests and community-building activities on the Hieroglyph site. As CSI gears up for the Frankenstein Bicentennial in 2016-2018, we see Hieroglyph as the ideal place to host a series of writing dares (just like the dare that Mary Shelley emphatically won with her amazing novel). These dares will be focused on particular topics, and we hope to attract a number of collaborative partners to these challenges.

We are also hard at work on a top secret Hieroglyph project that will focus on a particular arena of technological innovation with broad appeal. This effort will result in a collection of stories with a rich set of technical materials around them. Stay tuned for an announcement in spring 2016!

Finally, we will continue to build on Hieroglyph as a live laboratory for collaborative imagination. Engaging participants and building communities of interest around big ideas is a technical and social challenge, and we look forward to continuing our research on this living experiment.

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

2014 / 2015

Ed Finn
Director
Assistant Professor,
School of Arts, Media + Engineering
Assistant Professor,
Department of English

Ruth Wylie
Assistant Director
Assistant Research Professor,
Mary Lou Fulton Teachers College

Joey Eschrich
Editor and Program Manager

Chelsea Courtney
Business Operations Specialist

Nina Miller
Design Strategist
Instructor Professional,
The Design School

Lilian Kong
Visual Futurist

PO Box 870309
Tempe, AZ 85287-0309
imagination@asu.edu

csi.asu.edu