ARTS
CENTER FOR ART, SCIENCE & TECHNOLOGY
AT MIT

PROGRAMS 2014−15

**MIT CENTER FOR ART,
SCIENCE & TECHNOLOGY**
2014–15 PROGRAMS

/ **THE ARTS AT MIT**
are rooted in experimentation, risk
taking and imaginative problem solving.

CONTENTS

FROM THE DIRECTORS

This second edition of the MIT Center for Art, Science & Technology's portfolio covers the 2014-15 academic year. It illustrates, through numerous examples, the renewable interplay of ideas and action that drives creation, learning, research and innovation at MIT. Understanding that the Institute has always been a fertile environment for interaction among artists, engineers, humanists and scientists, CAST was established to enhance and develop the many ways in which the arts can flourish in MIT's cross-disciplinary culture, and to demonstrate how this interaction can benefit academic and creative communities at large. By affirming the inherent connections between the rigors of artistic practice and those of the laboratory and design studio, the Center reinforces the integral contribution of the arts to MIT.

Founded in 2012, CAST began to scale up in its third year of existence. This growth was marked in particular by two major, public-facing initiatives that expanded the Center's scope and outreach to a wider public. "Seeing/Sounding/Sensing"—a two-day event that launched the academic year—was the first in a planned biennial sequence of interdisciplinary symposia, while *MIT Sounding*—an ongoing annual performing arts series—put a public face on the adventurous musical exploration that has been thriving at MIT for years. In addition to these inflection points, CAST sponsored collaborative works with visiting artists Katerina Cizek, Tomás Saraceno and Anicka Yi, which were presented in significant festivals and exhibitions in Toronto, Berlin and New York. The "Active Matter Summit," hosted by the Self–Assembly Lab in the School of Architecture and Planning and supported by CAST, defined an emerging field, convening 38 researchers from a wide array of design, engineering and scientific domains. Overall, in 2014-15, CAST sponsored and produced more programs—residencies, conferences, exhibitions, performances, research projects—than it had in its first two years combined, all while increasing the synergy among these activities and the core educational mission of the Institute with corresponding classes, seminars, studios and workshops. The Andrew W. Mellon Foundation renewed its support for the Center through 2020, providing a solid foundation for its future.

CAST's inaugural symposium, "Seeing/Sounding/Sensing," deepened the dialogue between the arts and cognitive neurosciences, and demonstrated that there is a growing appetite for the kind of crossover exchange that the Center supports and nurtures. As Bruno Latour reminded us in his keynote address, the topic reactivated an ancient meaning of the word "aesthetics"—the study of the nature of sensation. To perceive, he emphasized, is not an act of static contemplation, but rather a way of dynamically engaging with the world. The symposium put this proposition into play. With the goal of opening up possibilities for future research, artists joined scientists and humanities scholars from a range of disciplines in an open-ended discussion that made no distinctions, for the purposes of the gathering, among the modes of research or knowledge formation in these different fields. For example, visual artist Tauba Auerbach discussed tetrachromacy and offered a tutorial on geometrical surfaces beyond the third dimension, while neuroscientist Bevil Conway, taking cues from Matisse, explained how color can provide access to emotional processing in the brain. MIT neuroscientist Josh McDermott explored the challenges that reverberation poses to the effective analysis of auditory perception. These challenges were "echoed" during the Symposium's concluding concert, in which composer Alvin Lucier performed *I am sitting in a room*, a landmark 1969 composition built wholly on the gradual merging of speech and room reverberation. Fittingly, Lucier dedicated the performance to acoustic engineer and MIT professor, the late Amar Bose, whose pioneering work had inspired the piece.

As Lucier recounted during an interview excerpted in the pages that follow, he had simply heard in passing that Bose tested the audio fidelity of his speakers by recycling sounds back into them; thus, *I am sitting in a room* was, in the Latourian sense, a literal "aestheticization" of this experimental action. Many of the artistic projects CAST has sponsored, and which unfold in these pages, reveal a similarly ingenious, probing and sometimes playful exploitation or inversion of contemporary technologies. Some draw on the quotidian: making a flute by blowing into an iPhone (Ge Wang) or a drinking straw (Pawel Romanczuk), or creating a sound installation from suspended strings of earbuds that pulse with the ambient buzzing of multiple soundtracks playing simultaneously (Arnold Dreyblatt). In others, the technologies may be more pathbreaking and complex, as in the software developed by MIT musicologist Michael Cuthbert to reconstruct the lost medieval and Renaissance scores that are performed by the esteemed vocal group Boston Camerata, or in the bacteria originally programmed for cancer research by Tal Danino that were cultured to generate a collective, female bacterium for an art installation by Anicka Yi.

In the hands of sensitive collaborators, these permutations of art and technology go beyond appropriation or instrumentalization to forge new possibilities for creative expression or affective response, which, in turn, can rebound into the scientific research and generate new avenues of exploration and discovery. In a notable ongoing project, Professor and Head of Civil and Environmental Engineering Markus Buehler has joined forces with artist Tomás Saraceno to develop a computer model that analyzes the "assisted" sculptures that the artist makes using social species of spiders and a scanning device that tracks their creation of webs in real time. Their goal is to understand how spiders build structures in open space without any scaffolding or support. These lessons may apply, eventually, to new building materials and methods of construction. Also in dialogue with Saraceno, Senior Lecturer in Earth, Atmospheric and Planetary Sciences Lodovica Illari has generated simulations of wind and ocean currents to predict how the artist's solar balloons—"airborne, inflatable sculptures" that are part of his ongoing, visionary *Cloud Cities* series— can be more accurately launched and tasked for scientific readings of toxins in the stratosphere. Their collaborative work was presented at the December 2015 COP21 talks in Paris, where the United States and 195 nations came to an historic agreement to reduce climate change.

The establishment of CAST has coincided with a strong and growing trend at research universities to encourage a purposeful blurring of boundaries among disciplines—"disciplinary infidelities" (to borrow a phrase coined by an MIT student) that create new avenues of approach to seemingly intractable problems, or which simply prompt original thinking and creative change.

Through encouraging sustained incursions by artists into classrooms, labs and research practice, CAST has helped MIT reaffirm and reinvigorate the interpenetration of art, science and engineering to produce unexpected and exciting results. The arts, as we characterize them at MIT, are an indispensable form of experimentation, risk taking and imaginative problem solving. Under CAST's aegis, the projects in the following pages reinforce the idea that making is an essential form of thinking, performing a vital way of testing, and exhibiting an exhilarating opportunity to introduce new material things into the world, and to do so in provocative, illuminating and beautiful ways.

Evan Ziporyn
Kenan Sahin Distinguished Professor of Music
Faculty Director, CAST

Leila W. Kinney
Executive Director of Arts Initiatives
Executive Director, CAST

CAST Visiting Artist Ge Wang demonstrates the Ocarina, an iPhone®
application he designed that transforms the device into a virtual flute.
Speakers are attached to his hands to amplify the sound.

ABOUT CAST

CAST MISSION STATEMENT

The MIT Center for Art, Science & Technology (CAST) facilitates and creates opportunities for exchange and collaboration among artists, humanists, engineers and scientists. A joint initiative of the Office of the Provost, the School of Architecture and Planning (SA+P) and the School of Humanities, Arts and Social Sciences (SHASS), the Center is committed to fostering a culture where the arts, science and technology thrive as interrelated, mutually informing modes of exploration, knowledge and discovery.

CAST's activities include the following:

CROSS-DISCIPLINARY CLASSES

Soliciting and supporting cross-disciplinary curricular initiatives that integrate the arts into the core curriculum and create new artistic work, materials, media and technologies for artistic expression.

PUBLIC OUTREACH

Disseminating to the public the creative and intellectual production supported by the Center through performances, exhibitions, installations, videos, publications and a biennial symposium.

RESIDENCIES

Producing a Visiting Artists Program that emphasizes the creative process, cross-fertilization among disciplines and extensive interaction with MIT faculty, students and researchers.

SUPPORT

Assisting in the presentation and curation of art relevant to the research of engineers, scientists and the MIT community as a whole. Supporting faculty, students and postdoctoral researchers whose work advances the mission of the Center.

FUNDERS

The Center for Art, Science & Technology is funded through 2020 by a grant from the Andrew W. Mellon Foundation. CAST also receives generous support from Dasha Zhukova, Fay Chandler, Ron and Carol Kurtz, Terry and Rick Stone, and Peter Athens. Additional support comes from Philip S. Khoury, Associate Provost with responsibility for the arts; Melissa Nobles, Kenan Sahin Dean, School of Humanities, Arts, and Social Sciences; Hashim Sarkis, Dean of the School of Architecture and Planning; and the Council for the Arts at MIT.

2014–15 CAST PROGRAM STATISTICS

654 students enrolled in classes or participated in workshops

52 MIT faculty and staff collaborated with Visiting Artists

Visiting Artists engaged with students during **47** class visits and individual meetings

Nearly **4,400** people attended **27** public programs in person, and another **938** joined via live web streams

3 collaborative projects appeared in significant festivals or exhibitions in Toronto, Berlin and New York

9 LECTURES
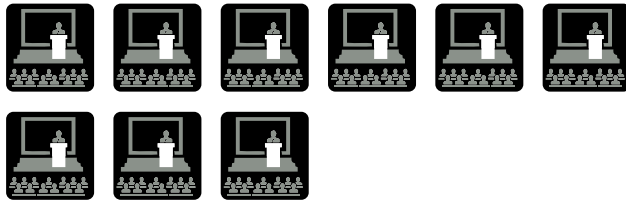
10 PERFORMANCES
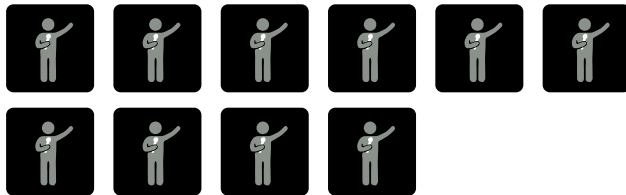
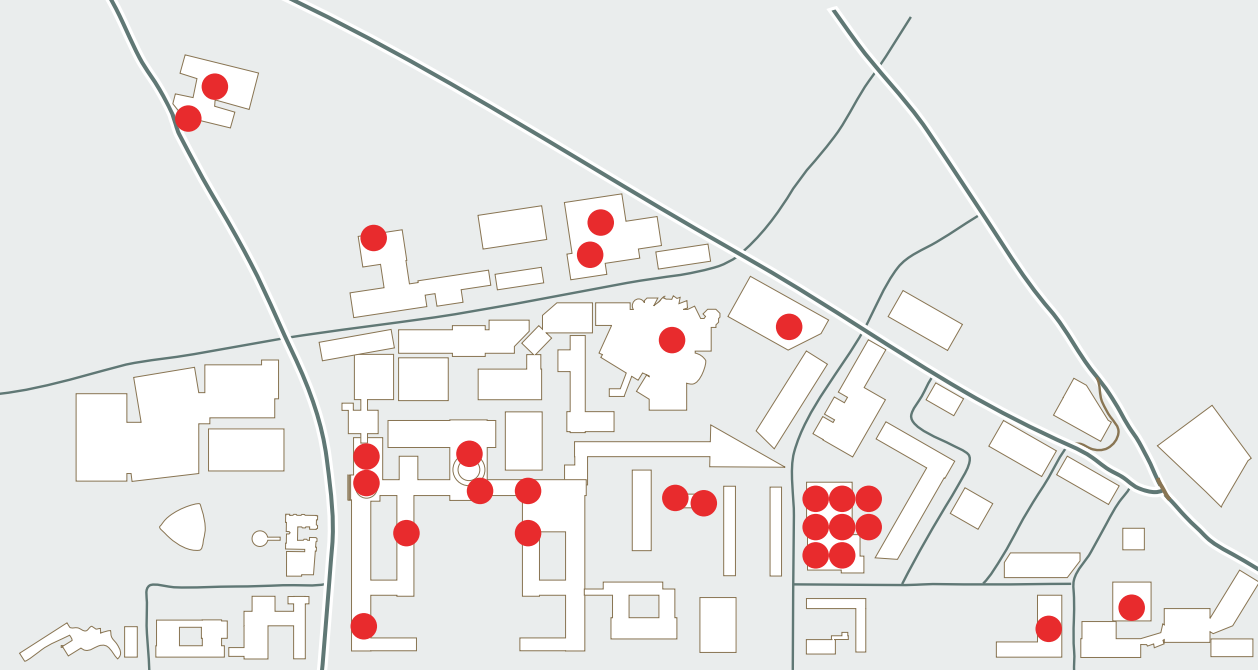## 6 WORKSHOPS/CONVERSATIONS

3 SYMPOSIA

3 CLASSES

2 EXHIBITIONS

PARTNER DEPARTMENTS, LABORATORIES, CENTERS AND PROGRAMS AT MIT

Anthropology Department

Architecture Department

Center for Biological and Computational Learning

Center for Civic Media

Comparative Media Studies / Writing

Computer Science and Artificial Intelligence Laboratory

Department of Brain and Cognitive Sciences

Department of Civil and Environmental Engineering

Department of Earth, Atmospheric and Planetary Sciences

Department of Mechanical Engineering

Department of Physics

Design and Computation Group

History, Theory and Criticism of Architecture and Art

Laboratory for Multiscale Regenerative Technologies

List Visual Arts Center

Media Lab

MIT Museum

MIT Museum Studio

MIT Music and Theater Arts

Open Documentary Laboratory

Program in Art, Culture and Technology

Program in Atmospheres, Oceans and Climate Synoptic Laboratory

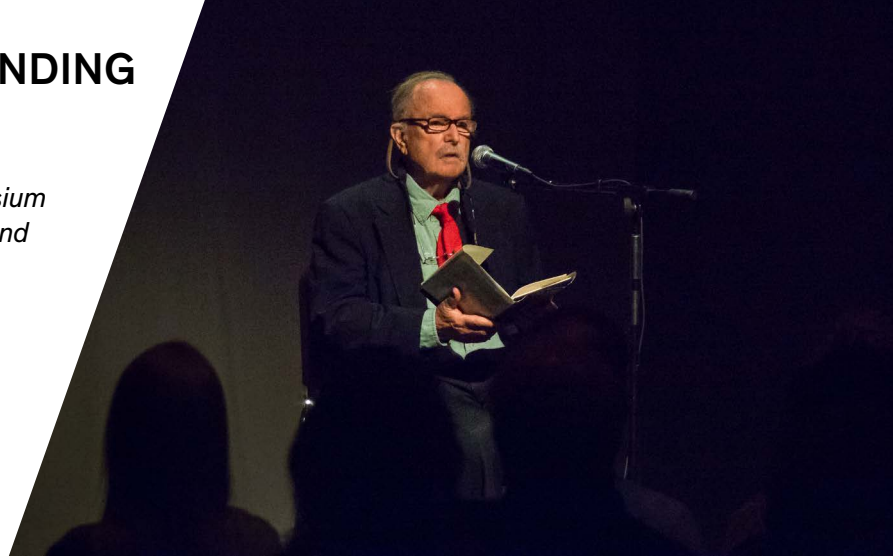Program in Science, Technology and Society

Self-Assembly Lab

CAST Faculty Director Evan Ziporyn addresses attendees at the 2014 "Seeing/Sounding/Sensing" Symposium.

"SEEING/SOUNDING /SENSING"

CAST's inaugural symposium investigates the senses and being aesthetic

/PERFORMANCE: ALVIN LUCIER, *I AM SITTING IN A ROOM;* EVAN ZIPORYN, *IN MEMORIAM JOHN HIGGINS;* ARNOLD DREYBLATT, *SPIN ENSEMBLE,* SEPTEMBER 27, 2014

In his keynote address for CAST's first symposium, "Seeing/Sounding/Sensing," Bruno Latour cautioned against succumbing to that "disease of the Dutch" that afflicted so much of our philosophy—the still life. Unlike the traditional fixed relationship between subject and object in a still life, objects have a trajectory. Latour suggested that to be *aesthetic*—in its true etymological sense, meaning "to make oneself sensitive to," it is better to imagine oneself in motion in the world.

Latour's directive to approach things dynamically could be seen as the guiding principle of the symposium itself. The organizers, MIT Professors Caroline Jones and Stefan Helmreich, along with Mellon Postdoctoral Fellow David Mather, convened artists, philosophers, cognitive neuroscientists, historians, anthropologists and humanities scholars to contribute to this cross-disciplinary investigation of the senses. The speakers explored their respective subjects, "Seeing—Color," "Sounding— Resonance" and "Sensing—Action," with kaleidoscopic diversity, each illuminating a different aspect of sensory experience. Latour stated, "I will make no distinction—because that is the goal of our symposium—between making oneself sensitive through scientific instruments or making oneself sensitive through the arts," and in that spirit, each panel involved researchers from the sciences, the arts and the humanities.

BRUNO LATOUR
University Professor, Institut d'études politiques de Paris
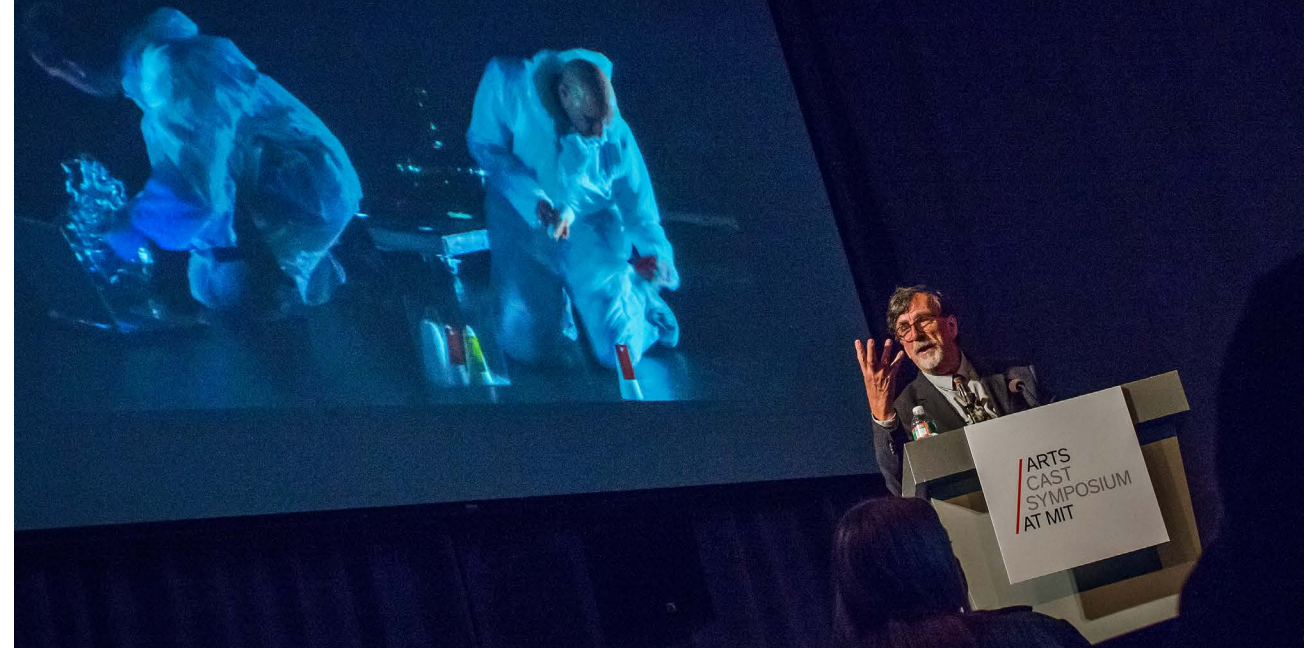
TAUBA AUERBACH
CAST Visiting Artist

BEVIL CONWAY
Associate Professor of Neuroscience, Wellesley College

ARNOLD DREYBLATT
CAST Visiting Artist

STEFAN HELMREICH
Elting E. Morison Professor of Anthropology and Head, Anthropology Department, MIT

CAROLINE JONES
Professor of Art History, History, Theory and Criticism of Architecture and Art Program, MIT

DAVID KAISER
Germeshausen Professor of the History of Science; Department Head, Program in Science, Technology, and Society; and Senior Lecturer, Department of Physics, MIT

BRIAN KANE
Assistant Professor of Music Theory, Yale University

LEILA W. KINNEY
Executive Director of Arts Initiatives and the Center for Art, Science & Technology (CAST), MIT

CARRIE LAMBERT-BEATTY
Professor of Visual and Environmental Studies, History of Art and Architecture and Director of Graduate Studies, Film and Visual Studies, Harvard University

ALVIN LUCIER
John Spencer Camp Professor of Music, Emeritus, Wesleyan University

JOSH MCDERMOTT
Fred & Carole Middleton Career Development Assistant Professor, Department of Brain and Cognitive Sciences, MIT

MARA MILLS
Assistant Professor of Media, Culture and Communication, New York University

ALVA NOË
Professor of Philosophy, University of California, Berkeley

TOMASO POGGIO
Eugene McDermott Professor, Department of Brain and Cognitive Sciences; Co-Director, Center for Biological and Computational Learning; Director, Center for Brains, Minds, and Machines; and Member, Computer Science and Artificial Intelligence Laboratory (CSAIL), MIT

TOMÁS SARACENO
CAST Visiting Artist

NATASHA DOW SCHÜLL
Associate Professor, Program in Science, Technology and Society, MIT

ALMA STEINGART
Junior Fellow, Harvard Society of Fellows

JOSH TENENBAUM
Professor of Computational Cognitive Science, Department of Brain and Cognitive Sciences, MIT

EVAN ZIPORYN
Faculty Director, Center for Art, Science & Technology (CAST) and Kenan Sahin Distinguished Professor of Music, MIT
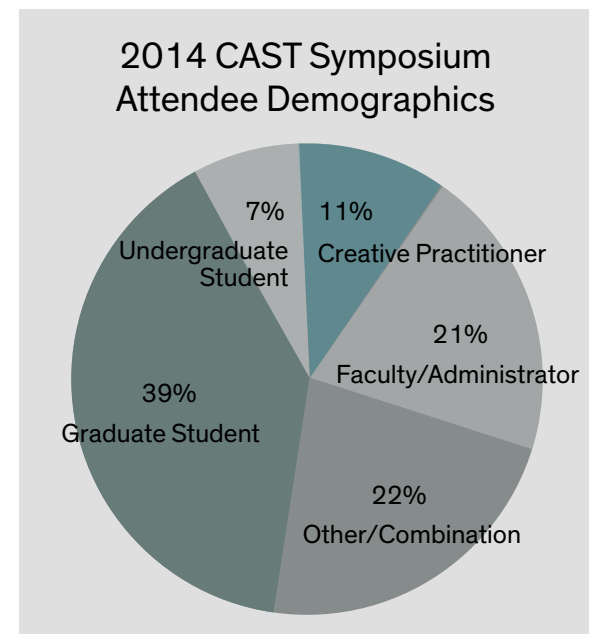
In "Sensing—Action," Carrie Lambert-Beatty suggested that neural activity depends on interaction with the world. Artist Tomás Saraceno described his work *On Space Time Foam* in the Pirelli HangarBicocca Milan (2012) in relation to the "butterfly effect" and proxemics, echoing Latour's assertion that a fixed face-to-face interaction with our environment is implausible. In his critique of the "still life" scenario, Latour pointed out that not only are subject and object in flux, but also the background itself, planet Earth, is changing in the current climate crisis and requires new responses. Saraceno's mutable installations create exactly this kind of fluctuating environment, thereby challenging us to find unusual ways to sense our world.

The two-day event highlighted the intriguing intersections between the arts and sciences and the drive to put theory into practice. Artists and scientists alike probe the realities of sense experience, albeit with different tools.

"Experience is perpetually on the move."

– Caroline Jones

The symposium's concluding concert, which featured performances by Alvin Lucier, Evan Ziporyn and Arnold Dreyblatt, reinforced the theoretical discussions with the experience of sound itself and our own abilities to sense and to be *aesthetic*.

2014 CAST Symposium Attendee Demographics

- 11% Creative Practitioner
- 21% Faculty/Administrator
- 22% Other/Combination
- 39% Graduate Student
- 7% Undergraduate Student

Previous page, top: Alvin Lucier performs *I am sitting in a room,* at the CAST symposium, "Seeing/Sounding/Sensing," 2014.

Previous page, right: Bruno Latour delivers the keynote address at the CAST symposium, "Seeing/Sounding/Sensing," 2014.

Above: In the session, "Seeing—Color," Bevil Conway presents a new integrated theory in which he argues that the primary role of color is not simply to aid in object segmentation, but rather to be a trainable system that facilitates the rapid detection of behaviorally relevant objects.

Right, top: Attendee Demographics.

Right, bottom: Stefan Helmreich (left) moderates the session, "Sounding—Resonance" with ASL Interpreter and seated (from left): Mara Mills, Brian Kane, Josh McDermott, Alexander Rehding and Alvin Lucier.

Caroline Jones explained how the session "Seeing—Color" would eschew the traditional approach to color in which scientists explain wavelength and artists explain hue; instead visual artist Tauba Auerbach discussed color and mathematics, and neuroscientist Bevil Conway described color's emotional and affective properties. As Latour noted, Conway showed that color is not fixed; it is based on a temporal dimension, rather than a spatial one.

The panelists in "Sounding—Resonance" addressed the manifold topics related to human audition, the sonic, tactile and haptic qualities of resonance and the larger issue of sensitivity. When asked about Latour's definition of aesthetics, for instance, composer Alvin Lucier responded that his work sometimes prompted listeners to be attentive to the process of hearing itself. Josh McDermott's talk on auditory perception seemed like a primer for listening to Lucier. He explained the way sound waves interact with room acoustics on the way to the ear—the very phenomenon that Lucier exploits in *I am sitting in a room* and *In Memoriam Jon Higgins.*

Tomás Saraceno, *Social... Quasi Social... Solitary... Spiders... On Hybrid Cosmic Webs*, Esther Schipper Art Gallery, 2012. Photo: Andrea Rossetti.

"ACTIVE MATTER SUMMIT"

The emerging field of self-generating and programmable materials

Snapshot: Zhao Qin

/SYMPOSIUM: "ACTIVE MATTER SUMMIT," APRIL 24-25, 2015

/CLASS: "ARCHITECTURE DESIGN FUNDAMENTALS," SPRING 2015

Assembling complex structures—a task that once fell to graduate students with high-precision tweezers—is being revolutionized by researchers in the emerging field of self-assembly and programmable materials. In recent decades, significant advances in computational origami, synthetic biology, DNA nanotechnology and soft robotics have led to the development of dynamic "smart" materials that can change shape, appearance or other properties without external manipulation, complex electronics or difficult assembly processes. Skylar Tibbits's Self-Assembly Lab in the MIT School of Architecture and Planning is a leader in this domain. His lab invents self-assembling and programmable materials aimed at reimagining fabrication, construction, manufacturing and adaptability in the built environment. For instance, 4D printing is a new process, created in collaboration with Stratasys and Autodesk, which prints customizable materials that transform over time, based on the material's inherent properties and a pre-programmed response to a particular stimulus.

As a research complement to a new studio class sponsored by CAST (see pp. 23 to 26), Tibbits convened the "Active Matter Summit" to showcase and help define this new area of materials research.

CONFERENCE ORGANIZED IN COLLABORATION WITH:

SKYLAR TIBBITS
Research Scientist and Director, Self-Assembly Lab, School of Architecture and Planning, MIT

ATHINA PAPADOPOULOU
PhD Candidate, Design Computation Group and Researcher, Self-Assembly Lab, MIT

Leading figures in art and design, engineering, synthetic biology and soft robotics, along with leaders from government and industry, gathered to demonstrate current research, explore future applications and discuss converging interests.

"If today we program computers and machines, tomorrow we will program matter itself."
— Skylar Tibbits

Among the topics discussed were 3D printing organic material such as chitin; creating self-folding, microscale RoboBees; programming bacteria to detect liver cancer; and designing resorbable electronics from silk proteins that can dissolve or biodegrade into the surrounding environment in a benign way. Grouping thematically similar work from different but related fields of research called attention to the potential for inspiration to travel between disciplines. During this two-day conference, a palpable sense of excitement grew, as participants sensed that they were discovering new territory and building a strong community that will collectively explore new challenges, applications and future scenarios.

Previous page, top left: Markus Buehler presents his work in bio-inspired materials, including spider silk. Tomás Saraceno's studio developed an original tomographic method, using a laser sheet, to scan a 3D web built by *Latrodectus mactans*, and this pioneering technique made access to the complete and accurate 3D data of a spider web possible for the first time.

Buehler's lab developed a network model, which reveals the elasticity and tension of the black widow's web that the artist scanned.

Previous page, right: Neri Oxman discusses projects in Material Ecology and her group's research at the intersection of computational design, digital fabrication, materials science and synthetic biology.

Above: Paola Antonelli, Senior Curator of the Department of Architecture and Design and the Director of Research and Development at The Museum of Modern Art, New York, discusses new developments in synthetic biology and design and her groundbreaking 2008 exhibition, "Design and the Elastic Mind."

Right, top: Merton C. Flemings, Toyota Professor Emeritus and founding director of the Materials Processing Center at MIT.

Right, bottom: Bio-Materials panel discussion.

AESTHETICIZING BACTERIA

Anicka Yi creates olfactory installations from bacterial cultures

Working with materials as diverse as bacteria, honey and tempura-fried flowers, Anicka Yi creates olfactory installations designed to disrupt our predominantly visual culture.

As part of her 2014–15 residency at MIT, Yi co-taught an IAP workshop, "The Art and Science of Bacteria," with Tal Danino. She and Danino explored the use of bacteria for artistic expression and shared their collaborative work in this area. Yi says her interest in bacteria evolved: "Before I was working on a microscopic level gathering these cultures, I was aestheticizing bacteria in my soap works. [Through Tal,] I became interested in bacteria's role in metabolisms and stomachs."

For an exhibition, *You Can Call Me F*, at The Kitchen in New York, Yi worked with Danino to develop strange and pungent works cultured into a "collective bacterium." Yi created a scent compiled from biological samples submitted by 100 women to evoke reactions related to paranoia about contagion and hygiene, feminism and the power of female networks. "This residency at MIT really opened the gates for me," said Yi in an interview in *Artspace*, "to have the opportunity to develop relationships

TAL DANINO
Postdoctoral Fellow, Laboratory for Multiscale Regenerative Technologies, MIT and TED Fellow

ANICKA YI
CAST Visiting Artist

with some of the top researchers and scientists. And then the biology started to become more tangible."

"I tried not to be repelled by things I smelled. I tried instead to catalog them in my brain."

— Anicka Yi

Yi's exhibition at the MIT List Visual Arts Center in summer 2015, *Anicka Yi: 6,070,430K of Digital Spit*, featured her ongoing project, *The Flavor Genome*. Yi filled the gallery with the scent of menthol and created an illuminated pond of synthetic and biological material, made of hair gel embedded with contact lenses, and cellulose leather grown from bacterial cultures found in kombucha tea. Inspired by a dish called Mint Pond, which she sampled at the famous Michelin three-star restaurant elBulli, Yi says, "I think the most radical artistic statements are being made in the world of cuisine. That interest translates and seeps into my approach to smell." Much of her work examines how visual, olfactory, gustatory and auditory "flavors" elicit sense memories and longing, and possess cultural and economic value.

Previous page, top left: Installation view (detail), *Anicka Yi: You Can Call Me F*, The Kitchen, New York, 2015. Photo: Jason Mandella. Courtesy of The Kitchen.

Previous page, middle: A petri dish with four samples of bacteria. During the IAP workshop, "The Art and Science of Bacteria," students collected bacteria by swabbing their bodies and objects in their environment in order to chart the bacteria's growth.

Previous page, bottom: CAST Visiting Artist Anicka Yi.

Previous page, right: Installation view, *Anicka Yi: You Can Call Me F*, The Kitchen, New York, 2015. Yi housed her olfactory works in structures that were modeled after quarantine tents to underscore the relationship between bacteria and contagion. Photo: Jason Mandella. Courtesy of The Kitchen.

Above: CAST Visiting Artist Anicka Yi leads a discussion on potential artistic uses for bacteria with MIT students and researchers.

Right, top: Installation View, *Anicka Yi: 6,070,430K of Digital Spit* at MIT List Visual Arts Center, Cambridge, MA. Photo: Peter Harris Studio.

Right, below: Students in the IAP Workshop, "The Art and Science of Bacteria," collect bacteria from a cell phone.

TRANSCENDING THE ALGORITHM

A fundamentally new approach to teaching design fundamentals

Banish the balsa wood and foam core of yesterday's design classes. Students in Skylar Tibbits's innovative architectural design studio course used everything from gummy bears to glass to rubber to foam in order to create 3D representations of generative drawings for one of three progressive and complex design projects. Tibbits's studio fused materials science, art and design with the emergent field of self-generating and programmable materials. Self-assembly promises to enable breakthroughs across many applications in biology, software, robotics, manufacturing, transportation, infrastructure, construction, the arts and even space exploration. This course prepares students to work in this exciting new domain.

Students first used the assembly language Processing to create generative drawings based upon the structural properties of materials as varied as hydrogels, capillaries, carbon nanotubes, snowflakes, microfibers, liquid crystal, electronic ink and graphene. Tibbits explains that, just as Jackson Pollock "curated forces" by subjecting paint to gravity, he asked students to select materials to subject to natural forces, and then to use an algorithm to display

SKYLAR TIBBITS
Research Scientist and Director, Self-Assembly Lab, School of Architecture and Planning, MIT

ATHINA PAPADOPOULOU
PhD Candidate, Design Computation Group and Researcher, Self-Assembly Lab, MIT

these forces at work. Tibbits stressed that this project was about embracing the notion that "the medium has a life of its own" and distinguishing between "one's own authorship and the force of the generative systems."

The students' generative drawings were translated into a series of material experiments for the second project, "Material Formations." They explored a range of processes, including multi-material printing, low-temperature metal casting, glass blowing, plastic/plaster/rubber casting, crystallization, electroplating, foams, bubbles and natural material growth.

Students continued to explore these unanticipated characteristics of materials in a final project, "Living Objects/Growing Structures," for which they worked in groups to create large-scale physical structures that possess various abilities to self-transform.

> "Usually, you begin with a concept and want to find a material that can achieve that idea. In this case, I wanted to do the opposite and have the students explore what the materials do first, and let that dictate the look of the models."
> – Skylar Tibbits

Tibbits says the point was to have the students "push their material to its failure." As he explains, pointing to a foam sculpture with a bulbous protuberance, "You couldn't anticipate that."

"REVISITING CASE"

Building on a dynamic period of architectural history

Paradigms do not shift overnight. In 1964, a group of young architects founded CASE, the Conference of Architects for the Study of the Environment, and together they proceeded to chip away at the status quo. Through debates, collaborations and productive disagreements, they helped move architecture beyond strictly formal concerns toward greater interdisciplinarity.

As Stanford Anderson recalls, "We took the name CASE—Conference of Architects for the Study of the Environment. The 'environment' part was an issue of contention. Most participants had strong formal commitments... . There were others, particularly at MIT, who wanted to cast the net a little wider. We wanted to be sure it was understood that architecture was not only a formal interest."

Led by Peter Eisenman, the group included such formidable architectural intellects as Kenneth Frampton, Michael Graves, Richard Meier, John Hejduk, Stanford Anderson, Hank Millon and Colin Rowe. They discussed everything from pedagogy

to practice, organized meetings and conferences at several East Coast universities, and broadcast their work through publications, an exhibition at MoMA and a teach-in at Oregon University—events that laid the groundwork for later developments in the field.

> "I realized there was a level of morality to architecture—I would call it a morality—about what was done and how it should be done, that didn't necessarily just deal with housing or housing the indigent, but also dealt with the whole idea of the relationship of architecture to culture, to an ideology of capital."
>
> — Peter Eisenman

Fifty years after the formation of the group, Stanford Anderson's essay, "CASE and MIT: Engagement," included in *A Second Modernism* (MIT Press, 2013), produced a rich memoir of the group's meetings and discussions. "Revisiting

CASE MEMBERS
Stanford Anderson, Anthony Eardley, Peter Eisenman, Kenneth Frampton, Robert Kliment, Donlyn Lyndon, Michael McKinnell, Richard Meier, Henry Millon, Jaquelin Robertson and Thomas Vreeland, plus Robert Goodman, K. Michael Hays, Sylvia Lavin, Reinhold Martin, Felicity Scott, Anthony Vidler, and faculty and students from History, Theory and Criticism of Architecture and Art, MIT.

MARK JARZOMBEK
Professor, History, Theory and Criticism of Architecture and Art, MIT

ANA MARÍA LEÓN
PhD candidate, History, Theory and Criticism of Architecture and Art, MIT

JOAN OCKMAN
Distinguished Senior Fellow, University of Pennsylvania School of Design

DEEPA RAMASWAMY
PhD candidate, History, Theory and Criticism of Architecture and Art, MIT

JESSICA VARNER
PhD candidate, History, Theory and Criticism of Architecture and Art, MIT

RIXT WOUDSTRA
PhD candidate, History, Theory and Criticism of Architecture and Art, MIT

CASE" built on the group's initial research and conversations from the late 1960s and early 1970s. Participants in the conference included the original CASE members, as well as noted scholars of the history of modern architecture in North America.

Organized around three panels, "The City in CASE," "Traveling CASE" and "Grays versus Whites: Prologue," the discussion explored the group's interest in the city as a place for theoretical speculation and political action, their pedagogical imperatives and the famous "Grays versus Whites" debate, which questioned the authority of modern architecture and highlighted tensions between practice and theory. The keynote discussion, "From CASE to IAUS," examined the links and divergences between this early formation of the United States architectural avant-garde and its resolution into the Institute for Architecture and Urban Studies. Although CASE and IAUS shared several members and discourses, their differences point to the complicated dynamics during this key period of architectural history.
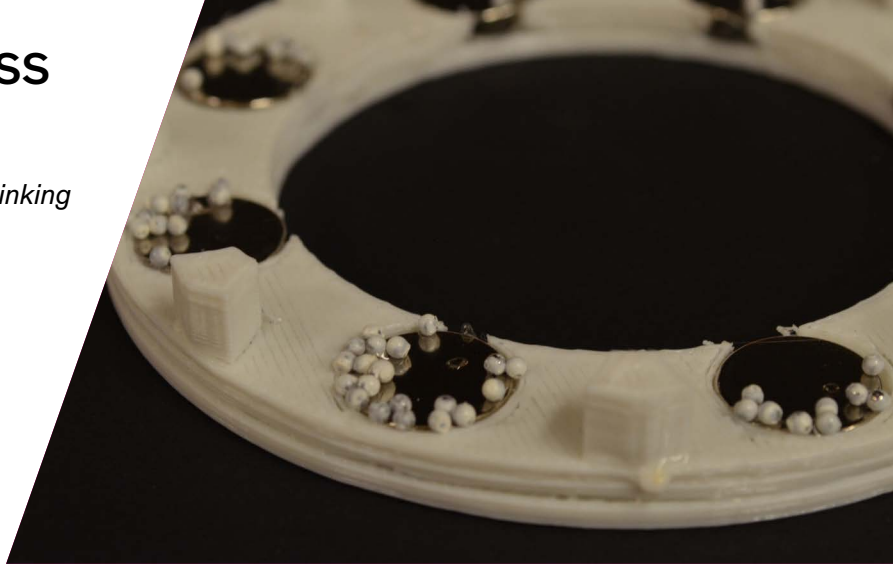
Revisiting CASE is a symposium organized by the History, Theory and Criticism program at MIT, and funded by the MIT Center for Art, Science & Technology (CAST) and the MIT Department of Architecture.

Previous page, top: Stanford Anderson in the panel, "Traveling CASE," at the "Revisiting CASE" symposium. Photo: Arindam Dutta.

Previous page, right: Thomas Vreeland in the panel, "Grays vs. Whites: Prologue," at the "Revisiting CASE" symposium. Photo: Arindam Dutta.

Above: "The City in CASE," moderated by Felicity Scott (far left). Panelists (from left): Kenneth Frampton, Michael McKinnell and Robert Goodman. Photo: Arindam Dutta.

Right, top: Thomas Vreeland in the session, "Grays versus Whites: Prologue," at the "Revisiting CASE" symposium. Photo: Arindam Dutta.

Right, bottom: "Keynote Discussion: From CASE to IAUS." Moderator Sylvia Lavin (left) and panelist Stanford Anderson (right). Photo: Arindam Dutta.

DESIGN ACROSS SCALES

Antidisciplinary design thinking

How far would you go to control your own image? How do you improve communication during earthquakes? How do you show people how small their problems are relative to the universe? From design provocations like the "Selfie Tail" to pragmatic solutions like the "Safe-Quake Seismic Alert" to interstellar projects that "launch your stress into space," students in the Spring 2015 section of Design Across Scales (DAS) tackled these and other design questions. Using interdisciplinary tools and methods, they represented, modeled, designed and fabricated objects and systems across physical, economic and social scales.

Transformations in science and technology have influenced design thinking, and vice versa. This course, taught by J. Meejin Yoon and Neri Oxman, explored these reciprocal relationships by covering topics ranging from industrial design and architecture to visualization, perception and design computation to material ecology, environmental design and sustainability. "The race to cure cancer, the Mars landing mission and the challenge to design sustainable cities and buildings require, perhaps more than ever, an interdisciplinary skill set and an ability to operate across multiple scales with creativity," Yoon and Oxman say.

Lectures and labs were organized by design systems, such as representation, fabrication and even play. How we represent the world has contributed to some of humanity's most significant revolutions, Oxman and Yoon remind their students: "Consider Galileo's representation of the world that brought about the Copernican revolution, or London's Tube Map that revolutionized our conception of underground public transportation as a circuit diagram." For one assignment, they asked students to design a representational system for any thing or phenomenon—dog food, silkworms, fast food, poverty, political regimes, global warming, the state of education, or why butterflies fly. Another project challenged students to design something that helps you make something and then to use it to make that object. The resulting projects ranged from the wearable to the edible to the inhabitable. In order to investigate gameplay as a primary means of generating culture, Oxman and Yoon asked students to design, build and test various kinds of games—single, multiplayer or games of strategy and chance.

"This class reflects in the best way a shift from [teaching the] the autonomy of architecture as a discipline to a more open, cross-disciplinary approach that regards architecture as part of design, rather than the opposite," says Athina Papadopoulou '14, a Teaching Assistant (TA) for the course. "I believe that DAS is launching a design

model that responds to today's educational and industrial needs. In that respect, its philosophy is very similar to the experimental cross-disciplinary design curriculum of the Bauhaus school, but adapted to the technologies of the present. One reason I wanted to be a TA in the class was to learn from such an experimental model."

"We may discover that structure tells a much larger story that holds the seeds to future design."
– Dhruv Jain,
Emma Pearl Willmer-Shiles,
Grayson Babbitt, Julia Canning
("Nervous Blocks")

Previous page, left top: Microbead filter.

Previous page, left middle: "Person du jour" bracelet, a project that envisions an alternative to social media platforms that introduce you to people only virtually.

Previous page, left bottom: With the "Person du jour" bracelet, users will be introduced to one another by illuminating when you are in close proximity. People will be matched based on individual profiles and location.

Previous page, right: Assignments ranged from designing with DNA to re-designing the wheel. Students were expected to respond to these interdisciplinary design problems not only by producing objects, but also by designing experiences, data, networks, territories and social frameworks.

Above: "Take a Seat" provides a minimalist alternative to a chair, comprised of a simple back and a scarf to tie around the sitter's legs. The team noted that in many cultures, sitting on the floor is preferred to the confines of a chair. Their design allows sitters to lean back or to entwine the ties with others to make a mutually supportive seating arrangement.

Right top: "Train Reaction" involved making hammocks for the homeless from recycled plastic bags in Boston's MBTA public transportation system. Students Zach Kirkman, Luke Vink, Caroline Alexander and Tapasya Wancho say this project was an attempt to create a pop-up maker community in train cars to test commuters' willingness to spend their travel time engaged in making.

Right bottom: "Nervous Blocks" explores the simple beam as a building block representing structure across scales. Embedded hardware sensors respond to changes made in a semi-rigid beam. The block glows blue at an unstressed state and becomes red as the stress is applied.
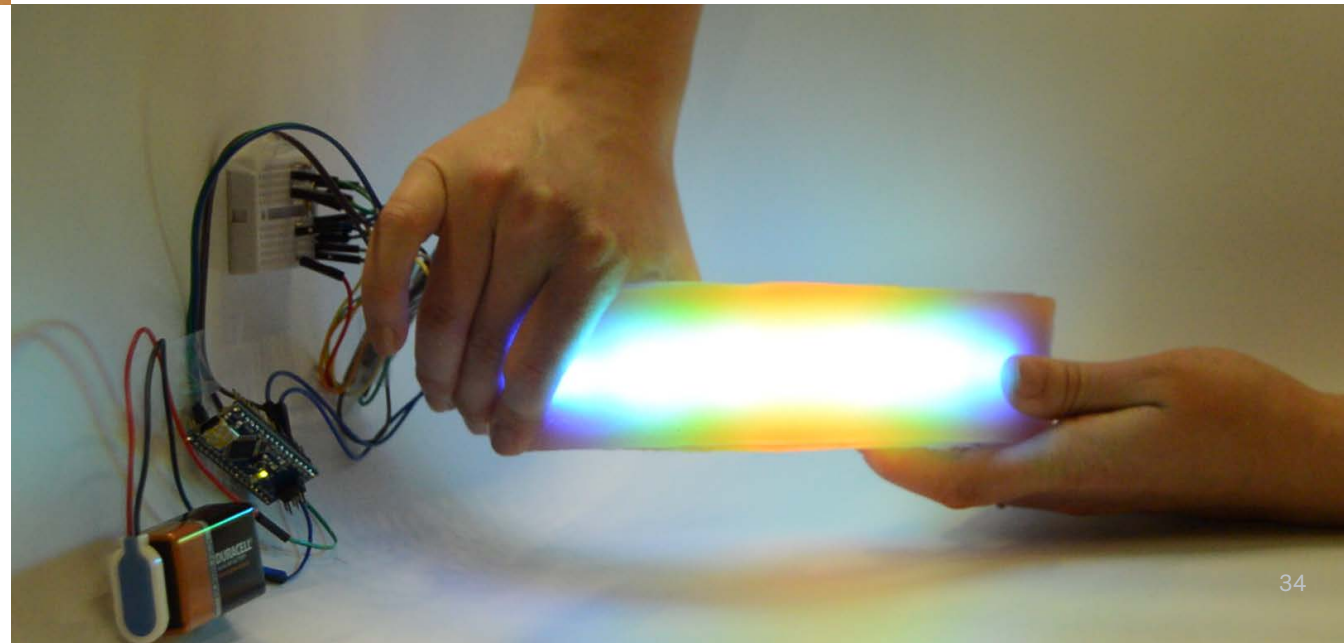
ENGINEERING CUISINE

Chefs from Mugaritz explore food's structure with MIT Professor Pedro Reis

"Food is connected to everything—language, texture, tradition," Chef Dani Lasa of Mugaritz told a packed audience at MIT. Now, the accomplished chef can add engineering to that list, thanks to Pedro Reis. Professor Reis invited chefs from Mugaritz, a Michelin two-star restaurant in Errenteria, Gipuzkoa (Basque Country, Spain), to be guest speakers in the Mechanics: Modeling, Experimentation, Computation seminar series.

With a dedicated Research and Development team focused on finding new techniques, ingredients and flavors, Mugaritz has the ability to "experiment, explore and play with materials and structures" in a way similar to that of Reis's EGS.Lab (Elasticity, Geometry and Statistics Laboratory). The EGS. Lab works extensively with thin structures, such as strands of hair or eggshells, finding functionality and structural integrity in these seemingly fragile forms.

Since opening in 1998, Mugaritz has gained an international reputation for its experimental approach to food. Its founder, Chef Andoni Luis Aduriz, has prioritized culinary evolution through an interdisciplinary approach. By altering the structure and texture of food, his team subverts diners' expectations in a provocative and playful way.

In their talk, "Mugaritz, a Natural Science of Cooking: Senses, Structures, Textures and Emotions," Chefs Lasa, Ramon Perisé and Oswaldo Oliva shared the art and science behind their culinary creations. The chefs showed how gastronomic experiences are not governed by taste alone, but also engage sense memories and cultural preferences , by having participants taste taste "sweet carpaccio" and "savory macarons."

"Opportunities for novelty are on the table."

– Pedro Reis

To the audience's surprise, the carpaccio was dehydrated watermelon, transformed through a process of freezing, thawing and smoking, and the seemingly chocolate macarons were made from blood pudding and pork. These social experiments underscored how our judgment is linked to prior knowledge of a food's texture, color and shape.

PEDRO REIS
Associate Professor, Civil and Environmental Engineering and Mechanical Engineering, MIT

CHEFS DANI LASA, RAMON PERISÉ AND OSWALDO OLIVA
Mugaritz Research and Development Team

Mugaritz has a close relationship with scientists in various disciplines, including chemists, microbiologists and neuroscientists, but previously had not worked with engineers. Having primarily focused on the chemical aspects of food, the Mugaritz team is just beginning to explore the structure of materials—something that is central to the expertise of the engineers at MIT. The chefs met with faculty working on the mechanics of fluids, materials and structures and visited nine laboratories. According to Oliva, "It may take months to assimilate and put into use in our menu" the many interesting things they saw at MIT.

Previous page, top left: Chefs Dani Lasa and Ramon Perisé of the Mugaritz R&D Team. Photo: Tony Pulsone.

Previous page, right: Carpaccio vegetal. Photo: Mugaritz.

Above: Macaron parisien. Photo: Mugaritz.

Right, top: Chef Ramon Perisé demonstrates a process created at Mugaritz to transform camellia leaves into an edible dish. The vegetable part of each leaf is removed through submersion in an alkaline solution of ash and baking soda. The leaves are then oven toasted and oven dried with honey. Photo: Tony Pulsone.

Right, bottom: MMEC Seminar, 2014. Pedro Reis with Chefs Dani Lasa, Ramon Perisé and Oswaldo Oliva of the Mugaritz R&D Team. Photo: Tony Pulsone.

ART FOR THE AGE OF THE ANTHROPOCENE

Tomás Saraceno's work with social spiders, their webs and the wind

When Tomás Saraceno first came to MIT as a Visiting Artist in 2012, he met with the late Otto Piene, who was then Professor Emeritus of Visual Design and the second director of the influential Center for Advanced Visual Studies. As Saraceno fondly recalls, he felt a kinship with Piene, not only because of their mutual interest in sky art, but also because of his immersion in the MIT community and his endless curiosity about the research being done around him.

Saraceno was the first Visiting Artist invited by the MIT Center for Art, Science & Technology (CAST) to participate in its residency program, and his ongoing collaboration with several MIT professors—Markus Buehler, Lodovica Illari and

Evan Ziporyn—testifies to the expansive character of his work and to his valuable contribution to the culture of MIT.

In December 2014, Saraceno met with Illari, whose research in synoptic meteorology, severe weather and atmospheric blocking involves modeling wind currents. Saraceno, who is well known for his inflatable and airborne biospheres, speculates that deeper understanding of the topography of wind currents could aid human travel via solar vehicles that would be more sensitive to the planet than our current fossil fuel-guzzling modes of transport. His work with solar balloons envisions more prevalent zero-emission aerial photography.

Saraceno's interest in air currents relates to his study of "ballooning" spiders that travel by

ALLAN DOYLE
Co-Director, MIT Museum Studio

JOHN DURANT
Director, MIT Museum and Adjunct Professor, MIT Program in Science, Technology and Society

ARTHUR GANSON
Visiting Artist

ANNE LILLY
Visiting Artist

JOHN POWERS
Visiting Artist

SETH RISKIN
Co-Director, MIT Museum Studio

MARKUS BUEHLER
Professor and Head, Civil and Environmental Engineering, MIT

LODOVICA ILLARI
Senior Lecturer, Earth, Atmospheric and Planetary Sciences and Director of the Synoptic Laboratory, MIT

TOMÁS SARACENO
CAST Visiting Artist

ZHAO QIN
Research Scientist in Civil and Environmental Engineering, MIT

EVAN ZIPORYN
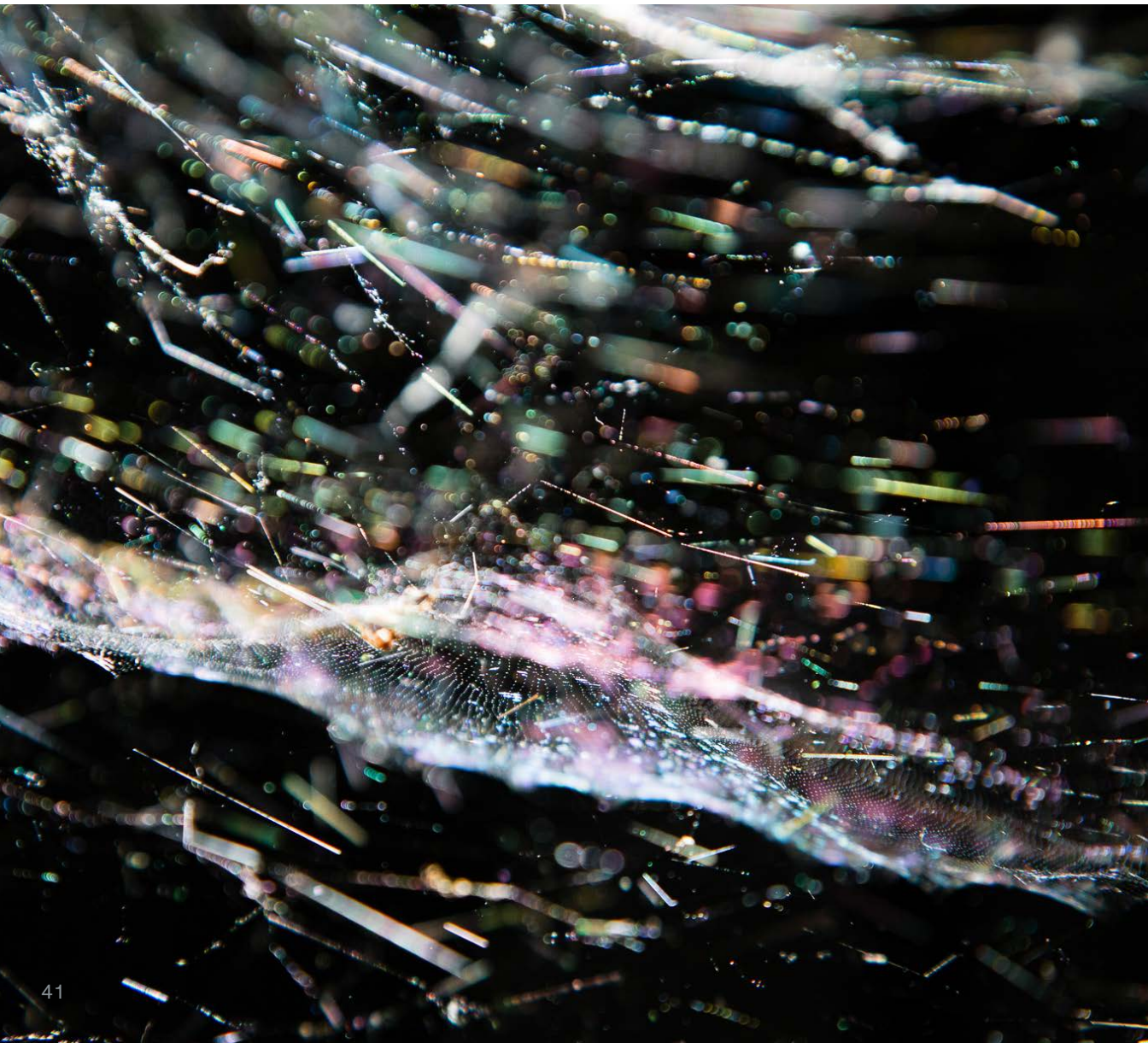Kenan Sahin Distinguished Professor of Music, MIT

releasing their threads from a high vantage point and gliding on atmospheric flows for up to 10,000 km. Another species of social spiders that he is documenting rides on "flying carpets" woven together by the atmosphere when they cast their webs in the air. He postulates that humans could join the 50 million animals (mostly spiders and other bugs) already inhabiting the air. "In the future, if we learn to be more sensitive to the weather and the climate and currents," he says, "we might inhabit not only the earth, but the air space as well. It might give us the possibility to have a society without fossil fuel."

He has also been working with Buehler and Zhao Qin to understand the construction techniques of social spiders and the structure of their 3D webs, which they discussed in "Reverberations: Spiders and Musical Webs." Saraceno's studio devised an original tomographic method, using a laser sheet, to scan a 3D web built by *Latrodectus mactans*. This pioneering technique produced complete and accurate 3D data of a spider web for the first time. Buehler's lab subsequently created a computer model of the data set generated by this project to reveal how strands behave and interact in the physical web. Such information is useful not only for architects and artists, but also for arachnologists, evolutionary biologists, ethnologists, physiologists and engineers. Buehler points out that understanding the chemical bonds of spider silk may in future be useful for unconventional approaches to design problems.

> "Everything is connected. And through making, you realize there is another way of thinking."
> – Tomás Saraceno

Saraceno has also taken his co-creation with social spiders and their webs into the realm of sound, exploring the incredible structural and vibratory properties of spider silk. At MIT, he discussed the structure of web-inspired instruments with

Buehler and the acoustic aspects of musical webs with Ziporyn. Three pieces by Ziporyn were later featured in "A Matter Theater," a concert in Berlin, which was part of *The Anthropocene Project*. Ziporyn explains, "Tomás described to me how the spiders seem to use web vibrations to communicate... . So I tried to find pieces that seemed to resonate with that idea, that more or less concerned themselves with a single type of resonance." Saraceno hopes that codifying a certain type of vibration will enable people to "understand the language of the spiders."

Much of Saraceno's work exhibits a sensitivity to nature. He points out that in this Age of the Anthropocene, "we humans are the biggest geological force in the planet. We are producing climate change, which may forever transform planet Earth." Saraceno's stated interest in "co-dependency, interdependency and the responsibility I have toward others, and how much I can perceive in the human and nonhuman world" is evident in his various bodies of work—including the solar balloons and inflatables, the web-inspired installations and the sonified webs. "From small works like the spider webs themselves to the large-scale installations, there is always some sort of vibration, frequency or relationship," he claims. As Saraceno built the structures to house the webs spun by spiders that he transported to Buehler's lab, he reveled in how their spontaneous sculpture may lead to deeper insights about our natural world.

Kat Cizek's avatar from her interactive documentary, *The Universe Within.*

ARTS INNOVATION IN THE DIGITAL AGE

Immersive and interactive storytelling

The nineteenth century gave us the medium of film and the twentieth, the Internet. Storytelling in the twenty-first century defies easy categorization, as documentarians increasingly engage in co-creation and conjure immersive environments with an ever-expanding array of digital tools. The speaker series, "Arts Innovation in the Digital Age," exposed MIT students to documentary storytellers who are pioneering new forms of artistic practice. Elaborating on concepts such as cross-platform, immersive media and documentary games, the five speakers in this series shared their experience, practice, distribution models and creative platforms with MIT students from a variety of disciplines.

Photojournalist Karim Ben Khelifa's work, *The Enemy*—a project that combines neurosciences, artificial intelligence, virtual reality and journalism—aims to engender empathy by introducing participants to soldiers from opposing sides of global conflicts. "Karim's enthusiasm and commitment were really motivating. It was an invitation to go deeper into my own research, and

encouraged me to research this kind of augmented reality work," commented Luisina Pozzo Ardizzi, an Open Documentary Lab (OpenDocLab) Research Affiliate.

> "I was always interested in 'choose your own adventure' stories. I wanted to make a documentary like that—an interactive documentary."
> — Suvi Andrea Helminen

Suvi Andrea Helminen and David Dufresne each incorporate elements of game design into their work. *48 Hour Games*—Helminen's documentary about Scandinavian game developers competing to design the most innovative computer game in 48 hours at the Nordic Game Jam—relies on familiar interactive features such as branched storytelling, collecting icons, "unlocking" bonus material through "achievements" and sharing content with other viewers/players. Dufresne's latest interactive piece, *Fort McMoney*, is a web documentary and strategy game that allows players to determine a city's future and responsibly develop its oil sands reserves.
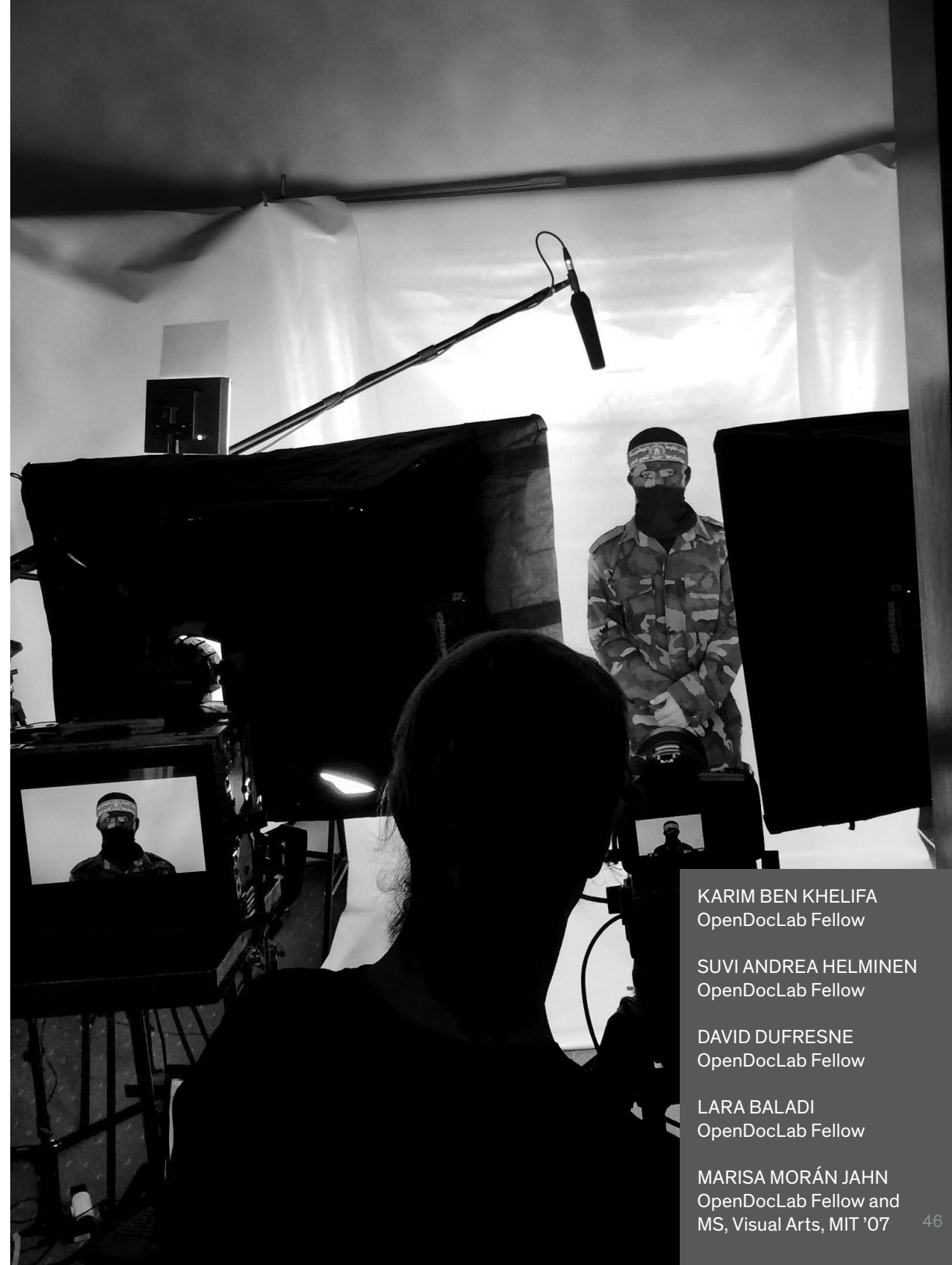
KARIM BEN KHELIFA
OpenDocLab Fellow

SUVI ANDREA HELMINEN
OpenDocLab Fellow

DAVID DUFRESNE
OpenDocLab Fellow

LARA BALADI
OpenDocLab Fellow

MARISA MORÁN JAHN
OpenDocLab Fellow and
MS, Visual Arts, MIT '07

Previous page, left top: Marisa Morán Jahn's project *El Bibliobandido* ("book bandit") is a masked bandit who eats stories and terrorizes kids until they offer him fresh stories they've written. Jahn invented this chief character everyone loves to hate with a Honduran community with an 80 percent illiteracy rate. Image: Courtesy of the artist.

Previous page, right: Filming of Karim Ben Khalifa's *The Enemy*. Image: Courtesy of the artist.

Below: Marisa Morán Jahn (Studio REV-), CareForce. Caretakers at Boston's National Nanny Training Day hosted by MIT. Courtesy of the artist.

Right, top: Image from one of the many design phases that shaped David Dufresne's project, Fort McMoney. Courtesy of the artist.
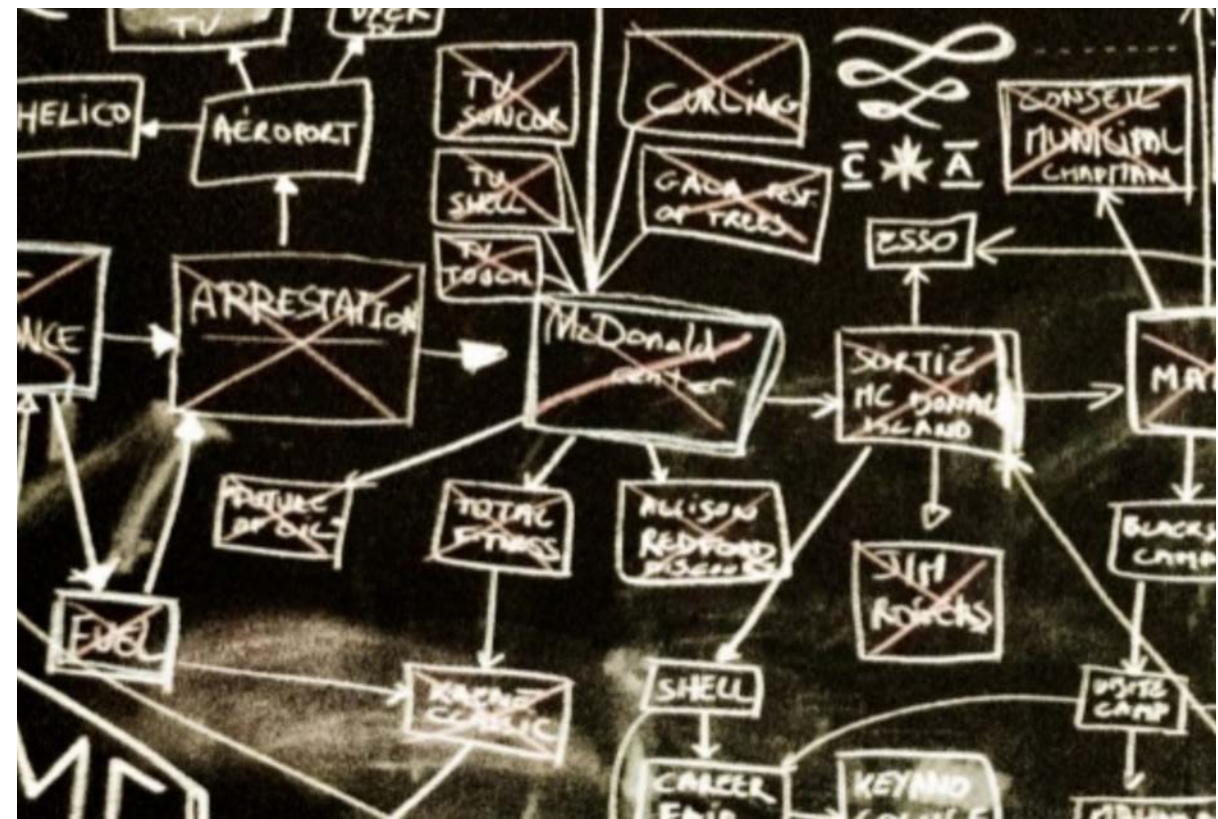
For multidisciplinary artists Lara Baladi and Marisa Morán Jahn, interactive storytelling is entwined with social activism. Baladi's media initiatives, *Radio Tahrir* and *Tahrir Cinema*, provided a platform for political debate during the 2011 Egyptian revolution. Using Tahrir Square as a case study, Baladi is making a trans-media documentary, *Vox Populi, Archiving a Revolution in the Digital Age*, which addresses the challenges of archiving history at the height of the digital age. Artist, activist and immersive media producer Marisa Morán Jahn has created international projects that border between performance art and social activism, including the Nanny Van, a mobile design studio and sound lab that "accelerates the movement for domestic workers' rights."

The series was a component of CAST's Creative Arts Entrepreneurship Initiative, which also included Hacking Arts, produced by students in MIT Sloan's Entertainment, Media and Sports (EMS) Club and the Creative Arts Track of the MIT $100K Entrepreneurship Competition.

KAT CIZEK'S
HIGHRISE: DIGITAL CITIZENSHIP AND UNIVERSE WITHIN
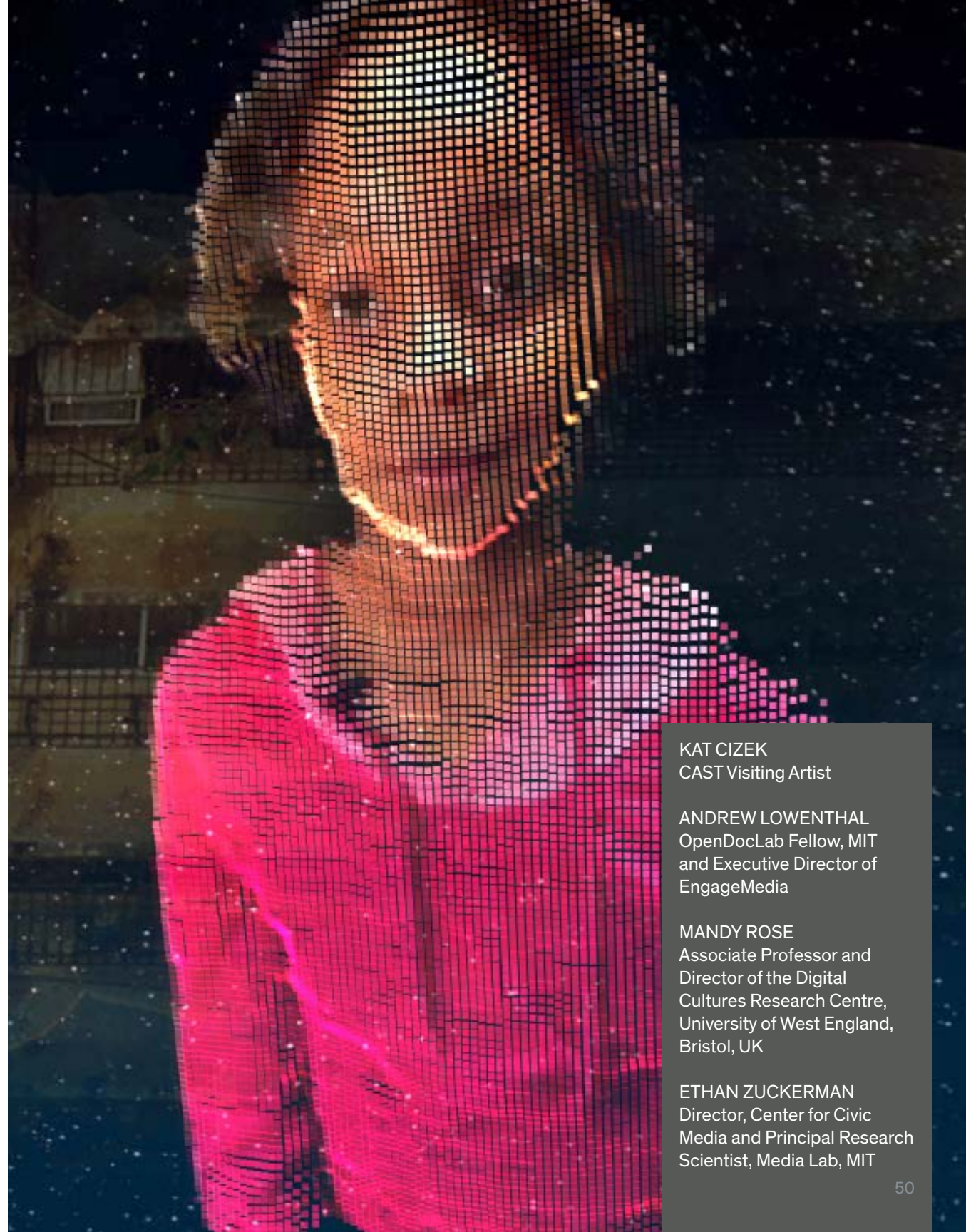
Co-creative, interactive documentary

Known for her Emmy Award-winning multimedia project, *Highrise*, which explores life in residential skyscrapers throughout the world, documentarian Katerina (Kat) Cizek recently completed a two-year residency at the MIT Open Documentary Lab. "I always think of the *Highrise* project as a storytelling prism. You can put anything through it, and it will all be connected somehow, but in unexpected ways," Cizek explains.

The latest phase of the project, *Highrise: Digital Citizenship*, examines how new technologies and modes of communication shape residents' personal and political lives. Cizek premiered the final chapter of the acclaimed digital documentary project as a multimedia participatory event, *Highrise: Universe Within*, Live, at HotDocs, the Canadian International Documentary Festival, and later launched this pioneering project as a web documentary. At MIT, she workshopped ideas for the live performance "to take a web documentary and make it into a theatrical, meaningful and cinematic experience on stage, involving participatory elements with the audience."

HIGHRISE
The TOWERS IN THE WORLD
World IN THE TOWERS

An Emmy-winning, multi-year, many-media, collaborative documentary experiment at the National Film Board of Canada, that explores vertical living around the world.

NEW PROJECT: Universe Within

KAT CIZEK
CAST Visiting Artist

ANDREW LOWENTHAL
OpenDocLab Fellow, MIT and Executive Director of EngageMedia

MANDY ROSE
Associate Professor and Director of the Digital Cultures Research Centre, University of West England, Bristol, UK

ETHAN ZUCKERMAN
Director, Center for Civic Media and Principal Research Scientist, Media Lab, MIT

"I'm really interested in how the technology of media can be used as a process of social change, not just as a way to make a final product of a film."
– Katerina Cizek

With a background in photojournalism, writing, film, radio and independent documentaries, Cizek claims to be "media agnostic" and avoids letting technology alone drive the story. She says, "It's a tricky question, story and technology and who leads whom, and I think that if you let one lead over the other, often there is a failure in this kind of work. The key to a good project is to really have the wheels firmly on both tracks and not to let one get ahead of or behind the other."

Cizek says that during her residency, MIT culture touched "every pixel of *Universe Within*"—from creative details, like basing the child's voice for one of the avatars on MIT's "Robot in Residence" to workshopping ideas with Scot Osterweil, creative director of the MIT Education Arcade, in the early phases of the project.

"OpenDocLab has really given a whole new renaissance to the relationship that MIT has with documentary," Cizek affirms. "They've become key players in the documentary world and in the digital world as well by re-imagining and critically rethinking what documentary can and should be in terms of the interactive space."

Audience members test new game from Harmonix at "The Art of Designing Electronic Music," Ge Wang and Eran Egozy talks, MIT Museum, 2015.

ALVIN LUCIER IN CONVERSATION WITH EVAN ZIPORYN

Recycling Ambient Sound

In this interview, composer Alvin Lucier shares insights about the artistic and musical landscape in the 1960s, including anecdotes about Sol LeWitt, the Judson Dance Theater, Steve Reich, John Cage and David Tudor. He also describes the impact that certain technologies—and approaches to technology—have had on his work.

The following excerpt focuses on two of Lucier's works, *I am sitting in a room* and *Music for Solo Performer*.

Ziporyn: I wanted to ask you a question that has to do with I am sitting in a room, which you're going to perform tomorrow night. One thing that interests me about that piece is that, more than any other one that I know of, it lets the audience in on the secret.

Lucier: Well, I sat there that night. I set up my equipment in my apartment in Middletown, and I just wrote that text out, almost in real time. And I don't know why I said that, exactly. I just did it. I didn't think about it. In another piece by Bob Ashley

called *Fancy Free*, he would record me speaking in four cassette players—and if I stuttered or even hesitated, they would rewind the tapes. It was that kind of listening to speech, everybody's speech. You stop and start; you hesitate a little bit each time. I was thinking of that, for example, because I do stutter. What do I say at the end, 'to smooth out any irregularities'? Everyone has irregularities in their speech. So I was thinking about everyone's speech, not just my own.

"He said, 'You know, last night I went to a lecture at MIT, where this man, Bose, was developing a loudspeaker.'"

– Alvin Lucier

Ziporyn: Since we're on the subject of *I am sitting in a room*, and since we're here at MIT, could you elaborate on what you wrote me in an email, when we were discussing doing this piece, that the idea had been triggered by the work of Amar Bose?

Lucier: Well, I worked with a wonderful scientist on my brainwave piece early in 1965. He was working with the Air Force in Hanscom Field on epilepsy. Some pilots were blacking out when their propeller planes were landing. He lent me his brainwave differential amplifier. And so one day in the hallway at Brandeis, he was walking through and said, "You know, last night I went to a lecture at MIT, where this man, Bose, was developing a loudspeaker. And he tests his speakers by recycling sounds back into the speakers." That's all he told me. He didn't say anything about whether it was in the room or how that worked. He just mentioned that process in passing.

I thought, "Well, that's something I should try out." And I did. And that's how I got this piece. I should look it up and see exactly what Bose was doing. All I know is that there was this repetitious process, recycling. It was important to do it into the room again; that was [the] whole idea, I think. That's all I know. I feel badly that I can't explain it. I didn't investigate at all.

Ziporyn: Well, in a way, you were your own LeWitt for that piece, right? You created a process and then you followed it. So in what repetition did you think, this is getting magical?

Lucier: Well, I stayed up all night doing it, to avoid sounds from outside. I was trying to make sure that the recordings weren't distorted, and then I went to bed. I suppose I thought it was wonderful. But somehow it didn't hit me until later how interesting it was.

Ziporyn: To get an idea for a piece from an overheard conversation about a loudspeaker experiment is extraordinary. Much of your work seems to take its cue from work that's being done in the sciences or in labs. And I just wonder where that inclination comes from in you?

Lucier: I met Edmond Dewan at Brandeis. I don't know why he was there. He said, "You know, I have this brainwave amplifier. And I'm trying to interest these composers in doing something with my alpha wave experiment, but they think it's a gimmick and silly." Well, I didn't have any ideas at that time. So I didn't think it was too silly. It's wonderful to have your mind blank. I'd been in Europe, and I heard all this music. I'd gone over as a Stravinsky addict, and I was at a loss as to what kind of music to write. I can't continue neoclassical. I don't feel good about serialism. I'll give this a try.

So that opened me up to this experimenting. The wonderful thing about the brainwave piece is you don't do anything. You sit there, and you don't move. For most music, there's a violinist or a pianist doing all of it. You sit quietly and let this natural phenomenon happen.

I did this piece in 1965. Can you imagine? That's so long ago. And people said, "Well, why don't you now experiment with other kinds of brainwaves?" I'm not interested in the brain—I'm interested in making a piece of music.

Left: Evan Ziporyn interviews Alvin Lucier amidst works by Sol LeWitt, 2014. The Sol LeWitt Floor, *Bars of Color Within Squares*, is located in the MIT Green Center for Physics (Building 6C). Photo: Video still by Chris Boebel.

ALVIN LUCIER
CAST Visiting Artist

EVAN ZIPORYN
Kenan Sahin Distinguished Professor of Music, MIT

MEDIEVAL MUSIC FOR THE DIGITAL AGE

*From manuscript fragments to musical sound*

Early Music performance often involves "filling in the blanks" from difficult-to-decipher medieval manuscripts. Practitioners such as the Boston Camerata (now in its 60th year) are musician-scholars, adeptly combining research into and knowledge of past practices with their own intuitions and inclinations, breathing new life into medieval and renaissance manuscripts. With the aid of MIT Professor Michael Scott Cuthbert's multifaceted *music21* project, the Camerata was able to take this process several steps further during their MIT residency, performing scores from manuscripts that, up until now, were simply too illegible or incomplete to be fully realized. By bringing the group's highly specialized musical techniques and rigorous scholarship together with Cuthbert's computer-based analyses, the Camerata brought music that had not been heard for centuries to two concerts at MIT.

Medievalists lead some of the most technologically sophisticated projects in the digital humanities. Cuthbert has contributed significantly to this area of research as the creator and principal investigator of *music21*. In the medieval period, many manuscript pages were effaced for
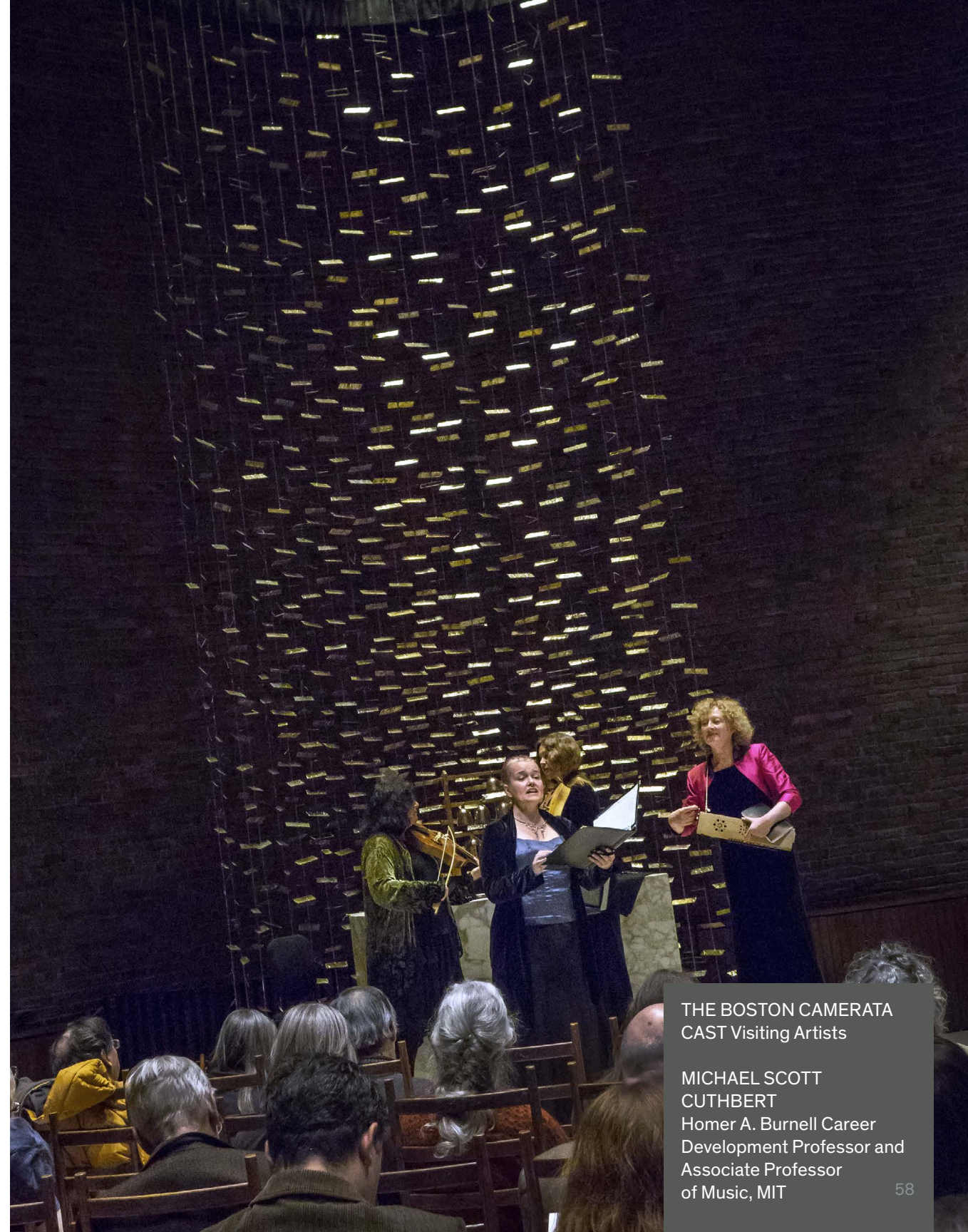
THE BOSTON CAMERATA
CAST Visiting Artists

MICHAEL SCOTT
CUTHBERT
Homer A. Burnell Career
Development Professor and
Associate Professor
of Music, MIT

economic reasons: the costliness of vellum made repurposing materials a practicality. Cuthbert points out that scraping out the old to make way for the new was especially commonplace with music manuscripts, since music went out of fashion faster than many other kinds of texts. To recover the lost music of centuries past, Cuthbert uses enhanced imaging techniques to recover palimpsests and runs partial scores through the Python-based *music21* program, finding matches for the fragmented material in extant manuscripts. This allows groups such as the Camerata to perform works that had otherwise literally been scratched out of history.

> "We need specialized tools for translating these manuscript objects into musical sound."
> – Michael Scott Cuthbert

"The Camerata's exquisitely researched concerts featured music that was rediscovered only through the use of technologies created at MIT for reconstructing pieces from otherwise illegible fragments from 14th- and 15th-century manuscripts," Cuthbert says.

Anne Azéma, director of the Boston Camerata, said that their two MIT programs were designed to make the music of this period "readable, meaningful and understandable." In "*Portes du Ciel* (Heaven's Gate): Songs from Medieval France," the Camerata performed the magnificent repertoire of songs produced near Reims in the regions of Champagne, Picardy and Lorraine.

"Of All the Flowers: Sacred and Secular Song of the Later Middle Ages," a specially commissioned program for MIT, showcased the Camerata's virtuoso soloists performing music by the greatest composers of the period, including de Machaut, da Firenze and da Bologna. Not only was their music new to modern ears, but the Camerata's historically accurate instruments—exact even in the metal alloys used for their bells—also gave students and other audience members a new perspective on this rich period in music history.

Karleigh Moore, a student in SHASS '16, observed, "What made this concert special was the focus on the then and the now—how we can make old music, in a way, new." She added, "Using technology, we were able to hear arrangements, particularly of de Machaut's compositions, that never would have been heard by 14th-century audiences."

Previous page, top: The Boston Camerata performs "Of All the Flowers: Sacred and Secular Song of the Later Middle Ages," in Walker Memorial.

Previous page, middle: Shira Kammen plays the vielle (left) while Anne Azéma sings (right).

Previous page, bottom: The Boston Camerata performs "Of All the Flowers: Sacred and Secular Song of the Later Middle Ages," in Walker Memorial.

Previous page, right: "*Portes du Ciel (Heaven's Gate)*: Songs from Medieval France" included songs that were composed in both the courtly and popular manners. The prior of Vic-sur-Aisne, Gauthier de Coincy (1177–1236), a passionate and prolix musician-poet, recounts the miracles of the Virgin that took place in his parish; Thibaut de Champagne (1201–1253), count of Champagne and king of Navarra, praises the Queen of Heaven in an elegant and subtle style; anonymous minstrels transform the worldly songs of the day into vigorous, toe-tapping spirituals.

Above: For "Of All the Flowers: Sacred and Secular Song of the Later Middle Ages," the Boston Camerata worked in collaboration with Michael Scott Cuthbert, focusing on the performance and rediscovery of works spanning the 12th to 15th centuries, with all the inherent ambiguities and possibilities for creative reinterpretation music manuscripts from this period provide.

Right: Susanne Ansorg, bells.

"THE ART OF DESIGNING ELECTRONIC MUSIC"

Ge Wang's laptop utopia

When you hear the tagline, "There's an app for that," you may not think *that* ever refers to genuine human connection. Musician and computer scientist Ge Wang, however, prefers "those cases when technology takes a back seat to the human proceedings."

In his talk, "The Art of Designing Electronic Music," Wang elaborated on creating ensembles of meta-instruments for laptop orchestras, how designing music apps allows him to bring electronic music to a mass audience and how a technological device can potentially connect its users. Full of practical information, such as how to convert wooden IKEA salad bowls into omnidirectional speakers, and demonstrations of novel musical instruments made from devices like joysticks, Wang's presentation resonated with the MIT audience of makers.

Known for inventing ChucK, an open-source audio programming language used for real-time sound synthesis and music creation, Wang also helped create the Princeton Laptop Orchestra (PLOrk), the Stanford Laptop Orchestra (SLOrk) and the Stanford Mobile Phone Orchestra (MoPhO). He also co-founded SMULE, a startup company exploring social music-making via mobile devices. Inspired by Wang's presentation, one student, Erin Main, Electrical Engineering and Computer Science '16, is working to create a laptop orchestra at MIT, The Tech Orchestra (TOrk).
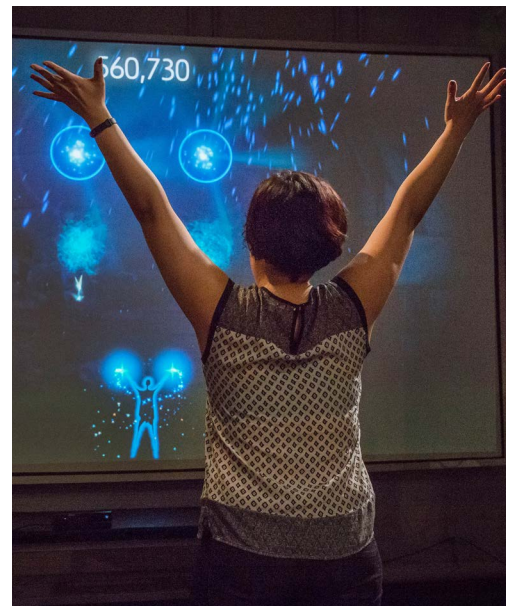
GE WANG
CAST Visiting Artist

ERAN EGOZY
MIT Alumnus, Co-Founder and CTO of Harmonix Music Systems and Visiting Lecturer in Music and Theater Arts, MIT

SMULE's Ocarina, an app that turns the iPhone into a flute, is one of the "Top 20 Downloaded Apps of All Time." It is just one example of how Wang is changing not only the way people make music, but also the way they use mobile devices to communicate. "The first thing I want people to think about when they hear Ocarina is not that it's cool technology. I want them to think, 'Hey, there's someone out there who's blowing into their iPhone like me.'" Wang shared some poignant user feedback from a U.S. soldier: "This is my peace on earth. I am currently deployed in Iraq, and hell on earth is an everyday occurrence. The few nights I may have off I am deeply engaged in this app. The globe feature that lets you hear everybody else in the world playing is the most calming art I have ever been introduced to. It brings the entire world together without politics or war. It is the EXACT opposite of my life."

Such testimonials, Wang says, make him think differently about using technology to create musical instruments: "That's the human angle, and there's something magical in that."

"We wanted to take people out of something that feels logical, like a computer, and get them to feel something more magical."

– Ge Wang

Previous page, top: Eran Egozy discusses his work as co-founder and chief technical officer of Harmonix Music Systems, one of the preteminent game development studios in the world, where he has developed more than a dozen critically acclaimed music-based video games, including "Guitar Hero" and "Rock Band."

Previous page, middle: Ge Wang and Eran Egozy discuss the transformative possibilities of combining music and computers, and art and technology.

Previous page, bottom: A student tests Eran Egozy's game, "Rock Band."

Previous page, right: Ge Wang demonstrates Ocarina, an app he designed that transforms the iPhone into an ancient flute-like instrument that responds to your breath, touch and movements. Created in 2008, it was one of the very first mobile/social musical instruments; its globe visualizes where people are playing Ocarina and even lets users listen in on one another.

Above: Ge Wang (middle), Eran Egozy (right), and MIT Museum Director of Education and Public Programs Brindha Muniappan (left) converse at the MIT Museum.

Right, top: CAST Visiting Artist Ge Wang.

Right, bottom: Audience members test new game from Harmonix at "The Art of Designing Electronic Music," Ge Wang and Eran Egozy talks, MIT Museum, 2015.

THE HARMONIC ARCHIVE

Music, Sound & Installation Art as Artistic Research

Anyone who rides public transportation has likely experienced this breach of commuter etiquette: fellow passengers' oblivion to the tinny blare emanating from their headphones. Students enrolled in "The Harmonic Archive: Music, Sound & Installation Art as Artistic Research" used this ubiquitous contemporary soundscape as the basis for one of two new works they composed collectively with CAST Visiting Artist Arnold Dreyblatt for the course's culminating performance, *The Harmonic Archive.* In this piece, the individual tracks are less significant than the experience of partial hearing and mishearing created by the hushed cacophony of multiple sets of earbuds, dangling like jungle vines, with which listeners could interact immersively or distantly.

The second work, also composed collectively over the course of the term, was a four-track piece using sine waves and room acoustics. In contrast to the earbud piece, where listeners know their experience is individual, this second work covertly masks its subjectivity. The piece "behaves" like a normal piece of electronic music: loud sound emanating from four fixed speakers. But the music is, in fact, equally interactive and individual, subjectively changing dramatically to listeners as they move around the room, shake their heads, or even shift their body positions. The ear—and the mind behind it—are revealed to be sonic filters, and the piece raises questions about the primal experience of sound, the nature of hearing and the relationship between aural perception and environment.

Dreyblatt, a composer and media installation artist, describes these pieces as "performance installations." "We want people moving," he says, "the works require the audience to change locations to appreciate fully each piece's aural and visual properties." The project was very much a continuation of Dreyblatt's own work: For over 30 years, under the aegis of his ensemble, The Orchestra of Excited Strings, he has developed a robust and expandable Just Intonation tuning system, and has invented numerous sets of original instruments and performance techniques to perform his extensive catalog of works.

ARNOLD DREYBLATT
CAST Visiting Artist

Below: Students collaborate to design a sound installation from hundreds of MP3 players for their final performance, *The Harmonic Archive.*

Right, top: Installation view, *The Harmonic Archive.*

Right, bottom: CAST Visiting Artist, Arnold Dreyblatt.

The Harmonic Archive gave students an extended opportunity to engage with Dreyblatt's ideas and methods. The course addressed three main topics: musical minimalism, instrument building and sound art. Dreyblatt says that when he was a student, sine waves—frequencies with no harmonic content—were an acoustic revelation to him. Having studied under La Monte Young and Alvin Lucier, he was eager to introduce his MIT undergraduates to their seminal minimalist works, as well as some of the basic principles of sound, which these composers—like Dreyblatt himself—so eloquently exploit in their work.

"I'm not primarily interested in compositional structure for its own sake, but rather in a visceral and empirical experience of sound."

— Arnold Dreyblatt

JUPITER QUARTET PERFORMS BEETHOVEN'S ENTIRE STRING QUARTET CYCLE

A two-year cycle of unequaled masterworks

"I go to see *Hamlet* every 10 years, and each time I find Shakespeare's rewritten it," Dorothy Parker once remarked. Beethoven's String Quartet Cycle is equally inexhaustible in its emotive depth and dramatic scale, with new elements revealing themselves with each rehearing. During their two-year residency, Jupiter Quartet performed this entire cycle in six concerts, adding new layers of insight to the works' formal, emotional and sonic depths with their virtuosic interpretation. Each program included quartets from Beethoven's early, middle and late periods, charting within each performance the growth of a master artist's vision over a lifetime.

The quartet concluded the series in April 2015 with their performance of Beethoven's Opus 18, No. 3; Opus 95; and Opus 130 with *Grosse Fuge* (Opus 133). With approximately half of MIT undergraduate students enrolled in music courses, it is no surprise that these profound works were well received both in the concert hall and in the classroom. The members of the Jupiter Quartet brought their deep connection to the core string quartet literature into their class visits and coaching sessions, igniting MIT student musicians' enthusiasm for the works of Dvořák, Debussy, Brahms, Shostakovich, Tchaikovsky, Babajanian and, of course, Beethoven.

"Watching [the Jupiter Quartet] rehearse a piece that we had studied in class and witnessing the sensitivity and the intimacy of the way that they played together was really incredible. They are really my idols."

— Daniel Parker

Jupiter Quartet, formed in 2001, is a particularly intimate group, consisting of violinists Nelson Lee and Megan Freivogel, violist Liz Freivogel (older sister of Meg) and cellist Daniel McDonough (husband of Meg; brother-in-law of Liz). As they enter their 16th year of making music together,

JUPITER QUARTET
CAST Visiting Artists

Including:
Liz Freivogel, Violist
Megan Freivogel, Violinist
Nelson Lee, Violinist
Daniel McDonough, Cellist

MARCUS THOMPSON
Institute Professor, Music and Theater Arts, MIT

MIT CONCERTS OFFICE

the members of this tightly knit ensemble are consistently able to deliver chamber music with the requisite intensity of interplay and communication. As MIT alumna Erika Trent (Brain and Cognitive Sciences, Music and Theater Arts '15) pointed out after one of their performances, "Most memorable were the 'conversations' between the instruments; the perfect execution of the brief fugal passage, in which the performers finished each other's 'sentences,' reflecting each musician's sensitivity to their music as a whole."

Previous page, top: Violinists Nelson Lee and Megan Freivogel.

Previous page, right: Cellist Daniel McDonough.

Left: During their residency, the Jupiter Quartet met with a number of music ensembles and individual students for rigorous coaching sessions. They worked with Daniel Zhang '15, violin; Pam Cai '16, violin; Valerie Peng '17, viola; Emily Mackevicius (G) cello; and Carl Lian '15, piano, on a Dvořák Piano Quintet. Killian Hall, 2015.

Above, top: The Jupiter Quartet performing an all-Beethoven program in Kresge Auditorium, 2014.

Above, right: Violinist Megan Freivogel and Violist Liz Freivogel.

LOCALLY SOURCED, INTERNATIONALLY CELEBRATED

*Lontano Ensemble celebrates the acclaimed works of MIT composers*

"Over the years, we've established such a close relationship with all of the MIT music professors," Lontano Ensemble's conductor, Odaline de la Martinez, mused. "After the wonderful reception we received last time we performed at MIT, it is a real treat to perform works by *all* the composers on this visit."

The famed London-based ensemble, which is dedicated to celebrating the works of major American composers, returned to MIT in spring 2015 to perform works by the numerous acclaimed composers who are music faculty at the Institute.

Lontano has engaged with the music of MIT faculty since 2011, when it was in residence at the Institute as part of MIT's 150th Anniversary celebrations. In November 2014, Lontano's 5th London Festival of American Music featured music by MIT composers, including two world premieres and several UK first performances. This program included Charles Shadle's *Red Cedar* and Peter Child's *Seeing the Unseen*, a soundtrack to the 1936 film by Doc Edgerton of the same name, which uses stroboscopic photography to show milk drops and hummingbirds in startling detail. Lontano also selected Elena Ruehr's *Blackberries* for the BBC Invitational in honor of International Women's Day on March 8, 2015. The piece is based on a poem written by the composer's daughter.
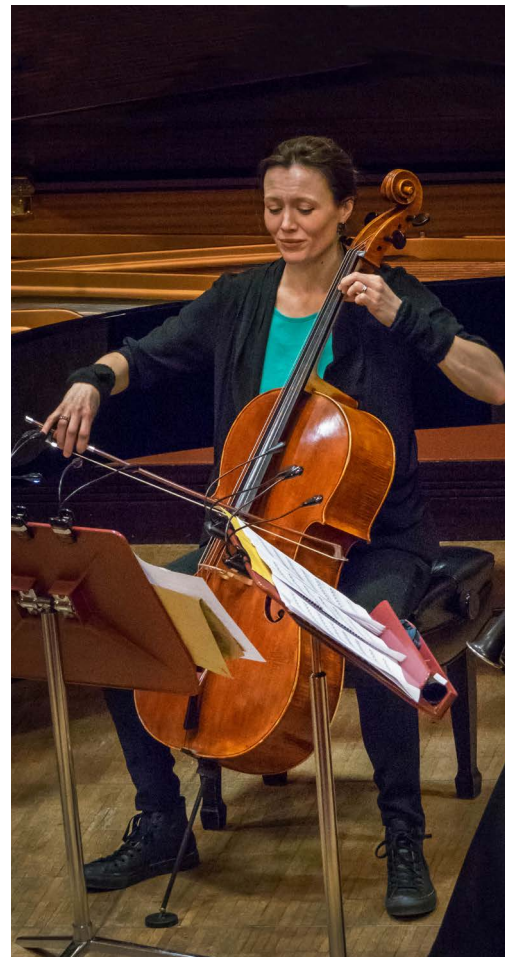
LONTANO ENSEMBLE
CAST Visiting Artists

Including:
Rowland Sutherland, Flute
Peter Furniss, Clarinet
Caroline Balding, Violin
Clare O'Connell, Cello
Mary Dullea, Piano
Odaline de la Martinez, Conductor

According to de la Martinez, Lontano was excited to reprise these works at MIT, where they originated. On this occasion, Lontano also performed John Harbison's *Chaconne*, Keeril Makan's *Afterglow* and a movement from Evan Ziporyn's *Thread*. Harbison's *Chaconne*, as the title suggests, is based on a simple ground bass figure: "I wanted to choose a pattern as familiar to our times as the descending chromatic used in Bach's cantatas 12 and 78 (and more loosely in his D Minor violin chaconne) was in the 1700s." Makan's *Afterglow*, as the title implies, is designed to draw the listener into hearing beyond the immediate, to focus on resonance and the remains of sound, including the sympathetic vibrations of unplayed piano strings. Ziporyn's *Thread* was originally part of a multidisciplinary piece based on the work of batik artist Mary Edna Fraser, something reflected in its slowly evolving, tightly woven micropolyphony.

The concert demonstrated the stylistic diversity and richness that are the hallmarks of both Lontano Ensemble and MIT composers.

"MIT has scored a triple play in the Boston musical scene: [We] compose, commission and perform new works on a daily basis."

– Leila W. Kinney

Previous page, top: Lontano Ensemble performs Peter Child's *Seeing the Unseen*, while the eponymous film by Doc Edgerton plays behind them.

Previous page, bottom: Clare O'Connell, cello.

Previous page, right: Lontano Ensemble in Killian Hall, 2015.

Above: Lontano Ensemble in Killian Hall, 2015.

Right, top: Rowland Sutherland, flute.

Right, bottom: Mary Dullea, piano.

CASSANDRA IN THE TEMPLES

From ancient myth to new a cappella opera

Apollo gives Cassandra the power of prophecy, then curses her to never be believed. This epic tragedy, typifying the blessing-and-coeval-curse topos, is the starting point for Elena Ruehr's *a cappella* opera *Cassandra in the Temples*, which premiered at MIT as part of the new music series, *MIT Sounding.*

Ruehr was awarded a Guggenheim fellowship to compose this opera for the Grammy®-winning vocal octet, Roomful of Teeth. She collaborated with librettist Gretchen E. Henderson to develop the narrative for this 13-movement, 40-minute production based on the themes of the myths surrounding the Greek heroine Cassandra. The opera—set in both Vitruvian temples and the temples of the head where thoughts and memories are housed—unfolds over the course of a single day, with each hour tied to events in Cassandra's life, death and mythic afterlife.

For Ruehr and Henderson, the Cassandra story is a vehicle to raise questions about prediction and prophecy, delusion and vision, the nature of belief

and doubt, and the fate of the rejected prophet. Ruehr observes, "It now seems particularly timely to explore the idea of a person or group of people who predict disaster, as we are inundated with apocalyptic visions of the future in contemporary culture."

This work provided Ruehr a chance to bring together two of her seemingly diverse performance aesthetics—world music and the classical voice. Roomful of Teeth's specialization in various non-western and non-classical music vocal techniques allowed the composer to expand her vision beyond what is possible when writing for strictly classically trained singers. Ruehr employed a wide range of these techniques in her *a cappella* opera, including central Asian throat singing and timbral effects found in traditional Bulgarian music. As Brad Wells, director of Roomful of Teeth, said, "The voice becomes an oboe; now, it's a clarinet. It has a broader range than we give it credit for."

In addition to *Cassandra in the Temples*, the group also premiered *Borderland: A Cantata in Memory of the Victims of the Ukrainian Conflict* by Christine Southworth and Evan Ziporyn, followed by *Allemande* (from *Partita for 8 Voices*) by Pulitzer Prize winner Caroline Shaw, *Run Away* by Judd Greenstein and *Otherwise* by Brad Wells.

GRETCHEN E. HENDERSON
Former Mellon Postdoctoral Researcher, MIT

ELENA RUEHR
Lecturer in Music and Theater Arts, MIT

ROOMFUL OF TEETH
CAST Visiting Artists

Including:
Estelí Gomez, Soprano
Sarah Brailey, Soprano
Eliza Bagg, Alto
Virginia Warnken, Alto
Eric Dudley, Tenor
Thomas McCargar, Baritone
Dashon Burton, Bass-baritone
Cameron Beauchamp, Bass
Brad Wells, Director

"It now seems particularly timely to explore the idea of a person or group of people who predict disaster."

– Elena Ruehr

Previous page, top: Roomful of Teeth performs *Cassandra in the Temples*, using no other instrument than the human voice. Through study with masters from singing traditions all over the world, the eight-voice ensemble continually expands its vocabulary of singing techniques, including Tuvan throat singing, yodeling, belting, Inuit throat singing, Korean P'ansori, Georgian singing, Sardinian cantu a tenore, Hindustani music and Persian classical singing.

Previous page, right: Screens behind the performers displayed the libretto, highlighting the opera's use of wordplay. For example, the homophonic lines, "Lie here," "Lyre?" and "Liar!" in the sixth movement, are meant to convey the difficulties in reconstructing and interpreting fragmentary texts.

Above: Roomful of Teeth's Bass-Baritone Dashon Burton.

Right, top, left: Elena Ruehr.

Right, top, right: Grammy award winning bass, Cameron Beauchamp.

Right, bottom: Snakes become a recurring motif in this poetic adaptation of the Cassandra story, manifesting as sacred healing serpents, monstrous sea serpents, historic map markers (designating terra incognita) or the dormant yogic serpent that aids meditation and enlightenment. The third movement, "Whispering of the Snakes: There's something to the salience of hissing," is constructed entirely using sibilance (stressed "s" sounds), unlike the vowel sounds librettists often use to carry sound forward, Henderson points out.

BORDERLAND: A CANTATA FOR UKRAINE

Responding to territorial violence with a multilingual memorial

"Ukraine" means "borderland, edge or outskirts." Christine Southworth and Evan Ziporyn's collaborative project, *Borderland: A Cantata for Ukraine,* also composed for Roomful of Teeth's residency, operates figuratively in such terrain. The piece is a four-movement cantata in memory of the victims of the Ukrainian conflict, which unfolded over polyglot media in real time while Southworth and Ziporyn composed the work.

Borderland takes the recent conflict as a point of departure to address the tumultuous past of Ukraine. In the composers' words, "The innocent casualties of conflict in the region go back generations, too many to even mention, from the passengers on the Malaysian Air jet that crashed literally on the date we began working on the piece in 2014 to the atrocities of the Second World War, back through the starvation and displacement of the Great Famine, the pogroms before that and the forced transmigration of the Tatar people, the original inhabitants of the Crimea. This piece uses the multilingual unfolding we experienced in becoming aware of the Ukrainian

situation over the late summer of 2014 to reflect on it all, and to provide a space for thoughts and feelings about the consequences of territorial violence."

> "This piece uses the multilingual unfolding we experienced in becoming aware of the Ukrainian situation to reflect on it all…"
> – Evan Ziporyn

Each movement relies on a different language, suggestive not only of the multicultural, multilingual environment of Ukraine—which the dominant powers have continually tried to suppress—but also the global import of these local conflicts, which affected everyone from Dutch tourists to Malaysian bureaucrats. As the composers explain, "The texts for the four movements retrace our own journey from up-to-the-minute news reports to deeper history: the first movement, in Dutch and Malay, is based on tweets from a passenger on MH17 and a Malaysian Air official. The second movement, in Russian, sets transcripts from partisan radio

communications regarding anti-aircraft equipment. The third movement literally grounds the piece with words by the Ukrainian national poet Shevchenko. The fourth takes us to the source with poetry in Tatar, a dialect of Turkish, by Bekir Çoban-zade."

Roomful of Teeth's formidable palette of vocal techniques—particularly their openness to the sounds and styles of various non-classical European traditions, such as yodeling, Croatian close-interval harmonies and Sardinian overtone singing—allows the composers to use timbre to evoke linguistic richness and the space at the borders where cultures and ideologies meet.

Left: Christine Southworth.

Below: Still from video accompanying Borderland, 4th movement. Photo: Christine Southworth.

CHRISTINE SOUTHWORTH
Composer

EVAN ZIPORYN
Kenan Sahin Distinguished Professor of Music, MIT
and Composer

ROOMFUL OF TEETH
CAST Visiting Artists

Including:
Estelí Gomez, Soprano
Sarah Brailey, Soprano
Eliza Bagg, Alto
Virginia Warnken, Alto
Eric Dudley, Tenor
Thomas McCargar, Baritone
Dashon Burton, Bass-baritone
Cameron Beauchamp, Bass
Brad Wells, Director

SAMORÓBKA SOUND

Crafting musical instruments from found objects

It is hard to have a bad time when you are playing a drinking straw as a flute. At the concluding concert for his IAP class, "Small Instruments: Musical Instrument Building and Performance," Pawel Romanczuk gave the audience their very own instrument—a rudimentary flute made from drinking straws—and invited everyone to participate at whim. Rarely does a concert of "experimental music" deliver such playfulness, humor and DIY spirit.

Romanczuk applied the term "Samoróbka" (Polish for "self-made") to the type of sound he and the students explored in the five-day workshop. This homemade aesthetic extended to the materials for the instruments themselves. Old rakes, plastic buckets, discarded lumber and other garden-variety household items were transformed into an array of surprisingly supple, expressive musical instruments. Not content with simple "show and tell," he and the students also developed a full program of new music that was performed for a rapt MIT Museum audience. The residency and performance vividly demonstrated Romanczuk's assertion that, while many of the things in our everyday experience have musical properties, it requires innovative thinking to exploit them in order to create sound.

Romanczuk's work involves an interactive and iterative approach to the materials that surround us. He showed clearly how simple technology can create basic instruments, and how the instruments themselves suggest the skills necessary to play them. His prescription is to forget one's habits, to be open to new thoughts and feelings, and to be fearless. On these counts, MIT students excelled, according to Romanczuk: "They are very dynamic, creative and happy to do something new." He also observed that MIT students were particularly good at thinking about the construction, mechanics and resonant properties of these everyday objects.

The students—only half had prior musical training—clearly responded to both Romanczuk's rigor and neo-Dadaist spirit. The instruments they built and demonstrated included the "drunkaphone" (a beer bottle submerged in a glass of water and played with a bow), balloon flutes (PVC pipes topped with a cap that has a balloon stretched over it), the "bass x 4" (a 2x4 with strings designed to emulate a bass), a triangular harp (made from reclaimed wood with buckets as amplifiers), a metal columba (made with prongs from an old rake) and a daxophone (a friction idiophone made from a tin can and a wooden pole).

PAWEL ROMANCZUK
CAST Visiting Artist

Romanczuk has come to international renown through his Małe Instrumenty (Small Instruments) project, which he founded in 2006. Małe Instrumenty centers around a wide array of small instruments—found, rebuilt from spare parts or designed from scratch. Inspired by the soundtracks of old Polish animated films, Romanczuk and his ensemble have produced albums, books, art installations and music boxes exploring an ever-expanding array of strange and beautiful musical inventions.

"Pawel Romanczuk can pick up a piece of trash and see straight into its soul. Minutes later, he will be coaxing beautiful music directly from that soul."
— Otto Briner '15

Previous page, top: CAST Visiting Artist Pawel Romanczuk with students in his IAP class, "Small Instruments: Musical Instrument Building and Performance."

Previous page, right: Workshop participant Nick Joliat plays a triangular harp (made from reclaimed wood with buckets as amplifiers).

Above: Workshop participants explain how they made the "bass x 4" (a 2x4 with strings designed to emulate a bass).

Right, top: Instrument demonstration.

Right, middle: Audience members play flutes made from drinking straws at the "Small Instruments" concert, MIT Museum, 2015.

Right, bottom: CAST Visiting Artist Pawel Romanczuk constructs instruments with participants in his IAP class, "Small Instruments: Musical Instrument Building and Performance."

MINIMALISM TO THE MAX: TERRY RILEY AT 80

Terry Riley's 80th Birthday Concert

"Prandit Pran Nath used to say, 'You in the note, and the note in you,' and that's a good way to describe the state to be in when you're performing. At least, it's the state I want to be in as a performer—and even as a composer," Terry Riley explained.

"Terry Riley's 80th Birthday Concert"—a return visit to MIT by the legendary composer— delivered this experience of being inside the sound. The mini-marathon concert traversed the length and breadth of Riley's career, from an expanded version of his 1969 "Poppy Nogood and the Phantom Band" to present-day new compositions and improvisations. The concert also included world premieres of new works by MIT composers, inspired by and dedicated to the "father of musical minimalism."

The evening began with two dozen saxophonists roving the aisles of Kresge Auditorium, enveloping the audience in sound and gradually unveiling Evan Ziporyn's arrangement of "Poppy Nogood and the Phantom Band." Pianist Sarah Cahill performed a veritable tribute concert-within-a-concert, playing seven compositions by and for Riley, including new works by Gyan Riley (his son) and Christine Southworth, as well as world premieres by MIT composers Keeril Makan, Elena Ruehr and Ziporyn.

Vocal and keyboard improvisations are central to Riley's music, as he demonstrated in the evening's third set, a collaboration with the Eviyan Trio, which features Czech violinist/vocalist Iva Bittova. For the evening's final set, Riley joined MIT's own Gamelan Galak Tika for the exuberant "White Space Conflict," composed by Riley for the Gamelan in 2012.

Ziporyn described the birthday concert as a "gift exchange...Terry sharing his own music with us as composer, performer and improviser; and our taking the opportunity to give something back—his own music reinterpreted, and a slew of new works written in his honor by colleagues, friends and family."
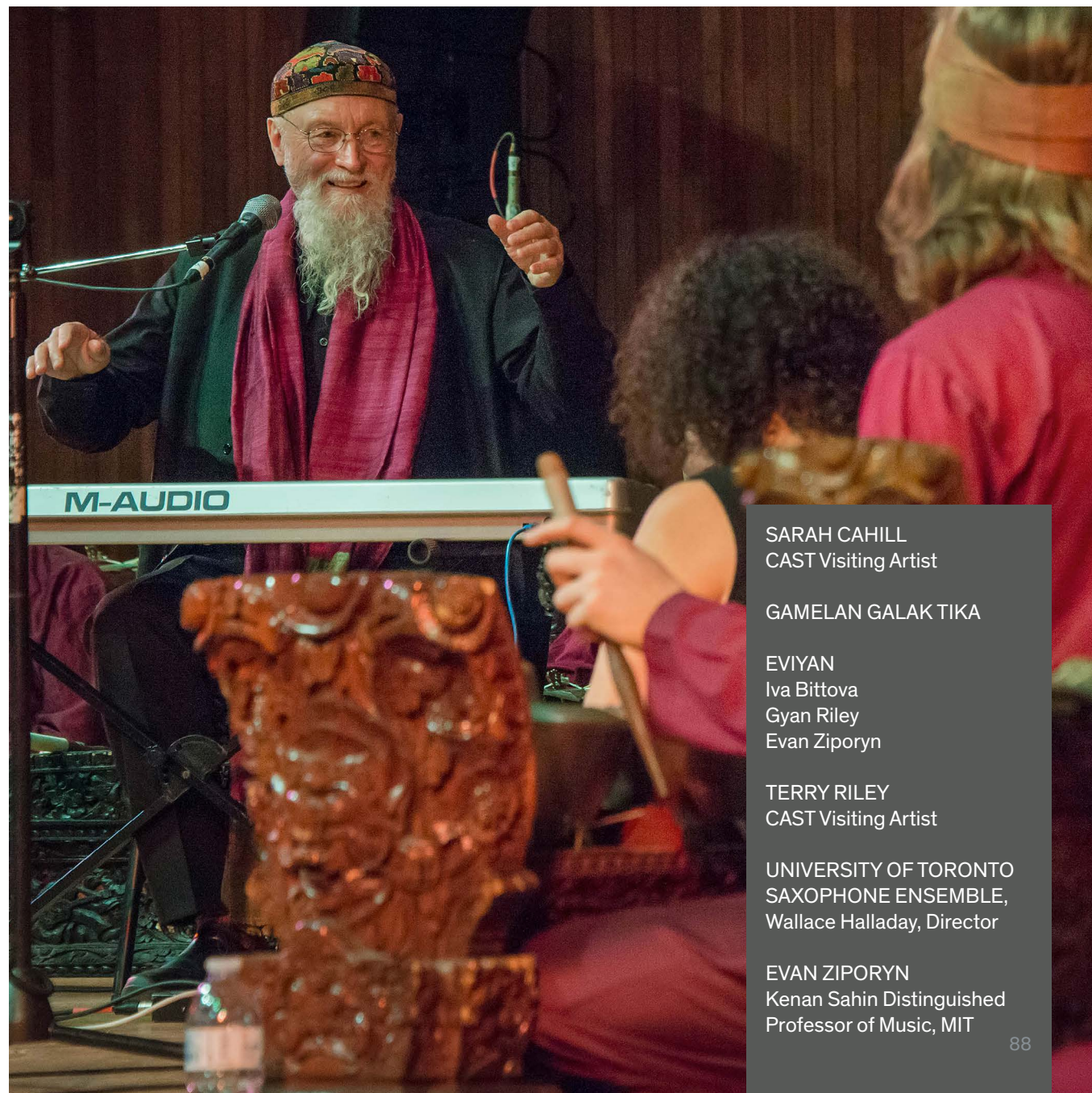
SARAH CAHILL
CAST Visiting Artist

GAMELAN GALAK TIKA

EVIYAN
Iva Bittova
Gyan Riley
Evan Ziporyn

TERRY RILEY
CAST Visiting Artist

UNIVERSITY OF TORONTO
SAXOPHONE ENSEMBLE,
Wallace Halladay, Director

EVAN ZIPORYN
Kenan Sahin Distinguished
Professor of Music, MIT

Riley's music was a fitting finale to the 2014–15 *MIT Sounding* series. As Ziporyn noted, "Terry's music sums up the aesthetic of the series: open and reaching across genres, yet directed to the future."

In Riley's view, what set his "80th Birthday Concert" at MIT apart from other such celebrations was the contribution from so many expert musicians: "You've got all these energies feeding in, so it's a special confluence."

"'You in the note, and the note in you.' That's a good way to describe the state to be in when you're performing."

— Terry Riley

Previous page, top: Gamelan Galek Tika.

Previous page, middle: Iva Bittová and Evan Ziporyn of EVIYAN.

Previous page, bottom: Gyan Riley of EVIYAN.

Above: Boston Phantom Saxophone Consort: Eliot Gattegno, Philipp Staudlin, Eric Hewitt, Joseph D'Aleo, Erik Anundson, Benjamin Porter, Zachary Robarge, Jonathan Hulting-Cohen, Scott Chamberlin and Charles Larson.

Right, top: Iva Bittová of EVIYAN.

Right, bottom: Terry Riley with Gamelan Galek Tika and EVIYAN, Kresge Auditorium.

ACKNOWLEDGMENTS